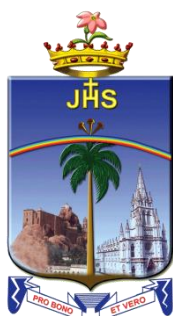


B.Sc. BOTANY
LOCF SYLLABUS – 2021

SCHOOLS OF EXCELLENCE
WITH CHOICE BASED CREDIT SYSTEM (CBCS)



DEPARTMENT OF BOTANY
SCHOOL OF BIOLOGICAL SCIENCES
ST. JOSEPH'S COLLEGE (AUTONOMOUS)

Special Heritage Status Awarded by UGC
Accredited at A⁺⁺ Grade (IV Cycle) by NAAC
College with Potential for Excellence by UGC
DBT-STAR & DST-FIST Sponsored College
Tiruchirappalli - 620 002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) UNDERGRADUATE COURSES

St. Joseph's College (Autonomous), a pioneer in higher education in India, strives to maintain and uphold the academic excellence. In this regard, it has initiated the implementation of five "Schools of Excellence" from the academic year 2014 – 15, to meet and excel the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system enhances the optimal utilization of both human and infrastructural resources. It also enhances academic mobility and enriches employability. The School system preserves the identity, autonomy and uniqueness of every department and reinforces Student centric curriculum designing and skill imparting. These five schools adhere to achieve and accomplish the following objectives.

Optimal utilization of resources both human and material for the academic flexibility leading to excellence.

Students experience or enjoy their choice of courses and credits for their horizontal mobility.

The existing curricular structure as specified by TANSCH and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice based credit system.

Human excellence in specialized areas

Thrust in internship and / or projects as a lead towards research and

The multi-discipline nature of the School System caters to the needs of stake-holders, especially the employers.

Credit system:

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The credits and hours of each course of a programme is given in the table of Programme Pattern. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For UG courses, a student must earn a minimum of 130 credits as mentioned in the programme pattern table. The total number of minimum courses offered by the Department is given in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

Outcome –Based Education (OBE): is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs):

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Programme Educational Objectives (PEOs): The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC)

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE)

Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

DSE: Four courses are offered, two courses each in semester V and VI

Note: To offer **one DSE**, a minimum of two courses of equal importance / weightage is a must.

A department with two sections must offer two courses to the students.

One DSE Course may be offered as interdisciplinary course among the departments in a School (Common Core Course) at the PG level.

Generic Elective Courses

An elective course chosen generally from an **unrelated discipline/subject**, with an intention to seek exposure is called a Generic Elective.

Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Two GE Courses are offered one each in semesters V and VI.

(open to the students of other Departments)

The Ability Enhancement Courses (AEC)

“AECC” are the courses based upon the content that leads to Knowledge enhancement; Communicative English, Environmental Science. These are mandatory for all disciplines.

AECC-1: Communicative English: It is a 4 credits compulsory course offered by the Department of English in the first semester of the Degree Programme, Classes are conducted outside the regular class hours.

AECC-2: Environmental Science: is a 2 credit course offered as a compulsory course during the second semester by the Department of Human Excellence.

Skill Enhancement Courses (SECs)

These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme.

These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

There are four courses under this category

SEC-1 is offered in semester **III as a course** Within the Department (**WD**) it is More of main discipline related skills.

SEC-2 is offered in semester **IV as a course** Between schools (**BS**) Offered to students of other schools (Except the school offering the course)

SEC-3 is offered in semester **V as a compulsory course** on Soft Skills offered by the Department of Human Excellence, common to all the students of UG programme.

SEC-4 is offered in semester **VI as a course** **Within School (WS)** Open to all the students within the same school (including the students of the parent department)

Self-paced Learning: It is a course for two credits. It is offered to promote the habit of independent/self learning of Students. Since it is a two credit course, syllabus is framed to complete within 45 hours. It is not taught in the regular working hours.

Field Study/Industrial Visit/Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Comprehensive Examinations: A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL and etc.

Undergraduate Programme:

Programme Pattern:

The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:

Part -I : Languages (Tamil / Hindi / French / Sanskrit)

Part-II : General English

Part-III : Core Course (Theory, Practicals, Discipline Specific Electives, Compulsory and Optional Allied courses, Project, Self paced courses, Internship , Comprehensive Examinations and field visit /industrial visit/Case Study)

Part-IV: Value Education, Ability Enhancement Courses, Skill Enhancement Courses/ Soft Skills , Generic Electives/ National Cadet Corps etc.

Part-V: Outreach Programme (SHEPHERD).

Ability Enhancement Courses (AEC): There are two Ability Enhancement courses viz AECC and SEC.

Value Education Courses:

There are four courses offered in the first four semesters for the First & Second UG Programme.

Course Coding

The following code system (11 alphanumeric characters) is adopted for Under Graduate courses:

21	UXX	N	N	XX	NN/NNX
Year of Revision	UG Department Code	Semester number	Part specification	Part Category	Running number/with choice

N:- Numeral X :- Alphabet

Part Category

GL - Languages (Tamil / Hindi / French / Sanskrit)

GE - General English

CC - Core Theory; CP- Core Practical

WS- Workshop

SP- Self Paced Learning

IS- Internship

FV- Field visit

CE- Comprehensive Examination

PW- Project Work& viva-voce

Electives Courses

ES – Department Specific Electives

EG- Generic Electives

Allied Courses

AC - Allied Compulsory

AO- Allied Optional

EC - Additional Core Courses for Extra Credits (If any)*

Ability Enhancement Courses

AE – Ability Enhancement Compulsory Courses; Bridge Course and Environment Science

SE – Skill Enhancement (WD), (BS), (WS) and Soft skills

VE - Value Education/ Social Ethics/Religious Doctrine

OR – Outreach SHEPHERD & Gender Studies (Outreach)

SU - AICUF / Nature Club / Fine Arts / NCC / NSS /etc. (Service Unit)

CIA AND SEMESTER EXAMINATION

Continuous Internal Assessment (CIA):

Distribution of CIA Marks	
Passing Minimum: 40 Marks	
Library Referencing	5
3 Components	35
Mid-Semester Test	30
End-Semester Test	30
Total CIA	100

MID-SEM & END – SEM TEST

Centralised – Conducted by the office of COE

1. Mid-Sem Test & End-Sem Test: (2 Hours each); will have Objective and Descriptive elements; with the below mentioned question pattern PART-A; PART-B; PART-C and PART D.

2. One of the CIA Component II/III for UG & PG will be of 15 marks and compulsorily a online objective multiple choice question type.

3. The online CIA Component must be conducted by the Department / faculty concerned at a suitable computer centre.

4. The 7 marks of PART-A of Mid-Sem and End-Sem Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS.

5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.

6. English Composition once a fortnight will form one of the components for UG general English

Duration of Examination must be rational; proportional to teaching hours 90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS	Lower Order Thinking			Higher Order Thinking			Total %
	K1	K2	K3	K4	K5	K6	
SEMESTER EXAMINATIONS	15	20	35	30			100
MID / END Semester TESTS	12	20	35	33			100

QUESTION PATTERN FOR SEMESTER EXAMINATION

SECTION	MARKS
SECTION-A (No choice ,One Mark) THREE questions from each unit (15x1 =15)	15
SECTION-B (No choice ,2-Marks) TWO questions from each unit (10x2 =20)	20
SECTION-C (Either/or type) (7- Marks) ONE question from each unit (5x7 =35)	35
SECTION-D (3 out of 5) (10 Marks) ONE question from each unit (3x10 =30)	30
Total	100

BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.				Max Mark : 100			
K- LEVELS	K1	K2	K3	K4	K5	K6	Total Marks
SECTIONS							
SECTION-A (One Mark, No choice) (15x1=15)	15						15
SECTION-B (2-Marks, No choice) (10x2=20)		10					20
SECTION-C (7- Marks) (Either/or type) (5x7=35)			5				35
SECTION-D (10 Marks) (3 out of 5) (3x10=30) Courses having only K4 levels				3			30
Courses having K4 and K5 levels One K5 level question is compulsory				2	1		
(Courses having all the 6 cognitive levels One K5 and K6 level questions can be compulsory				1	1	1	
Total	15	20	35	30			100

QUESTION PATTERN FOR MID/END TEST		
SECTIONS		MARKS
SECTION-A (No choice, One Mark) (7x1 =7)		7
SECTION-B (No choice , 2-Marks) (6x2 =12)		12
SECTION-C (Either/or type) (7- Marks) (3x7 =21)		21
SECTION-D (2 out of 3) (10 Marks) (2x10=20)		20
Total		60

BLUE PRINT OF QUESTION PAPER FOR MID/END TEST							
DURATION: 2. 00 Hours.				Max Mark: 60.			
K- LEVELS	K1	K2	K3	K4	K5	K6	Total Marks
SECTIONS							
SECTION -A (One Mark, No choice) (7 x 1 = 7)	7						07
SECTION-B (2-Marks, No choice) (6 x 2 = 12)		6					12
SECTION-C (Either/or type) (7- Marks) (3 x 7 =21)			3				21
SECTION-D (2 out of 3) (10 Marks) (2x10=20) Courses having only K4 levels				2			20
Courses having K4 and K5 levels One K5 level question is compulsory				1	1		
Courses having all the 6 cognitive levels One K6 level question is compulsory					1	1	
Total Marks	07	12	21	20			60
Weightage for 100 %	12	20	35	33			100

Assessment pattern for two credit courses.

S. No.	Course Title	CIA	Semester Examination	Total Marks
1	Self Paced Learning Course	25 + 25 = 50	50 Marks (MCQ) (COE)	100
2	Comprehensive Examinations	25 +25 = 50	50 Marks (MCQ) (COE)	100
3	Internship	100	--	100
4	Field Visit	100	--	100
5	Ability Enhancement Course (AEC) for PG	50 (Three Components)	50 (COE) (Specific Question Pattern)	100
Assessment Pattern for Courses in Part - IV				
6	Value Education Courses and Environmental Studies	50	50 Marks (For 2.00 hours) (COE)	100
7	Skill Enhancement Courses(SECs)	50 marks (by Course in-charge) 50 Marks (by an External member from the Department)		100
8	SEC: SOFT SKILLS (For UG and PG)	100 (Fully Internal)		100

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) respectively. These two are calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$	$WAM (Weighted Average Marks) = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$
<p>Where,</p> <p>C_i is the Credit earned for the Course i G_i is the Grade Point obtained by the student for the Course i M_i is the marks obtained for the course i and n is the number of Courses Passed in that semester.</p>	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

- i) For each of the first three parts, there shall be separate classification on the basis of CGPA, as indicated in Table-2.
- ii) For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management/Literature as Outstanding/Excellent/Very Good/Good/Above Average/Average, the marks and the corresponding CGPA earned by the candidate in Part-III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in the all the Five parts of the Programme.
- iii) Grade in Part –IV and Part-V shall be shown separately and it shall not be taken into account for classification.
- iv) A Pass in SHEPHERD will continue to be mandatory although the marks will not count for the calculation of the CGPA.
- v) Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	0	RA

Table-2: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appearance

Credit based weighted Mark System is adopted for the individual semesters and cumulative semesters in the column 'Marks secured' (for 100)

Declaration of Result

Mr./ MS. _____ has successfully completed the Under Graduate in _____ programme. The candidate's Cumulative Grade Point Average (CGPA) in Part – III is _____ and the class secured is _____ by completing the minimum of 130 credits. The candidate has acquired _____ (if any) more credits from SHEPHERD / AICUF/ FINE ARTS / SPORTS & GAMES / NCC / NSS / NATURE CLUB, ETC. The candidate has also acquired _____ (if any) extra credits by attending MOOC courses.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes (POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment is done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

Mapping	<40%	$\geq 40\%$ and < 70%	$\geq 70\%$
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Mean Scores of COs = $\frac{\text{Sum of values}}{\text{Total No.of POs \& PSOs}}$		Mean Overall Score = $\frac{\text{Sum of Mean Scores}}{\text{Total No.of COs}}$	
Result	Mean Overall Score	< 1.2	# Low
		≥ 1.2 and < 2.2	# Medium
		≥ 2.2	# High

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value-driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

- Graduates will be able to accomplish professional standards in the global environment.
- Graduates will be able to uphold integrity and human values.
- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to apply the concepts learnt, in real life situations with analytical skills.
2. Graduates with acquired skills and enhanced knowledge will be employable/ become entrepreneurs or will pursue higher Education.
3. Graduates with acquired knowledge of modern tools and communicative skills will be able to contribute effectively as team members.
4. Graduates will be able to read the signs of the times analyze and provide practical solutions.
5. Graduates imbued with ethical values and social concern will be able to appreciate cultural diversity, promote social harmony and ensure sustainable environment.

Program Specific Objectives (PSOs)

1. Graduates will acquire the basic concepts to utilize them for lifelong learning, communicative skills and to imbibe ethical values to create a better world.
2. Will learn about the systematics, structure and functions of plants for effective management of cultivation practices for improved plant performance.
3. Will develop laboratory skills utilizing modern tools, techniques and protocols to collect and process data to design innovative scientific problems and solutions.
4. Will apply the skills for the benefit of the society through teamwork and project management practices for employability and entrepreneurship.
5. Will exploit the knowledge gained through various courses for sustainable environment and human welfare.

B.Sc. Botany						
PROGRAMME STRUCTURE						
Part	Sem.	Specification	No. of Courses	No. of Hours	Credits	Total Credits
I	I-IV	Languages (Tamil / Hindi / French / Sanskrit)	4	16	12	12
II	I-IV	General English	4	20	12	12
III	I-VI	Core course : Theory	12	52	32	82
	I-VI	Core course : Practical	7	22	13	
	I-IV	Core course- Allied/(Practical)	4	16(8)	16	
	V-VI	Discipline Specific Elective	4	20	12	
	VI	Project Work	1		2	
	V	Self-paced learning	1	--	2	
	V	Field study/ Industrial visit/ Case study	1		1	
	V	Internship	1	-	2	
	VI	Comprehensive Exam	1	--	2	
	II,III,V	Extra Credit courses (MOOC)	(3)	--	(6)	(6)
IV	V,VI	Generic Elective	2	8	6	14
	I	AECC-1 Communicative English	1	--	4	
	II	AECC-2 Environmental studies	1	2	2	
	III	SEC -1 Within Dept. (WD)	1	2	1	
	IV	SEC -2 Between Schools (BS)	1	2	1	
	V	SEC -3 Soft skill	1	2	1	
	VI	SEC -4 within school (WS)	1	2	1	
	I-IV	Value Education	4	8	4	
V	1-V	Outreach Programme/NCC	-	-	-	4
		Total		180		130(6)

B.Sc. Botany								
PROGRAMME PATTERN								
Course Details						Scheme of Exams		
Sem	Part	Course Code	Course Title	Hrs	Cr	CIA	SE	Final
I	1	21UTA11GL01	General Tamil - I	4	3	100	100	100
		21UFR11GL01	French-I					
		21UHI11GL01	Hindi-I					
		21USA11GL01	Sanskrit-I					
	2	21UEN12GE01	General English-I	5	3	100	100	100
	3	21UBO13CC01	Algae and Bryophytes	5	3	100	100	100
	3	21UBO13CC02	Fungi, Plant Pathology and Lichens	5	3	100	100	100
	3	21UBO13CP01	Lab Course 1	3	2	100	100	100
	3	21UBO13AC01	Allied I: Zoology I: General Zoology	4	2	100	100	100
	3	21UBO13AP01	Allied I: Lab. Course: Zoology 1	2	2	100	100	100
	4	21UEN14AE01	AECC-1 : Communicative English	(6)	4	100	-	100
	4	21UHE14VE01	Essentials of Humanity	2	1	50	50	50
Total				30	23			
II	1	21UTA21GL02	General Tamil - II	4	3	100	100	100
		21UFR21GL02	French-II					
		21UHI21GL02	Hindi-II					
		21USA21GL02	Sanskrit-II					
	2	21UEN22GE02	General English-II	5	3	100	100	100
	3	21UBO23CC03	Pteridophytes, Gymnosperms and Paleobotany	4	3	100	100	100
	3	21UBO23CC04	Anatomy and Embryology	4	2	100	100	100
	3	21UBO23CP02	Lab Course 2	3	2	100	100	100
	3	21UBO23AC02	Allied I: Zoology II: Agricultural Entomology	4	2	100	100	100
	3	21UBO23AP02	Allied I: Lab. Course: Zoology II	2	2	100	100	100
	4	21UHE24AE02	AECC-2: Environmental studies	2	2	50	50	50
	4	21UHE24VE02	Techniques of Social Analysis: Fundamentals of Human Rights	2	1	50	50	50
Total				30	20(2)			
III	1	21UTA31GL03	General Tamil - III	4	3	100	100	100
		21UFR31GL03	French-III					
		21UHI31GL03	Hindi-III					
		21USA31GL03	Sanskrit-III					
	2	21UEN32GE03	General English-III	5	3	100	100	100
	3	21UBO33CC05	Taxonomy of Angiosperms	5	3	100	100	100
	3	21UBO33CC06	Plant Breeding and Evolution	3	2	100	100	100
	3	21UBO33CP03	Lab Course 3	3	2	100	100	100
	3	21UBO33AO03A	Allied-II Optional: Chemistry for Biologists - I	4	3	100	100	100
		21UBO33AO03B	Allied-II Optional: Biometrics & Computer Applications I	4	2	100	100	100
	3	@	Allied-II Optional: Lab. Course 1 (Chemistry for Biologists)	2	-	-	-	-
		21UBO33AP03B	Allied-II Optional: Lab. Course 1 (Biometrics & Computer Applications)	2	2	100	100	100
	4	21UBO34SE01	SEC-1 (WD): Mushroom technology	2	1	100	-	100
	4	21UHE34VE03A	Professional Ethics-I: Social Ethics - I	2	1	50	50	50
	4	21UHE34VE03B	Professional Ethics I:Religious Doctrine- I					
			Extra Credit courses (MOOC)-2		(2)			

			Total	30	18/19(2)			
IV	1	21UTA41GL04B	Scientific Tamil	4	3	100	100	100
		21UFR41GL04	French-IV					
		21UHI41GL04	Hindi-IV					
		21USA41GL04	Sanskrit-IV					
	2	21UEN42GE04	General English-IV	5	3	100	100	100
	3	21UBO43CC07	Cell Biology and Genetics	4	3	100	100	100
	3	21UBO43CC08	Ecology and Climate Change	4	2	100	100	100
	3	21UBO43CP04	Lab Course 4	3	2	100	100	100
	3	21UBO43AO04A	Allied-II Optional: Chemistry for Biologists - II	4	3	100	100	100
		21UBO43AO04B	Allied-II Optional: Biometrics & Computer Applications II	4	2	100	100	100
	3	21UBO43AP04A	Allied-II Optional: Lab Course 2 (Chemistry for Biologists)	2	2	100	100	100
		21UBO43AP04B	Allied-II Optional: Lab Course 2 (Biometrics & Computer Applications)	2	2	100	100	100
	4	21UBO44SE02	SEC-2 (BS): Mushroom Technology	2	1	100	-	100
	4	21UHE44VE04A	Professional Ethics II: Social Ethics-II	2	1	50	50	50
	4	21UHE44VE04B	Professional Ethics II: Religious Doctrine-II					
			Total	30	19/20			
V	3	21UBO53CC09	Biophysics and Biostatistics	5	2	100	100	100
	3	21UBO53CC10	Microbiology & Immunology	5	3	100	100	100
	3	21UBO53CP05	Lab. Course 5	4	3	100	100	100
	3	21UBO53ES01A	DSE-1: Molecular Biology	5	3	100	100	100
	3	21UBO53ES01B	DSE-1: Bioinformatics & Bionanotechnology					
	3	21UBO53ES02A	DSE-2: Research Methodology	5	3	100	100	100
		21UBO53ES02B	DSE-2: Biopesticides					
	3	21UBO53IS01	Internship	-	2	100	-	100
	3	21UBO53SP01	Self-paced learning: Economic Botany	-	2	50	50	50
	3	21UBO53FV01	Field study/ Industrial visit/ Case Study	-	1	100	-	100
	3	21UBO54EG01	GE-1: Landscape designing	4	3	100	100	100
	4	21USS54SE03	SEC-3: Soft Skills	2	1	100	-	100
			Extra Credit courses (MOOC)-3		(2)			
			Total	30	23(2)			
VI	3	21UBO63CC11	Plant Physiology	4	3	100	100	100
	3	21UBO63CP06	Lab. Course 6	3	1	100	100	100
	3	21UBO63CC12	Genetic Engineering and Biotechnology	4	3	100	100	100
	3	21UBO63CP07	Lab. Course 7	3	1	100	100	100
	3	21UBO63ES03A	DSE-3: Biochemistry	5	3	100	100	100
	3	21UBO63ES03B	DSE-3: Agricultural Botany					
	3	21UBO63ES04A	DSE-4: Medicinal Botany	5	3	100	100	100
	3	21UBO63ES04B	DSE-4: Biological Techniques					
	3	21UBO63PW01	Project Work	-	2	100	100	100
	3	21UBO63CE01	Comprehensive Examination	-	2	50	50	50
	3	21UBO64EG02	GE-2: Solid Waste Management	4	3	100	100	100
	4	21UBO64SE04	SEC-4 (WS): Herbal Technology	2	1	100	-	100
			Total	30	22			
I-VI	5	21UCW65OR01	Outreach Programme		4			
			TOTAL (three years)	180	130(6)			

*The courses with a scheme of Exam 50 in CIA and SE will be converted to 100 for grading.

SEC-2: BETWEEN SCHOOL 4th Semester							
Between schools (BS)- Offered to students of other schools (Except the school offering the course)							
Course Details					Scheme of Exams		
Offering Department	Course Code	Course Title	Hr	Cr	CIA	SE	Final
SBS							
Botany	21UBO44SE02	Mushroom Technology	2	1	100	-	100
SCS							
Computer Science	21UCS44SE02	Data Analysis Using Spreadsheet	2	1	100	-	100
Mathematics	21UMA44SE02	Numerical Ability	2	1	100	-	100
Statistics	21UST44SE02	Quantitative Methods	2	1	100	-	100
Information Technology	21UBC44SE02	Digital Artwork	2	1	100	-	100
SLAC							
English	21UEN44SE02	English for Competitive Examinations	2	1	100	-	100
History	21UHS44SE02	Historical Monuments in Tiruchirappalli	2	1	100	-	100
Tamil	21UTA44SE02A	மேடைப் பேச்சுக்கலை	2	1	100	-	100
Tamil	21UTA44SE02	திரைப்படத் திறனாய்வும் குறும்பட உருவாக்கம்	2	1	100	-	100
SMS							
Commerce	21UCO44SE02A	Personal Finance Management	2	1	100	-	100
Commerce	21UCO44SE02B	Marketing Skills	2	1	100	-	100
Commerce	21UCO44SE02C	Event Planning and Management	2	1	100	-	100
Economics	21UEC44SE02	Financial Economics	2	1	100	-	100
BBA	21UBU44SE02A	Entrepreneurial Skills Enhancement	2	1	100	-	100
BBA	21UBU44SE02B	Practical Stock Trading	2	1	100	-	100
CommerceCA	21UCC44SE02	Practical Banking in India	2	1	100	-	100
SPS							
Chemistry	21UCH44SE02A	Health Chemistry	2	1	100	-	100
Chemistry	21UCH44SE02B	Industrial Chemistry	2	1	100	-	100
Physics	21UPH44SE02A	Weather Physics	2	1	100	-	100
Physics	21UPH44SE02B	Electrical Wiring	2	1	100	-	100
Electronics	21UEL44SE02	PC Assembling and Servicing	2	1	100	-	100

GENERIC ELECTIVE -1: 5th Semester							
Generic Elective Courses are designed for the students of other disciplines. (open to the students of other departments)							
Course Details					Scheme of Exams		
Offering Department	Course Code	Course Title	Hrs	Cr	CIA	SE	Final
SBS							
Botany	21UBO54EG01	Landscape Designing	4	3	100	100	100
SCS							
Computer Science	21UCS54EG01	Ethical Hacking	4	3	100	100	100
Mathematics	21UMA54EG01	Mathematics for Competitive Examinations	4	3	100	100	100
Statistics	21UST54EG01	Actuarial Statistics	4	3	100	100	100
Information Technology	21UBC54EG01	Fundamentals Of Data Science	4	3	100	100	100
SLAC							
English	21UEN54GE01	Film Studies	4	3	100	100	100
History	21UHS54EG01	Tamil Heritage and Culture	4	3	100	100	100
Tamil	21UTA54EG01	தமிழிலயக்கத்தில் மனித உரிமைகள்	4	3	100	100	100
SMS							
Commerce	21UCO54EG01A	Computerised Accounting	4	3	100	100	100
Commerce	21UCO54EG01B	Basics of Excel	4	3	100	100	100
Commerce	21UCO54EG01C	Personal Investment Planning	4	3	100	100	100
Economics	21UEC54EG01	Principles of Economics	4	3	100	100	100
Commerce CA	21UCC54EG01	E-commerce and E Business Management	4	3	100	100	100
BBA	21UBU54EG01A	Global Supply Chain Management	4	3	100	100	100
BBA	21UBU54EG01B	Start – Ups and Small Business Management	4	3	100	100	100
SPS							
Chemistry	21UCH54EG01A	Chemistry for Competitive Examinations	4	3	100	100	100
Chemistry	21UCH54EG01B	Everyday Chemistry	4	3	100	100	100
Physics	21UPH54EG01A	Everyday Physics	4	3	100	100	100
Physics	21UPH54EG01B	Renewable Energy Physics	4	3	100	100	100
Electronics	21UEL54EG01A	Everyday Electronics	4	3	100	100	100
Electronics	21UEL54EG01B	Wireless Communication	4	3	100	100	100

GENERIC ELECTIVE -2: 6 th Semester							
Generic Elective Courses are designed for the students of other disciplines. (open to the students of other departments)							
Course Details					Scheme of Exams		
Offering Department	Course Code	Course Title	Hrs	Cr	CIA	SE	Final
SBS							
Botany	21UBO64EG02	Solid Waste Management	4	3	100	100	100
SCS							
Computer Science	21UCS64EG02	3D Printing and Design	4	3	100	100	100
Mathematics	21UMA64EG02	Analytical Skill for Competitive Examinations	4	3	100	100	100
Statistics	21UST64EG02	Applied Statistics	4	3	100	100	100
Information Technology	21UBC64EG02	Industry 4.0	4	3	100	100	100
SLAC							
English	21UEN64EG02	English for the Media	4	3	100	100	100
History	21UHS64EG02	Intellectual Revivalism in Tamil Nadu	4	3	100	100	100
Tamil	21UTA64EG02	சித்த மருத்துவம்	4	3	100	100	100
SMS							
Commerce	21UCO64EG02A	Rural Marketing	4	3	100	100	100
Commerce	21UCO64EG02B	Entrepreneurship Development	4	3	100	100	100
Commerce	21UCO64EG02C	Digital Marketing	4	3	100	100	100
Economics	21UEC64EG02	Economics for Competitive Exams	4	3	100	100	100
CommerceCA	21UCC64EG02	Total Quality Management	4	3	100	100	100
BBA	21UBU64EG02A	Personality Development	4	3	100	100	100
BBA	21UBU64EG02B	NGO Management	4	3	100	100	100
SPS							
Chemistry	21UCH64EG02A	Food And Nutrition	4	3	100	100	100
Chemistry	21UCH64EG02B	Waste Management	4	3	100	100	100
Physics	21UPH64EG02A	Laser Technology and its Application	4	3	100	100	100
Physics	21UPH64EG02B	Physics of Earth	4	3	100	100	100
Electronics	21UEL64EG02A	CCTV and Smart Security System	4	3	100	100	100
Electronics	21UEL64EG02B	Entrepreneurial Electronics	4	3	100	100	100

Semester	Course Code	Title of the Course	Hours	Credits
I	21UTA11GL01	General Tamil - I	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	இப்பாடத்தின் நிறைவில் மாணவர்கள்	
CO-1	இக்கால இலக்கிய வகைகளைக் கண்டறிவர்	K1
CO-2	எழுத்து, சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிவர்	K1
CO-3	அயலகக் கவிதை வடிவங்களை விளங்கிக் கொள்வர்	K2
CO-4	மொழிபெயர்ப்புக் கவிதைகளின் வாயிலாக மொழிபெயர்ப்புத் திறனை வளர்த்தெடுப்பர்	K3
CO-5	புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக, அரசியல் விழுமியங்களை மதிப்பிடுவர்	K4

அலகு - 1

(12 மணிநேரம்)

- பாரதியார் கவிதைகள் - குயில்பாட்டு (குயில் தன் பூர்வ ஜன்மக் கதை உரைத்தல்)
- பாரதிதாசன் கவிதைகள் - சஞ்சீவி பர்வதத்தின் சாரல்
- உரைநடை - முதல் மூன்று கட்டுரைகள்

அலகு - 2

(12 மணிநேரம்)

- வெ.இராமலிங்கனார் - சொல், தமிழன் இதயம்
- முடியரசனார் - உயிர் வெல்லமோ, மனத்தாய்மை
- பெருஞ்சித்திரனார் - அஞ்சாதீர், மொழி இனம் நாடு,
- பட்டுக்கோட்டை - வருங்காலம் உண்டு, உழைக்காமல் சேர்க்கும் பணம்.
- கல்யாணசுந்தரனார் - எழுத்து
- இலக்கணம் - மூன்றாம் பாகம் - தண்டமிழ்த் தொண்டர்கள்
- இலக்கிய வரலாறு

அலகு - 3

(12 மணிநேரம்)

- சுரதா - நல்ல தீர்ப்பு
- கண்ணதாசன் - ஒரு பாணையின் கதை
- அப்துல் ரகுமான் - வீடு
- மேத்தா - ஒரே குரல்
- இலக்கிய வரலாறு - மூன்றாம் பாகம் - இருபதாம் நூற்றாண்டு
- இலக்கியவளர்ச்சி - முதல் ஐந்து சிறுகதைகள்
- சிறுகதை

அலகு - 4 : அரசியல் கவிதைகள்

(12 மணிநேரம்)

- ஈரோடு தமிழன்பன் - அகல் விளக்காக இரு
- ஆதவன் தீட்சண்யா - இன்னும் இருக்கும் சுவர்களின் பொருட்டு

சுகிர்தராணி	- என் கண்மணியே இசைப்பிரியா
சக்தி ஜோதி	- யுகாந்திர உறக்கம்
பழநிபாரதி	- வெள்ளைக்காகிதம்
லிவிங் ஸ்மைல் வித்யா	- நினைவில் பால்யம் அழுத்தம்
இலக்கணம்	- சொல்

அலகு - 5 அயலகக் கவிதைகள்

(12 மணிநேரம்)

ஓசே ரிசால்	- விடைகொடு என் தாய் மண்ணே
ஹைபுன் கவிதைகள்	- அறுவடை நாளின் மழை (மூன்று கவிதைகள்)
சிறுகதை	- ஆறு முதல் பத்து சிறுகதைகள்
உரைநடை	- நான்கு முதல் ஆறு கட்டுரைகள்

பாட நூல்கள்

1. பொதுத்தமிழ், செய்யுள் திரட்டு, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021
2. சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017
3. நற்றமிழ்க் கோவை (கட்டுரைத் தொகுப்பு). தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021
4. சிறுகதைத் தொகுப்பு - ஒவ்வொரு கல்வியாண்டிற்கும் ஒவ்வொரு சிறுகதைத்தொகுப்பு
5. (2021-2022 கல்வியாண்டுக்கு மட்டும்): நல்லாசிரியர், சிறுகதைத் தொகுப்பு, - தமிழாய்வுத்துறை, நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை, முதற்பதிப்பு, 2021

Relationship matrix for Course outcomes, Programme outcomes / Programme Specific Outcomes

Semester	Course code	Title of the Course									Hours/ week	Credits
I	21UTA11GL01	General Tamil - I									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	2	1	2	2	3	3	3	2	3	2	2.3	
CO-2	2	1	2	2	2	3	2	2	2	2	2.0	
CO-3	2	1	2	2	3	3	3	2	3	2	2.3	
CO-4	1	2	1	2	2	3	2	2	3	2	2.0	
CO-5	1	1	2	2	3	3	3	2	3	2	2.2	
Mean overall Score											2.16	(High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UFR11GL01	FRENCH – I	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	recall and spell the alphabets, numbers, colours, days of the week and months in French.	K1
CO–2	compare the definite and indefinite articles and its usages.	K2
CO–3	construct simple phrases by using ‘er’ verbs in present tense.	K3
CO–4	make use of correct terminology and introduce oneself in French.	K3
CO–5	distinguish between affirmative and negative phrases and take part in role play - conversation.	K4

Unit – I (12 hours)

TITRE: BONJOUR CA VA?

GRAMMAIRE : Les pronoms personnels sujets, les articles définis et indéfinis, Etre et avoir (verbes auxiliaires)

LEXIQUE : Saluer, Entrer en contact, demander et dire comment ça va ?, L’alphabet, les couleurs, les pays et les nationalités, les animaux domestiques.

PRODUCTION ORALE : Epeler son nom et son prénom, Comprendre des personnes qui se saluent.

PRODUCTION ECRITE : Les formules de politesse

Unit – II (12 hours)

TITRE: SALUT ! JE M’APPELLE AGNES

GRAMMAIRE : La conjugaison du 1^{er} groupe, les adjectifs possessifs, la formation du féminin, la formation du pluriel.

LEXIQUE : Se présenter, Présenter quelqu’un, Remercier, Les jours de la semaine, les mois de l’année, les nombres de 0 à 69, la famille

PRODUCTION ORALE : Comprendre des informations essentielles

PRODUCTION ECRITE : Présentez –vous

Unit - III (12 hours)

TITRE: QUI EST-CE?

GRAMMAIRE : La phrase interrogative : Qu’est-ce que... ?/Qu’est-ce que c’est ?/Qui est-ce ?, quelques indicateurs du temps, la formation du féminin, les verbes aller et venir

LEXIQUE : Demander et répondre poliment, les professions

PRODUCTION ORALE : Parler de ses projets

PRODUCTION ECRITE : Ecrire de brefs messages

Unit - IV (12 hours)

TITRE: DANS MON SAC, J’AI?

GRAMMAIRE : la phrase négative, c’est/il est, les articles contractes, les pronoms personnels toniques

LEXIQUE : Demander des informations personnelles, Quelques objets, la fiche d’identité, les

nombre à partir de 70

PRODUCTION ORALE : Comprendre un message sur un répondeur téléphonique

PRODUCTION ECRITE : Remplir une fiche d'identité

Unit - V

(12 hours)

TITRE:IL EST COMMENT? / ALLO?

GRAMMAIRE : les adverbes interrogatifs, les prépositions de lieu, les verbes du deuxième groupe, le verbe faire

LEXIQUE : Parler au téléphone, décrire quelqu'un, l'aspect physique, le caractère

PRODUCTION ORALE : Un jeu de rôle – la conversation téléphonique

PRODUCTION ECRITE : Décrivez votre aspect physique et votre caractère en quelques lignes

Book for Study

P. Dauda, L.Giachino and C.Baracco, *Generation AI*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecher, *Echo AI*, CLE International, 2^eédition, 2017
2. Régine Mérieux and Yves Loiseau, *Latitudes AI*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers,2011

Web Resources

1. <https://www.wikihow.com/Pronounce-the-Letters-of-the-French-Alphabet>
2. <https://français.lingolia.com/en/grammar/tenses/le-present>
3. <https://www.lawlessfrench.com/grammar/articles/>
4. <https://www.frenchpod101.com/french-vocabulary-lists/10-lines-you-need-for-introducing-yourself>
5. <https://www.tolearnfrench.com/exercices/exercice-french-2/exercice-french-3295.php>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code		Title of the Course					Hours		Credits	
I	21UFR11GL01		FRENCH – I					4		3	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO–1	3	1	2	3	2	3	2	1	2	3	2.2
CO–2	3	3	3	2	2	2	1	2	2	3	2.3
CO–3	3	1	2	3	2	3	2	1	2	2	2.1
CO–4	2	2	3	2	1	3	2	1	2	3	2.1
CO–5	3	2	3	2	2	3	2	2	3	2	2.4
Mean overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UHI11GL01	HINDI- I	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, students will be able to	
CO -1	list out the literary works in Hindi during the period of 12th century in India.	K1
CO -2	compare the vocabulary & expressions related to day-to-day conversation.	K2
CO -3	use simple Phrases from English to Hindi.	K3
CO -4	investigate the values of Indian society & summarize the duties of a citizen for his/her country.	K4
CO -5	identify the sentences in Hindi using basic grammar.	K4

Unit - I (12 Hours)

Dr. Abdul Kalam
Ling
Kabir Ke Dohe
Baathcheeth - Aspathal mein
Adhikal - Namakarn

Unit - II (12 Hours)

Vachan Badaliye
Thulasi ke Dohe
Adhikal - Samajik Paristhithiyam
Moun Hee Mantra Hai

Unit - III (12 Hours)

Sangya
Soordas ke Pad
Baathcheeth - Hotel mein
Adhikal - Sahithyik Paristhithiyam

Unit - IV (12 Hours)

Sarvanam
Rahim ke Dohe
Bathcheeth - Kaksha mein
Adhikal - Salient Features, Main Divisions

Unit - V**(12 Hours)**

Anuvad - 1
 Visheshan
 Bihari - Dohe
 Bathcheeth - Kariyalay mein
 Adhikal - Visheshathayem

Books for Study

1. M.kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta,2020.
Unit-I Chapters 2 and 3
2. Viswanath Tripathy, *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd, New Delhi,2018.
Unit-II, III and IV Chapters 4 and 5
3. Dr. Sanjeev Kumar Jain, *Anuwad: Siddhant Evam Vyavhar*, Kailash Pustak Sadan, Madhya Pradesh 2019.
Unit-V Chapter 1

Books for Reference

1. Dr.A.P.J.Abdul Kalam, *Mere sapnom ka Bharath*, Prabath Prakashan, Noida, 2020,
2. Lakshman prasad singh, *Kavya ke sopan*, Bharathy Bhavan Prakashan, 2017.
3. Aravind Kumar, *Sampoorna Hindi Vyakaran our Rachana*, Lucent publisher, 2019.
4. Adhunik Hindi Vyakaran our Rachana, bharati bhawan publishers & distributors, 2018.
5. Acharya ramchandra shukla, *Hindi Sahitya Ka Itihas*, Prabhat Prakashan, 2021.

Web Resources

1. <https://youtu.be/LrdrcP2oiyU>
2. <https://youtu.be/Cib2FNv8KyA>
3. <https://youtu.be/aXARykpyCxA>
4. <https://youtu.be/RUDFis-tdg4>
5. <https://youtu.be/upivTmLTPQA>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course									Hours	Credits
I	21UHI11GL01	HINDI - I									4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	3	2	3	1	3	1	3	3	2	2.3	
CO-2	2	2	3	3	1	3	2	3	3	2	2.4	
CO-3	3	2	2	1	2	3	2	3	2	3	2.3	
CO-4	3	2	1	3	2	3	2	3	3	2	2.4	
CO-5	2	3	3	2	3	2	3	3	3	1	2.5	
Mean Overall Score											2.38	(High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21USA11GL01	SANSKRIT - I	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, the student will be able to	
CO-1	remember and Recall words relating to objects.	K1
CO-2	understand classified vocabulary.	K2
CO-3	apply nouns and verbs.	K3
CO-4	analyze different forms of names and verbs.	K4
CO-5	appreciate the good saying of Sanskrit Improve the self-values.	K5

Unit - I (12 Hours)

Samyakthakshatra pada paricaya

Unit - II (12 Hours)

Vartmanakala prayogaha

Unit - III (12 Hours)

Samskruta varathanamanakalaha

Unit - IV (12 Hours)

Shadha priyoghaa aakaarnta ikaraantha ukarantha

Unit - V (12 Hours)

Subhashitani manoharani Dasaslokani

Book for Study

Shaptamanjari , K.M., Saral Snakrit Balabodh , Bharathiya Vidya Bhavan , Munushimarg
Mumbai – 4000 007 2018, 2019

Books for Reference:

1. Kulapathy , K.M., Saral Snakrit Balabodh , Bharathiya Vidya Bhavan , Munushimarg
Mumbai – 4000 007 2018
2. R.S.Vadhar & Sons , Book – Sellers and publishers , Kalpathi.Palgahat 678003, Kerala
South India , Shabdha Manjari 2019
3. Balasubramaniam R, Samskrita Akshatra Siksha , Vangals Publications, 14th Main road
JP Nagar , Bangalore – 78

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course									Hours	Credit
I	21USA11GL01	SANSKRIT- I									4	3
Course Outcomes ↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	1	1	3	2	3	2	3	2	2	2.2	
CO-2	2	2	3	3	1	2	2	3	3	2	2.3	
CO-3	3	2	2	2	2	2	2	3	3	2	2.3	
CO-4	3	2	2	3	2	3	3	3	2	2	2.3	
CO-5	3	2	3	2	3	2	2	3	3	3	2.6	
Mean Overall Score											2.34	
Result											# High	

Semester	Course Code	Title of the Course	Hours	Credits
I	21UEN12GE01	GENERAL ENGLISH - I	5	3

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	recall what they observe and experience	K1
CO-2	arrange different parts of a text in a coherent manner	K2
CO-3	examine the underlying meaning in a text	K3
CO-4	analyse and evaluate letters regarding the use of appropriate language and format	K4 & K5
CO-5	use conversational English to communicate with friends	K6

Unit-I

(15 Hours)

01. Personal Details
02. Positive Qualities
03. Listening to Positive Qualities
04. Relating and Grading Qualities
05. My Ambition
06. Abilities and Skills
07. Self-Improvement Word Grid
08. What am I Doing?
09. What was I Doing?
10. Unscramble the Past Actions
11. What did I Do Yesterday?

Unit-II

(15 Hours)

12. Body Parts
13. Actions and Body Parts
14. Value of Life
15. Describing Self
16. Home Word Grid
17. Unscramble Building Types
18. Plural Forms of Naming Words
19. Irregular Plural Forms
20. Plural Naming Words Practice
21. Whose Words?

Unit-III

(15 Hours)

22. Plural Forms of Action Words
23. Present Positive Actions
24. Present Negative Actions
25. Un/Countable Naming Words
26. Recognition of Vowel Sounds
27. Indefinite Articles
28. Un/Countable Practice

29. Match the Visual
30. Letter Spell-Check
31. Drafting a Letter

Unit-IV

(15 Hours)

32. Friendship Word Grid
33. Friends' Details
34. Guess the Favourites
35. Guess Your Friend
36. Friends as Guests
37. Introducing Friends
38. What are We Doing?
39. What is (S)He / are They Doing?
40. Yes / No Question
41. What was S/He Doing?
42. Names and Actions
43. True Friendship
44. Know Your Friends
45. Giving Advice/Suggestions
46. Discussion on Friendship
47. My Best Friend

Unit-V

(15 Hours)

48. Kinship Words
49. The Odd One Out
50. My Family Tree
51. Little Boy's Request
52. Occasions for Message
53. Words Denoting Place
54. Words Denoting Movement
55. Phrases for Giving Directions
56. Find the Destination
57. Giving Directions Practice
58. SMS Language
59. Converting SMS
60. Writing Short Messages
61. Sending SMS
62. The Family Debate
63. Family Today

Book for Study

Joy, J.L., and Peter, F.M. *Let's Communicate I*. New Delhi, Trinity P, 2014.

Books for Reference

1. Ahrens, Sönke. *How to Take Smart Notes: One Simple Technique to Boost Writing, Learning and Thinking*. New York: Create Space, 2017.
2. Aspinall, Tricia. *Test Your Listening*. London: Pearson, 2002.
3. Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. New York: Routledge, 2004.
4. Fitikides, T.J. *Common Mistakes in English* (6th ed.). London: Longman, 2002.

5. Wainwright, Gordon. *How to Read Faster and Recall More: Learn the Art of Speed Reading with Maximum Recall* (3rd ed.). Oxford: How to Books, 2007.

Web Resources

1. <https://learnenglish.britishcouncil.org/>
2. <https://oneminuteenglish.org/en/best-websites-learn-english/>
3. <https://www.dailywritingtips.com/best-websites-to-learn-english/>

Relationship Matrix for Course Outcomes, Programme Outcomes, and Programmes Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credit
I	21UEN12GE01		GENERAL ENGLISH – I								5	3
Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO -1	2	3	2	2	3	2	3	2	3	2	2.4	
CO -2	2	2	3	2	3	3	2	3	2	2	2.3	
CO -3	2	3	2	3	2	2	3	2	3	2	2.4	
CO -4	2	2	3	2	3	3	2	3	2	3	2.5	
CO -5	2	2	2	3	2	2	2	3	2	2	2.2	
Mean Overall Score											2.36	(High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UBO13CC01	CORE-1: ALGAE AND BRYOPHYTES	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire thorough knowledge on the salient features of Algae and Bryophytes.	K1
CO-2	learn the major classes, types, structure and reproduction of various genera.	K1
CO-3	conserve them in their natural environment.	K2
CO-4	acquire the basic knowledge of the evolutionary relationship between algae and bryophytes.	K3
CO-5	identify the economic importance of Algae and Bryophytes.	K4

Unit-I (15 Hours)

Algae: General characteristics of algae. Commonly found algae in India. Classification (F.E. Fritsch, 1945). Salient features of various classes as per Fritsch's system. Cell structure of prokaryotic algae (Cyanophyceae cell) and eukaryotic algae (Chlorophyceae cell).

Unit-II (15 Hours)

Thallus organization, mode of reproduction, algal life cycle patterns (haplontic, diplontic, haplo-diplontic and diplobiontic). Mass culture (spirulina), economic importance and BGA in *Azolla* as fodder and biofertilizer.

Unit-III (15 Hours)

Detailed study of the following genera: occurrence, distribution, common species, structure and reproduction of *Oscillatoria*, *Oedogonium*, *Caulerpa*, *Cyclotella*, *Sargassum* and *Polysiphonia* (developmental studies on sex organs not required).

Unit-IV (15 Hours)

Bryophytes: General characteristics of Bryophytes, Various natural habitats of Bryophytes, Classification (Rothmaler, 1951), vegetative reproduction and economic importance. Evolution of gametophytes and sporophytes among Bryophytes.

Unit-V (15 Hours)

Detailed study of the following genera: occurrence, distribution, common species, structure and reproduction of *Marchantia*, *Anthoceros* and *Funaria* (developmental studies on sex organs not required).

Books for Study

1. Pandey, BP. 2018. College Botany Volume I, 20/e, S. Chand and Company, New Delhi.
2. Pandey, BP. 2005. Simplified Course in Botany. S. Chand and Company, New Delhi.
3. Sharma, OP. 1992. Text Book of Algae. Tata McGraw Hill, New Delhi.

Books for Reference

1. Gangulee, HC. And Kar, AK. 1989. College Botany, Vol-II, Books & Allied Pvt. Ltd., Calcutta.
2. Prem Puri. 1981. Bryophytes - Morphology growth and differentiation. Atma Ram & Sons. Lucknow.
3. Smith, GM. 1955. Cryptogamic Botany Vol-1&II, McGraw Hill, New York.

Semester	Course Code	Title of the Course									Hours	Credits
I	21UBO13CC01	CORE-1: ALGAE AND BRYOPHYTES									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	2	1	1	3	3	2	2	1	2.1	
CO2	1	2	2	2	2	3	2	2	2	1	1.9	
CO3	3	3	3	3	3	2	3	3	3	2	2.8	
CO4	1	2	3	3	3	1	2	3	3	3	2.4	
CO5	3	2	3	3	3	3	2	1	3	3	2.6	
	Mean overall score											2.36
Result											HIGH	

Semester	Course Code	Title of the Course	Hours	Credits
I	21UBO13CC02	CORE-2: FUNGI, PLANT PATHOLOGY AND LICHENS	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire thorough knowledge on the salient features of fungi and lichens.	K1
CO-2	learn the major classes, types, structure and reproduction of various genera.	K2
CO-3	attain basic skills on aetiology and control of various plant diseases.	K3
CO-4	understand the disease cycle caused by the pathogens.	K3
CO-5	identify the ecological importance and economic importance of fungi and lichens.	K4

Unit-I (15 Hours)

Fungi: General characteristics - range of thallus organization, cell wall composition, mode of nutrition and reproduction. Outline on the Classification of fungi (G. C Ainsworth, 1973; C. J Alexopoulos and C. W. Mims, 1979) and general characteristics of the Divisions and Classes in Fungi. Economic importance.

Unit II (15 Hours)

Fungi: detailed study of morphology and reproduction of the following: (a) Mastigomycotina- *Albugo*; (b) Zygomycotina- *Rhizopus*; (c) Ascomycotina- *Saccharomyces* and *Penicillium*; (d) Basidiomycotina- *Puccinia*; (e) Deuteromycotina- *Cercospora*.

Unit III (15 Hours)

Plant Pathology: Definition of terms used in plant pathology; plant diseases: concept and classification of plant diseases—methods of control of plant diseases: mechanical, chemical and biological. Defence mechanism in plants: structural, morphological and biochemical.

Unit IV (15 Hours)

Plant Pathology: Detailed study of the following plant diseases with reference to causes, symptoms, dissemination, control and preventive measures - Viral Diseases: Bunchy top of Banana, mosaic disease of tobacco; Bacterial diseases: Bacterial blight of paddy, Citrus canker, Fungal diseases: Late blight of potato, red rot of sugarcane, paddy blast; Mycoplasma disease: Little leaf of brinjal.

Unit V (15 Hours)

Lichens: occurrence, distribution, classification, structure, vegetative and sexual reproduction (with reference to fruticose lichen - *Usnea*). Economic importance and role in succession and pollution monitoring.

Books for Study

1. Singh V, Pande PC & Jain DK. 2020. A Text Book of Botany (5th ed), Rastogi Publication, Meerut.
2. Pandey, BP. 2018. College Botany Volume I, 20/e, S. Chand and Company, New Delhi.
3. Pandey, BP. 2005. Simplified Course in Botany. S. Chand and Company, New Delhi.

Books for Reference

1. Sharma OP 1989. Text Book of fungi. Tata McGraw Hill, New York.
2. Vasishta BR & Sinha AK. 2003. Botany for degree students Fungi. S Chand New Delhi.
3. Mehrotra R S 1991. Plant Pathology, Tata McGraw-Hill Publishing, New Delhi.
4. Hale ME, 1983 The Biology of Lichens, New Age International publishers, New Delhi.

Semester	Course Code	Title of the Course									Hours	Credits
1	21UBO130202	CORE-2: FUNGI, PLANT PATHOLOGY AND LICHENS									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	1	2	3	1	2	3	3	2.2	
CO-3	2	2	3	2	1	2	3	2	3	2	2.2	
CO-4	3	2	2	1	2	3	2	3	2	3	2.4	
CO-5	2	3	2	3	1	3	2	3	2	1	2.2	
Mean Overall Score											2.3	
Result											#	Medium

Semester	Course Code	Title of the Course	Hours	Credit
1	21UBO13CP01	LAB COURSE 1 (ALGAE, BRYOPHYTES, FUNGI, PLANT PATHOLOGY AND LICHEN)	3	2

Detailed study of the following genera:

Algae:

Oscillatoria, Oedogonium, Caulerpa, Cyclotella, Sargassum and Gracilaria.

Bryophytes:

Marchantia, Anthoceros and Funaria.

Fungi:

Plasmodiophora, Albugo, Peziza, Puccinia and Cercospora.

Plant Pathology:

Tobacco Mosaic Virus, Citrus Canker, Late Blight of Potato, Red Rot of Sugarcane, Bunchy Top of Banana, Little Leaf of Brinjal, Paddy Blast

Lichen:

Usnea

Semester	Course Code	Title of the Course	Hours	Credits
I	21UBO13AC01	ALLIED-I: ZOOLOGY I: GENERAL ZOOLOGY	4	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire basic knowledge on animal organization.	K1
CO-2	understand the mode of action of various hormones.	K2
CO-3	understand the role of protozoan in human health.	K2
CO-4	identify the invertebrate and their role in human welfare.	K3
CO-5	study the physiology and functions of various organs in human.	K4, K5

Unit I (12 Hours)

Basic principles of zoological taxonomy and nomenclature. General classification of the animal kingdom (up to phylum with examples). Salient features of all phyla - Vertebrates (Classes: Pisces, Amphibia, Reptilia, Aves and Mammalia)

Unit II (12 Hours)

Type study of *Plasmodium vivax*, *Leucosolenia*, *Aurelia aurita*, *Taenia solium*, *Ascaris lumbricoides* and *Asterias rubens* – morphology and life history. General topics – human diseases caused by protozoans; canal system of sponges.

Unit III (12 Hours)

Principles of human physiology: Digestion - physiology of digestion, absorption and excretion of food – accessory glands and their role. Respiration: transport of oxygen and carbon dioxide, cellular oxidation. Excretion: structure of a nephron, physiology of urine formation, physical characteristics and chemical composition of urine.

Unit IV (12 Hours)

Circulation – structure and working of artery, vein and heart. Blood: haemopoiesis, types of blood cells, structure of haemoglobin; mechanism of blood clotting, functions of plasma proteins. Blood grouping, lymph and its functions. Muscles: contraction. Proteins involved and theories of contraction. Structure and functions of human eyes ears

Unit V (12 Hours)

Hormones: Types, control - and general mode of action of water soluble and steroid hormones. Reproduction – male and female reproductive organs and formation of gametes, Pregnancy and birth. Nervous control: Structure of neuron; Types of neurons; nerve impulse transmission, synaptic transmission.

Books

1. Agarwal, VK. 2011. Zoology for Degree Students. S. Chand and Company, New Delhi.
2. Rajan K. 2016. Manual of Zoology. Theory and Practicals, Dept. of Botany, St. Joseph's College, Tiruchirappalli.

Reference

1. Gerard, J. Tortord, R. L. Evans & Anagnostakos, NP. 1982. Principles of Human Physiology, Harpor Roul Publishers, New York.
2. Jordan, E. L. & Verma, P. S. 1976. Invertebrate Zoology, S. Chand& Co. Ltd., 6th e, New Delhi.
3. Kotpal, RL 1976. Modern text book of Zoology (Invertebrate), Rastogi Publications, Meerat.

Semester	Course Code	Title of the Course									Hours	Credits
I	21UBO13AC01	ALLIED-I: ZOOLOGY I: GENERAL ZOOLOGY									4	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	3	2	2	2	2	2	3	2	2.2	
CO-2	2	3	2	1	2	2	3	2	2	3	2.2	
CO-3	2	2	3	2	2	1	3	2	3	2	2.2	
CO-4	1	2	2	2	2	2	3	2	3	2	2.1	
CO-5	1	2	2	3	2	3	3	2	2	2	2.2	
Mean Overall Score											2.18	
Result											High	

Semester	Course Code:	Title of the Course	Hours	Credits
I	21UBO13AP01	ALLIED I: LAB COURSE: ZOOLOGY 1	2	2

Earthworm: External features and dissection of digestive and nervous systems; Mounting of body and Penial setae, Ovary and Spermatheca

Representative animal for each class in vertebrate and invertebrate phyla.

Different tissues. Human blood cell identification.

Campus fauna identification.

Visit to a vermin-compost farm and submission of report.

Semester	Course Code	Title of the Course	Hours	Credits
I	21UHE14VE01	ESSENTIALS OF HUMANITY	2	1

CO No	CO – Statements	Cognitive Levels (K-Levels)
	On completion of this course, the graduates will be able to:	
CO-1	recall the prescribed values and their dimensions	K1
CO-2	examine themselves by learning the developmental changes happening in the course of their life time	K2
CO-3	apply the trained values in their day today life	K3
CO-4	analyze themselves as responsible men and women	K4
CO-5	create a constructive approach to life	K5 & K6

Unit-I Principles of Value Education

(6 Hours)

Introduction to values - Characteristics and Roots of Values - Value Education & Value Clarification - Moral Characters - Kinds of Values - Objectives of Values.

Unit-II The Development of Human Personality

(6 Hours)

Personality: Introduction, Theories, Integration & Factors influencing the development of personality - SEL Series - Discovering self - Defense Mechanism - Power of positive thinking - Why worry?

Unit-III The Dimensions of Human Development

(6 Hours)

Areas of Development: Physical, Intellectual, Emotional, Social Development, Moral & Spiritual development

Unit-IV Responsible Parenthood

(6 Hours)

Human sexuality - Marriage and Family - Sex and Love - Characteristics of Responsible parent - Causes of Marriage disharmony - Art of wise parenting.

Unit-V Gender Equality and Empowerment

(6 Hours)

Historical perspective - Women in Independence struggle - Women in Independent India - Education & Economic development - Crimes against Women - Women rights - Time-line of Women Achievements in India

Books for Study

Department of Human Excellence. *Essentials of Humanity*, St. Joseph's College, Tiruchirappalli-02, 2021.

Books for Reference:

1. Alphonse Xavier Dr SJ. *You Shall Overcome*, (6th Ed.) Chennai: ICRDCE Publication, 2012.
2. Alex K. *Soft Skills*, New Delhi: S. Chand, 2009.
3. Kalam Abdul APJ. *You Are Unique*, Bangalore: Punya Publishing, 2012.

Web Sources:

<http://livingvalues.net>. Accessed 05 Mar. 2021.

<https://www.apa.org/topics/personality#>. Accessed 05 Mar. 2021.

<https://www.peacecorps.gov/educators/resources/global-issues-gender-equality-and-womens-empowerment/>. Accessed 05 Mar. 2021.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UTA21GL02	General Tamil - II	4	3

CO No.	CO- Statement	Cognitive Levels (K- levels)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	தமிழிலக்கிய வரலாற்றில் சைவ, வைணவ இலக்கியங்கள் பெறும் இடத்தை அறிந்துகொள்வர்	K 1
CO-2	அகப்பொருள், புறப்பொருள் இலக்கணங்களின் அடிப்படை அறிவைப் பெறுவர்.	K 1
CO-3	காப்பியச் சுவையை மாணவர்கள் புரிந்துகொள்வர்	K 2
CO-4	இஸ்லாமிய இலக்கியச் சிந்தனைகளைப் பெறுவர்	K 3
CO-5	கிறித்தவ மதிப்பீடுகளைச் சிற்றிலக்கிய வகைகளின் வழியாகத் திறனாய்வர்.	K 4

அலகு - 1

(12 மணிநேரம்)

- சிலப்பதிகாரம் - கனாத்திறம் உரைத்த காதை
மணிமேகலை - ஆபுத்திரன் திறம் அறிவித்த காதை
இலக்கிய வரலாறு - சைவம் வளர்த்த தமிழ் முதல் புராணங்கள் முடிய.
இலக்கணம் - அகப்பொருள் இலக்கணம்

அலகு - 2

(12 மணிநேரம்)

- திருவாசகம் - திருச்சாழல்
சிவவாக்கியார் பாடல்கள் - 25 பாடல்கள் (04, 14, 16, 22, 27, 33, 34, 35, 36,37, 38, 47, 81, 91, 225, 237, 242, 495, 504, 520,522, 533, 534, 536, 548.)

அலகு - 3

(12 மணிநேரம்)

- நாலாயிர திவ்வியப் பிரபந்தம்- அமலானாதிபிரான் (10 பாடல்கள்)
- பெருமாள் திருமொழி (11 பாடல்கள்)
கம்பராமாயணம் - கைகேயி சூழ்வினைப்படலம்
உரைநடை - 7 முதல் 9 முடிய உள்ள கட்டுரைகள்

அலகு - 4

(12 மணிநேரம்)

- சீறாப்புராணம் - உடும்பு பேசிய படலம்
இலக்கணம் - புறப்பொருள் இலக்கணம்
இலக்கிய வரலாறு - தமிழ் இலக்கண நூல்கள் முதல் சிற்றிலக்கியங்கள் முடிய

அலகு - 5

(12 மணிநேரம்)

- திருக்காவலூர்க் கலம்பகம் - சமூக உல்லாசம்
உரைநடை - 10 முதல் 12 வரையிலான கட்டுரைகள்

பாடநூல்கள்:

1. பொதுத்தமிழ் - செய்யுள் திரட்டு, தமிழாய்வுத்துறை வெளியீடு, தூய வளனார் கல்லூரி. திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021
2. சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017
3. நற்றமிழ்க் கோவை (கட்டுரைத் தொகுப்பு). தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021

Semester	Course Code			Title of the Course						Hours	Credit
II	21UTA21GL02			General Tamil - II						4	3
Course Outcomes (Cos)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	2	2	1	2	3	2	2	2	3	2	2.1
CO-2	2	1	2	2	3	3	2	2	3	2	2.2
CO-3	2	1	2	2	3	3	2	2	3	2	2.2
CO-4	1	1	2	2	3	3	2	2	3	2	2.1
CO-5	1	1	2	2	3	2	2	3	3	2	2.1
Mean Overall Score											2.14 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	21UFR21GL02	FRENCH – II	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	relate pronominal verbs in expressing one’s day today activity.	K1
CO–2	compare the different types of articles.	K2
CO–3	construct texts using pronouns – passages and dialogues.	K3
CO–4	discover the food habits of the French culture.	K4
CO–5	appraise the French fashion.	K5

Unit - I (12 hours)

TITRE:LES LOISIRS

GRAMMAIRE : les adjectifs interrogatifs, les nombres ordinaux, les verbes pronominaux

LEXIQUE : les différentes activités quotidiennes,les loisirs, les activités quotidiennes, les matières

PRODUCTION ORALE : parler sur votre passe-temps

PRODUCTION ECRITE : décrire sa journée

Unit -II (12 hours)

TITRE:LA ROUTINE

GRAMMAIRE : les pronoms personnels COD, les verbes du premier groupe en e/er/eler/eter, le verbe prendre

LEXIQUE : exprimer ses goûts et ses préférences, le temps, l’heure, la fréquence

PRODUCTION ORALE : savoir comment dire l’heure

PRODUCTION ECRITE : écrire vos préférences en quelques lignes

Unit - III (12 hours)

TITRE:OU FAIRE SES COURSES?

GRAMMAIRE : les articles partitifs, le pronom en (la quantité), très ou beaucoup

LEXIQUE : inviter et répondre à une invitation, les commerces et les commerçants, demander et dire le prix, les quantités

PRODUCTION ORALE : faire des courses pour une soirée

PRODUCTION ECRITE : écrire un message en acceptant l’invitation

Unit - IV (12 hours)

TITRE:DECOUVREZ ET DEGUSTEZ

GRAMMAIRE : l’impératif, il faut, les verbes devoir, pouvoir, savoir,vouloir

LEXIQUE : Commander et commenter sur un plat de la carte,les aliments, les services, les moyens de paiement

PRODUCTION ORALE : Jeu de rôle – au restaurant (entre vous et le garçon)

PRODUCTION ECRITE : faire une comparaison avec la carte française et indienne

Unit - V (12 hours)

TITRE:TOUT LE MONDE S’AMUSE/ LES ADOS AU QUOTIDIEN

GRAMMAIRE : les adjectifs démonstratifs, le pronom indéfini on, le futur proche, le passé composé, les verbes en –yer, voir et sortir

LEXIQUE : connaître les marques connues sur les vêtements, les sorties, situer dans le temps, les vêtements et les accessoires

PRODUCTION ORALE : décrire une tenue
 PRODUCTION ECRITE : écrire une lettre amicale, une carte postale

Book for Study

P.Dauda, L.Giachino and C.Baracco, *Generation AI*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *Echo AI*, CLE International, 2^e edition, 2017
2. Régine Mérieux and Yves Loiseau, *Latitudes AI*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Web Resources

1. <https://www.frenchtoday.com/blog/french-verb-conjugation/french-reflexive-verbs-list-exercises/>
2. <https://www.fluentu.com/blog/french/french-subject-pronouns/>
3. <https://grammarist.com/french/french-partitive-article/>
4. <https://www.talkinfrench.com/guide-french-food-habits/>
5. <https://www.fluentu.com/blog/french/talking-about-clothes-in-french/>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code		Title of the Course						Hours		Credits
II	21UFR21GL02		FRENCH – II						4		3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO–1	3	3	3	3	1	3	1	2	2	2	2.2
CO–2	2	1	2	3	2	3	1	2	2	2	2.0
CO–3	3	2	3	2	2	3	3	1	3	2	2.4
CO–4	3	2	2	1	3	3	3	1	1	3	2.2
CO–5	2	1	2	2	3	3	3	2	2	2	2.2
Mean overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	21UHI21GL02	HINDI - II	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, students will be able to	
CO -1	Find out the Terms & Expressions related to letter writing	K1
CO -2	Explain the works of Hindi writers	K2
CO -3	Complete the sentences in Hindi using basic grammar	K3
CO -4	Analyze the social & political conditions of Devotional period in Hindi Literature	K4
CO -5	Justify the human values stressed on the works of the following authors “Premchand, Nirala, etc.”	K5

Unit - I (12 Hours)

Kafan
Letter Writing - Chutti Patra
Bakthikal - Namakarn
Sarkari kariyalayom ka naam

Unit - II (12 Hours)

Baathcheeth - Dookan mein
kriya
Letter Writing - Rishthedarom ko patra
Bakthikal - Samajik Paristhithiyam

Unit - III (12 Hours)

Vah Thodthi patthar
Adverb
Letter Writing - Naukari keliye Avedan Patra
Bakthikal - Sahithyik Paristhithiyam

Unit - IV (12 Hours)

Mukthi
Samas
Letter Writing - Kitab Maangne Keliye Patra
Bakthikal - Salient Features, Main Divisions

Unit - V**(12 Hours)**

Anuvad - 2

Sandhi

Letter writing - Nagarpalika ko Patra

Bakthikal - Visheshathayem

Books for Study

1. Viswanath Tripathy, *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd, New Delhi, 2018.

Unit-I Chapter 1

2. M.kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.

Unit-II, III and IV Chapter 2

3. Dr.Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020.

Unit-V Chapter 4**Books for Reference**

1. Adhunik Hindi Vyakaran our Rachana, bharati bhawan publishers & distributors, 2018.
2. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.
3. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.
4. Aravind Kumar, Sampoorna Hindi Vyakaran our Rachana, Lucent publisher, 2019.
5. Lakshman prasad singh, Kavya ke sopan, Bharathy Bhavan Prakashan, 2017.

Web Resources

1. <https://youtu.be/tE2RHQcqlbI>
2. <https://youtu.be/Xxvco3qa284>
3. <https://youtu.be/1z8x95IFGi4>
4. <https://youtu.be/CBMYf8NRLW4>
5. <https://youtu.be/h31tMLeFtHs>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credits
II	21UHI21GL02		HINDI - II								4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	3	3	2	2	3	3	3	2	2	2.5	
CO-2	1	3	1	2	2	3	3	3	2	3	2.3	
CO-3	3	2	3	2	2	3	2	3	2	2	2.4	
CO-4	2	3	3	1	3	2	3	2	1	2	2.2	
CO-5	3	2	2	2	3	2	3	2	3	2	2.4	
Mean Overall Score											2.36	(High)

Semester	Course Code	Title of the Course	Hours	Credits
II	21USA21GL02	SANSKRIT - II	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, the student will be able to	
CO-1	remembering names of different objects , remembering different verbal forms and sandhi.	K1
CO-2	contrast different verbal forms Explain good sayings , Relate good saying to life.	K2
CO-3	apply and build small sentences.	K3
CO-4	analyze different forms of Verbs and nouns.	K4
CO-5	appreciate subhashitas and Sanskrit poetry Expand Sanskrit vocabulary.	K5

Unit - I (12 Hours)

Asmath usmath tat kim (MFN)

Unit - II (12 Hours)

Sandhi Niyamaaha Abuyaasha (Guna , Visarga , Dirgha , Vrddhi)

Unit - III (12 Hours)

Lang lakaaraha Kriyapadaani

Unit - IV (12 Hours)

Raguvamsaha Pratama sargaha (1 –15)

Unit - V (12 Hours)

Suvachana Prayogha

Book for Study

SARALASAMKRITHAM SIKSHA, 2020 , K.M Saral sankrit Balabodh , Bharathiys Vidya Bhavan , Munshimarg Mumbai – 400007, 2018

Books for Reference

1. Paindrapuram Ashram , Srirangam – 620006 Gopalavimshanthi 2019
2. R.S.Vadhyar & Sons book Kulapthy , K.M Saral sankrit Balabodh , Bharathiys Vidya Bhavan , Munshimarg Mumbai – 400007, 2018

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course									Hours	Credit
II	21USA21GL02	SANSKRIT -II									4	2
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	1	3	2	2	2	3	3	2	1	2.1	
CO-2	3	2	3	2	2	3	2	3	3	2	2.5	
CO-3	2	2	3	2	2	2	2	3	3	1	2.1	
CO-4	3	2	3	3	1	2	3	3	3	1	2.4	
CO-5	3	2	2	2	3	2	2	3	3	1	2.3	
Mean Overall Score											2.28	
Result											# High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21UEN22GE02	GENERAL ENGLISH - II	5	3

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	remember the use of suitable punctuation marks in appropriate places	K1
CO-2	describe their pictures with appropriate expressions	K2
CO-3	infer meaning from the given context	K3
CO-4	analyse real-life situations and ask open-ended questions	K4 & K5
CO-5	use polite expressions in appropriate ways	K6

Unit-I

(15 Hours)

01. Education Word Grid
02. Reading Problems and Solutions
03. Syllabification
04. Forms for Expressing Quality
05. Expressing Comparison
06. Monosyllabic Comparison
07. Di/polysyllabic Comparison
08. The Best Monosyllabic Comparison
09. The Best Di/Polysyllabic Comparison
10. Practising Quality Words

Unit –II

(15 Hours)

11. Wh Words
12. Yes/No Recollection
13. Unscramble Wh Questions
14. Wh Practice
15. Education and the Poor
16. Controlled Role Play
17. Debate on Education
18. Education in the Future
19. Entertainment Word Grid
20. Classify Entertainment Wordlist
21. Guess the Missing Letter
22. Proverb-Visual Description
23. Supply Wh Words
24. Rearrange Questions
25. Information Gap Questions

Unit-III

(15 Hours)

26. Asking Questions
27. More about Actions
28. More about Actions and Uses
29. Crime Puzzle
30. Possessive Quiz
31. Humorous News Report

32. Debate on Media and Politics
33. Best Entertainment Source

Unit-IV

(15 Hours)

34. Career Word Grid
35. Job-Related Wordlist
36. Who's Who?
37. People at Work
38. Humour at Workplace
39. Profession in Context
40. Functions and Expressions
41. Transition Fill-in
42. Transition Word Selection
43. Professional Qualities
44. Job Procedures
45. Preparing a Resume
46. Interview Questions
47. Job Cover Letter Format
48. Emailing an Application
49. Mock Interview

Unit-V

(15 Hours)

50. Society Word Grid
51. Classify Society Wordlist
52. Rearrange the Story
53. Storytelling
54. Story Cluster
55. Words Denoting Time
56. Expressing Time
57. What Can You Buy?
58. Noise Pollution
59. Positive News Headlines
60. Negative News Headlines
61. Matching Conditions
62. What Would You Do?
63. If I were Elected
64. My Dream Country

Book for Study

Joy, J.L. & Peter, F.M. *Let's Communicate 2*, New Delhi: Trinity Press, 2014.

Books for Reference

1. Ahrens, Sönke. *How to Take Smart Notes: One Simple Technique to Boost Writing, Learning and Thinking*. New York: CreateSpace, 2017.
2. Aspinall, Tricia. *Test Your Listening*. London: Pearson, 2002.
3. Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. New York: Routledge, 2004'
4. Fitikides, T.J. *Common Mistakes in English* (6th ed.). London: Longman, 2002
5. Wainwright, Gordon. *How to Read Faster and Recall More: Learn the Art of Speed Reading with Maximum Recall* (3rd ed.). Oxford: How to Books, 2007.

Web Resources

1. <https://learnenglish.britishcouncil.org/>
2. <https://oneminuteenglish.org/en/best-websites-learn-english/>
3. <https://www.dailywritingtips.com/best-websites-to-learn-english/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credits
II	21UEN22GE02		GENERAL ENGLISH - II								5	3
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5		
CO-1	2	3	2	2	3	2	3	2	3	2	2.4	
CO-2	2	2	3	2	3	3	2	3	2	2	2.3	
CO-3	2	3	2	3	2	2	3	2	3	2	2.4	
CO-4	2	2	3	2	3	3	2	3	2	3	2.5	
CO-5	2	2	2	3	2	2	2	3	2	2	2.2	
Mean Overall Score											2.36	(High)

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23CC03	CORE-3: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	learn the economic importance of Pteridophytes and gymnosperms.	K1
CO-2	acquire knowledge on fossils and fossilization process.	K1
CO-3	understand the salient features of Pteridophytes and Gymnosperms.	K2
CO-4	comprehend the relative similarities and differences between genera.	K3
CO-5	analyse the evolutionary relationship between Pteridophytes and Gymnosperms.	K4

Unit I (12 Hours)

Pteridophytes: general characteristics, classification (Reimer's System, 1954). General characteristics of major subdivisions: Psilopsida, Lycopsidea, Sphenopsida and Pteropsida. Telome theory. Stelar evolution, homospory, heterospory, seed habit and economic importance.

Unit II (12 Hours)

Detailed study of morphology, anatomy and reproduction of *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum* and *Marsilea*.

Unit III (12 Hours)

Gymnosperms: general characteristics, distribution and classification (Sporne, 1965). Salient features of Pteridospermales, Bennettitales, Cycadales, Cordaitales, Coniferales and Gnetales. Economic importance.

Unit IV (12 Hours)

Gymnosperms: detailed study of morphology, anatomy, reproduction of the following genera: *Cycas*, *Pinus* and *Gnetum*.

Unit V (12 Hours)

Paleobotany: fossils, types (compression, impression, petrification, coal balls). Indian fossil flora – Rajmahal hill flora. Contribution of Birbal Sahni to Indian Paleobotany. Geological time scale. Morphology, anatomy and reproduction in *Rhynia*, *Lepidodendron*, *Calamites* and *Medullosa*.

Books for Study

1. Sharma OP. 2017. Pteridophyta, McGraw Hill Education, New York.
2. Bhatnagar, S.P. and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.

Books for Reference

1. Rashid .A. 2007. An Introduction to Pteridophyta-Vikas publications, New Delhi.
2. Johri , RM, Lata S , Tyagi K (2005), A text book of Gymnosperms , Dominate pub and Distributer, New Delhi.
3. Vasista PC, Sinha AK and Anilkimar. 2005. Botany for degree students, Gymnosperms, S Chand, NewDelhi.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23CC03	CORE-3: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	4	3

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	1	2	2	3	2	2	2	2	2.1
CO-2	3	2	1	2	2	3	2	2	2	2	2.1
CO-3	3	2	1	2	2	2	3	2	1	2	2.0
CO-4	2	3	2	2	1	2	2	2	1	2	1.9
CO-5	2	3	1	3	2	2	3	2	2	1	2.1
Mean Overall Score											2.1
Result											Medium

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23CC04	CORE-4: ANATOMY AND EMBRYOLOGY	4	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge about the tissues of stem, root and leaves present in plants.	K1
CO-2	understand the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.	K2
CO-3	acquire knowledge on the structure, properties and economic importance of wood.	K3
CO-4	attain basic knowledge of the structure and development of male and female gametophytes in plants.	K4
CO-5	understand the morphogenesis, endosperm development and polyembryony.	K5

Unit I (12 Hours)

Tissues - definition, types - simple tissue - parenchyma, collenchyma, sclerenchyma. Fibres and sclerieds - structure and functions. Complex tissues: xylem and phloem. Meristems - classifications. Vegetative shoot apex: and the theories: apical cell, and tunica-carpus. Root apex: Korper – Kappe theory. Concept of totipotency, differentiation, dedifferentiation and redifferentiation. Hydathodes, Lenticels and laticifers.

Unit II (12 Hours)

The stem - primary and secondary structure of dicotyledonous and monocotyledonous stems. Nodal anatomy: unilacunar, trilacunar and multilacunar. Leaf anatomy: monocot and dicot. The root: primary and secondary structure of dicotyledonous and monocotyledonous roots. Anomalous secondary growth.

Unit III (12 Hours)

Wood anatomy – component of secondary xylem. Physical and chemical properties of wood. Dendrochronology -Classification of wood. Commercial wood species of South India (teak wood, rose wood, sandal wood and red sanders wood).

Unit IV (12 Hours)

Microsporangium: microsporogenesis, development of male gametophyte. Megasporangium: megasporogenesis, development of female gametophyte. Monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*).

Unit V (12 Hours)

Fertilization. Double fertilization. Structure and types of ovules; Types of embryo sacs, Development of dicot embryo (Capsella) & development of monocot embryo (Sagittaria).Endosperm: structure, function and types. Apomixis and polyembryony – types and significance. Parthenogenesis and its significance.

Semester	Course Code	Title of the Course					Hours	Credits			
II	21UBO23CC04	CORE-4: ANATOMY AND EMBRYOLOGY					4	2			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	2	3	2	2	2	2	2.3
CO-2	2	3	2	3	3	2	3	2	2	2	2.4
CO-3	2	2	3	2	3	3	3	2	3	3	2.7.
CO-4	3	3	2	1	2	3	2	3	1	2	2.3
CO-5	2	3	2	2	3	2	3	2	2	3	2.6
Mean Overall Score											2.5
Result											High

Semester	Course Code	Title of the Paper	Hours	Credit
II	21UBO23CP02	LAB COURSE 2 (PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY, ANATOMY AND EMBRYOLOGY)	3	2

Pteridophytes:

Lycopodium, Selaginella, Adiantum and Marsilea.

Gymnosperms:

Cycas, Pinus and Gnetum.

Paleobotany (Fossils): Rhynia, Lepidodendron, Calamites and Medullosa.

Anatomy

Study of simple and complex tissue.

Internal structure of young and old dicot and monocot stem.

Internal structure of dicot and monocot root.

Anomalous secondary thickening in Aristolochia, Bignonia, Boerhaavia, Thunbergia and Dracaena.

Nodal anatomy: Uni, tri and multi lacunar.

Embryology

TS of mature anther. Types of ovule, dissection and isolation of developmental stages of dicot embryos.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23AC02	ALLIED-I: ZOOLOGY II: AGRICULTURAL ENTOMOLOGY	4	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge on morphology and classification of insects.	K1
CO-2	identify beneficial and harmful insects.	K2
CO-3	understand the physiology of insects.	K3
CO-4	apply integrated pest management.	K3
CO-5	evaluate the economical important insects.	K4

Unit I (12 Hours)

General classification of insects. Morphology of insects: head, external structure. Mouth parts, tentorium, compound eye, types of antennae- thorax-tergum, sternum, pleuron. Wing structure, wing venation, Legs and their modification, Abdomen- abdominal appendages, Male and female external genitalia.

Unit II (12 Hours)

Physiology of digestive, respiratory, circulatory, nervous and reproductive systems, Immature stages of insects – metamorphosis, types and hormonal regulation.

Unit III (12 Hours)

Economically important insect (orders): Coleoptera, Dictyoptera, Diptera, Hemiptera, Hymenoptera, Isoptera and Lepidoptera. General characters and classification (up to Orders). Social behaviour/life of insects.

Unit IV (12 Hours)

Economic classification of insects: beneficial insects (predators, parasites, pollinators, weed killers and scavengers). Destructive insects, a general knowledge of apiculture, sericulture and lac culture. Insects' role in forensic science. Recent trends in Integrated Pest Management. Plant protection - physical, chemical and biological methods of pest control.

Unit V (12 Hours)

Pests of stored food materials (*Sitophilus oryzae*, *Rhizopertha dominica*, *Tribolium castaneum*) and their control, Study of Bionomics and control of pests of Paddy (*Tryporyza incertulas*, *Chilopoly charysa*, *Spodoptera amauritia*), Sugarcane (*Chilo infus catellus*, *C. sacchariphagas*, *Tryporyza nivella*), Cotton (*Aphis gossypii*, *Amaras cabiguttula*, *Thrips tabaci*), Coconut (*Oryctes rhinoceros*, *Rhynchophorus ferrugineus*) and Spices pests. Locust and their role in agriculture.

Books

1. Ambrose, PD. 2004. The Insect: Structure, function and biodiversity, First edition. Kalyani Publishers, New Delhi.

Reference

1. Rajan, K & McConnell, MS. 2006. Manual of agricultural entomology - theory and practicals, Dept. of Plant biology & Plant biotechnology, St. Joseph's College, Trichy.
2. Daly, HV, Doyen, JT. & Ehrlich, PR. 1998. Introduction to Insect Biology Diversity, First Edition, McGraw Hill Book, New York.
3. Vasantharaj D B & Kumaraswami, T. 1978. Elements of Economic Entomology, Popular Book Department, Chennai.
4. Nayar, KK., Ananthakrishnan, TN. & David, BV. 1976 General and Applied Entomology, Tata McGraw Hill, New Delhi.
5. Imms, AD. 1963. General Text Book of Entomology, Asia Publ House, New Delhi.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23AC02	ALLIED-I: ZOOLOGY II: AGRICULTURAL ENTOMOLOGY	4	2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	2	3	2	2	2	2	2	3	2	2.2
CO-2	2	3	2	1	2	2	3	2	2	3	2.2
CO-3	2	2	3	2	1	2	3	2	2	2	2.1
CO-4	1	2	2	2	2	2	3	2	3	2	2.1
CO-5	1	2	2	3	2	2	3	2	2	3	2.2
Mean Overall Score											2.16
Result											High

Semester	Course Code	Title of the Course	Hours	Credits
II	21UBO23AP02	ALLIED I: LAB COURSE: ZOOLOGY II	2	2

Detailed study:

- * Study of distinguishing features of insects studied in theory and making sketches.
- * Field collection, identification and preservation of insects of agricultural importance, predators, pollinators, and weed killers – plant galls.
- * Study of different categories of insect pests and types of damage done by them in the field, go-down and warehouses.
- * Dissection of Cockroach to study the mouthparts, digestive, nervous and reproductive systems, Salivary gland, Haemocytes. Modification of Antenna, legs, mouth parts.
- * Light trap collection and identification.
- * Visit to a local sericulture center and submission of report.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UHE24AE02	Environmental Studies	2	2

CO No.	CO - Statements	Cognitive Levels (K-Levels)
	On Completion of this course, the graduates will be able to:	
CO-1	identify the concepts related to the environmental global scenario	K1
CO-2	comprehend the natural resources and environmental organizations	K2
CO-3	apply the acquired knowledge to sensitize individuals and public about the environmental crisis	K3
CO-4	analyze the causes and changes in the structure of biodiversity	K4
CO-5	enhance their skills in the society by solving the environmental problems and preserving nature by the acquired knowledge	K5

Unit I Introduction to Environmental Studies (6 Hours)

Introduction – Scope and Importance – Subsystems of Earth – Various recycling Methods – Environmental Movements in India – Eco- Feminism – Public awareness – Suggestions to conserve environment

Unit II Natural Resources (6 Hours)

Food Resources – Land Resources – Forest resources – Mineral Resources – Water Resources – Energy Resources

Unit III Ecosystems, Biodiversity and Conservation (6 Hours)

General structure of ecosystem - Functions of Ecosystem - Energy flow and Ecological pyramids – Levels of Biodiversity - Hot spots of Biodiversity - Endangered and Endemic Species - Value of Biodiversity - Threats to Biodiversity - Conservation of Biodiversity

Unit IV Environmental Pollution (6 Hours)

Air Pollution – Water Pollution – Oil Pollution – Soil Pollution – Marine Pollution – Noise Pollution - Thermal Pollution – Radiation Pollution

Unit V Environmental Organizations and Treatise (6 Hours)

United Nations Environment Program (UNEP) - International treaties on Environmental protection - Ministry of Environment, Forest and Climate Change - Important National Environmental Acts and rules– Environmental Impact Assessment.

Books for Study:

1. Department of Human Excellence, *Environmental Studies*, St. Joseph's College, Tiruchirappali-02, 2021.

Books for Reference:

1. Rathor, V.S. and Rathor B. S. *Management of Natural Resources for Sustainable Development*. New Delhi: Daya Publishing House, 2013.
2. Sharma P.D, *Ecology and Environment*, 8 ed., Meerut: Rastogi Publications, 2010.
3. Agrawal, A and C.C. Gibson. *Introduction: The Role of Community in Natural Resource Conservation*. NJ: Rutgers University Press, 2001.

Web Sources:

<https://www.unep.org/>. Accessed 05 Mar. 2021.

<http://moef.gov.in/en/> Accessed 05 Mar. 2021.

<https://www.ipcc.ch/reports/>. Accessed 05 Mar.2021.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UHE14VE02	TECHNIQUES OF SOCIAL ANALYSIS: FUNDAMENTALS OF HUMAN RIGHTS	2	1

CO No.	CO - Statements	Cognitive Levels (K-Levels)
	On completion of this course, the graduates will be able to:	
CO-1	identify the importance and the values of human rights	K1
CO-2	understand the historical background and the development of Human Rights and the related organizations	K2
CO-3	apply the provisions of National and International human rights to themselves and the society	K3
CO-4	analyse the violations of human rights to the marginalized section in the society	K4
CO-5	animate the people to involve in the struggles and activities of the human rights organizations	K5

Unit-I Human Rights - An Introduction (6-Hours)

Introduction- Classification of Human Rights- Scope of Human Rights-Characteristics of Human Rights-NHRC-SHRC- Challenges for Human Rights in the 21st Century.

Unit-II Historical Development of Human Rights (6-Hours)

Human Rights in Pre-World War Era- Human Rights in Post-World War Era- Evolution of International Human Rights Law - the General Assembly Proclamation- Institution Building, Implementation and the Post- Cold War Period. The ICC.

Unit-III India and Human Rights (6-Hours)

Introduction-Classification of Fundamental Rights-Salient Features of Fundamental Rights- and Fundamental Duties.

Unit-IV Human Rights of Women and Children (6-Hours)

Women's Human Rights- Issues related to women's rights - and Rights of Women's and Children

Unit-V Human Rights Violations and Organizations (6-Hours)

Human Rights Violations - Human Rights Violations in India - the Human Rights Watch Report, January 2012- Human Rights Organizations.

Books for Study:

1. The Department of Human Excellence, *Techniques of Social Analysis: Fundamentals of Human Rights*, St. Joseph's college, Tiruchirappalli -02, 2021.

Books for Reference:

1. Venkatachalem. Dr. *The Constitution of India*, Salem: Giri Law House, 2005.

2. NaikVarunand Mukesh Shany. *Human rights education and training*, New Delhi:crescent Publishing Corporation, 2011.
3. BhathokeNeera. *Human Rights content and extent*,New Delhi: swastika publications, 2011.

Web Sources:

<https://www.un.org/en/universal-declaration-human-rights/>. Accessed 05 Mar. 2021.

<https://www.ilo.org/global/lang--en/index.htm>. Accessed 05 Mar. 2021.

<https://www.amnesty.org/en/>. Accessed 05 Mar. 2021.

Semester	Course Code	Title of the Course	Hours	Credits
III	21UTA31GL03	General Tamil - III	4	3

CO No.	CO- Statement	Cognitive Level (K- level)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	சங்க இலக்கிய வகைகளை நினைவுகூருவர்	K 1
CO-2	இலக்கியத்தினை நுட்பமாக அறிதலின் வழியாக ஆற்றுப்படுத்தும் திறன் பெறுவர்	K 2
CO-3	இலக்கிய அறநெறிகளைத் தற்கால வாழ்வியலில் பயன்படுத்தும் திறன் பெறுவர்	K 3
CO-4	அகம் மற்றும் புற இலக்கியத் திணை, துறைகளைப் பகுத்தாராய்வர்	K 4
CO-5	யாப்பு, அணி இலக்கண நுட்பங்களை இலக்கியங்களில் மதிப்பிடுவர்	K 5

அலகு - 1

(12 மணிநேரம்)

பொருநராற்றுப்படை (முழுமையும்)

அலகு - 2

(12 மணிநேரம்)

நற்றிணை - 5 பாடல்கள் - (1, 19, 21, 70, 148)

ஐங்குறுநூறு - அன்னாய் வாழிப்பத்து.

யாப்பிலக்கணம் - வெண்பா, ஆசிரியப்பா

அலகு - 3

(12 மணிநேரம்)

கலித்தொகை - (குறிஞ்சிக்கலி- 62, பாலைக்கலி -22, மருதக்கலி- 87,

நெய்தற்கலி-149, முல்லைக்கலி - 116)

இலக்கிய வரலாறு - முதற்பாகம் ('தமிழ் மொழியின் தொன்மையும் சிறப்பும்' முதல் 'சங்க தொகை நூல்கள்' முடிய),

புதினம் - குடும்ப அட்டை (2022-2023)

அலகு - 4

(12 மணிநேரம்)

பதிற்றுப்பத்து - 3 பாடல்கள் (14, 32, 61)

புறநானூறு - 5 பாடல்கள் (95, 121, 130, 204, 279)

அணியிலக்கணம்

அலகு - 5

(12 மணிநேரம்)

திருக்குறள் - புறங்கூறாமை, பழமை, புலவி நுணுக்கம் ஆகிய அதிகாரங்கள்

திரிகடுகம்

- 5 பாடல்கள் (2, 6, 12, 15, 42)

இலக்கிய வரலாறு - சங்க இலக்கியங்களின் தனித்தன்மைகள் முதல் இரட்டைக் காப்பியங்கள் முடிய

பாடநூல்கள் :

1. பொதுத்தமிழ் செய்யுள் திரட்டு, தமிழாய்வுத்துறை வெளியீடு, தூய வளனார் கல்லூரி, திருச்சிராப்பள்ளி-2, முதற்பதிப்பு, 2021
2. சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017
3. புதினம் (ஒவ்வொரு கல்வியாண்டிற்கும் ஒவ்வொரு புதினம்)
2022 – 2023 கல்வியாண்டுக்கு மட்டும் : வீ.செந்தில் குமார், குடும்ப அட்டை, தாமரை பப்ளிகேஷன்ஸ் பிரைவேட் லிமிடெட், சென்னை, முதற்பதிப்பு, 2009

Semester	Course Code		Title of the Course							Hours	Credit
III	21UTA31GL03		General Tamil - III							4	3
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	3	2	2	3	2	3	2	3	3	2	2.5
CO-2	2	2	2	3	3	2	2	3	3	2	2.4
CO-3	3	3	2	3	3	2	2	3	3	3	2.7
CO-4	3	2	2	3	2	3	2	3	2	3	2.5
CO-5	2	3	2	3	2	3	2	3	2	3	2.5
Mean Overall Score											2.52 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21UFR31GL03	FRENCH – III	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	relate colours, materials and shapes to the french clothing.	K1
CO–2	select appropriate prepositions in giving directions.	K2
CO–3	construct a text in present tense using different verbs.	K3
CO–4	examine the travel manners and celebrations of the French.	K4
CO–5	justify the usage of past tense in a biography.	K5

Unit – I (12 hours)

TITRE:VIVRE LAVILLE

GRAMMAIRE : la comparaison, les prépositions avec les noms géographiques, les pronoms personnels COI, le pronom y (le lieu)

LEXIQUE : se repérer sur un plan de ville, la ville, les lieux de la ville

PRODUCTION ORALE : demander et indiquer une direction dans un dialogue

PRODUCTION ECRITE : décrire votre ville natale, créez les affiches en appréciant votre ville

Unit - II (12 hours)

TITRE:VISITER UNE VILLE

GRAMMAIRE : la position des pronoms compléments, les verbes du premier groupe en – ger et – cer, les verbes ouvrir et accueillir

LEXIQUE : dire les informations sur une ville de votre choix, les transports, les points cardinaux, les prépositions de lieu

PRODUCTION ORALE : Indiquer le chemin

PRODUCTION ECRITE : Demander des renseignements touristiques

Unit - III (12 hours)

TITRE:ON VEND OU ON GARDE

GRAMMAIRE : la formation du pluriel, les adjectifs de couleurs, l'adjectif beau, nouveau,vieux

LEXIQUE : savoir comment s'habiller des grandes occasions, les couleurs, les formes, les matériaux

PRODUCTION ORALE : comprendre une présentation de catalogues vestimentaires en France

PRODUCTION ECRITE : adresser des souhaits à quelqu'un

Unit - IV (12 hours)

TITRE:VENTES D'AUTREFOIS, VENTES D'AUJOURD'HUI

GRAMMAIRE : les pronoms relatifs qui et que, l'imparfait, les verbes connaître, écrire, mettre et vendre, la question avec inversion

LEXIQUE : comprendre la description de personnes dans un extrait de roman, les mesures,

l'informatique

PRODUCTION ORALE : imaginez un dialogue avec un personnage célèbre. Utilisez l'inversion.

PRODUCTION ECRITE : écrire une biographie en utilisant les pronoms relatifs

Unit- V

(12 hours)

TITRE:FELICITATIONS ! / ON VOYAGE!

GRAMMAIRE : les pronoms démonstratifs, les articles : particularités, les pronoms interrogatifs variables : lequel, les adverbes de manières, les verbes recevoir et conduire

LEXIQUE : les moyens de transports, les voyages, les fêtes, l'aéroport et l'avion, la gare et le train, l'hôtel

PRODUCTION ORALE : Présenter ses vœux

PRODUCTION ECRITE : Faire une réservation

Book for Study

P.Dauda,L.Giachino and C.Baracco, *Generation A2*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *EchoA2*, CLE International, 2^eedition,2017
2. Régine Mérieux and Yves Loiseau, *Latitudes A2*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Web Resources

1. <https://francais.lingolia.com/en/grammar/prepositions>
2. <https://www.lawlessfrench.com/grammar/present-tense/>
3. <https://www.thoughtco.com/textures-french-adjectives-and-expressions-1368980>
4. <https://study.com/academy/lesson/past-tense-in-french.html>
5. <https://absolutely-french.eu/french-celebrations/?lang=en>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code		Title of the Course					Hours	Credits		
III	21UFR31GL03		FRENCH – III					4	3		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	1	2	2	3	2	3	1	2	3	2.1
CO-2	3	2	3	3	1	2	1	2	2	3	2.2
CO-3	2	1	3	2	2	3	1	3	2	2	2.1
CO-4	3	1	3	2	3	3	3	1	2	3	2.4
CO-5	3	2	3	2	2	3	3	2	2	1	2.3
Mean overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21UHI31GL03	HINDI - III	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, students will be able to	
CO-1	find out the dialects of Hindi language.	K1
CO-2	compare the poems of Sumithra Nandanpanth, Prasad & Bachan in Context with their experience of life.	K2
CO-3	illustrate the importance given to family ethics by the youth in the modern period according to “Bahoo Ki vidha” One Act play.	K3
CO-4	categorize the poetics in some selective poems.	K4
CO-5	justify the social & political conditions of Devotional period in Hindi Literature.	K5

Unit - I (12 Hours)

Tera sneh na khoon
Samband Bodak
Reethikal - Namakarn
Tense

Unit - II (12 Hours)

Himadri Thung Sring Se
Paribakshik shabdavali
Samuchaya Bodak
Reethikal - Samajik Paristhithiyam

Unit - III (12 Hours)

Insan our Kuthae
Vismayadi Bodak
Reethikal - Sahithyik Paristhithiyam
Reethikal - Salient Features

Unit - IV (12 Hours)

Shokgeeth
Avikary shabdh
Reethikal - Main Divisions
Social media and modern world

Unit - V (12 Hours)

Reethikal - Visheshathayem
Anuvad – 3
Bahoo ki vidha (one act play)

Books for Study

1. Dr. Sanjeev Kumar Jain, Anuwad: Siddhant Evam Vyavhar, Kailash Pustak Sadan, Madhya Pradesh, 2019.
Unit-I Chapter 1
2. M. Kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.
Unit-II, III and IV Chapter 2
3. Dr. Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020.
Unit-V Chapter 4

Books for Reference

1. Ramdev, Vyakaran Pradeep, Hindi Bhavan, 2016.
2. Lakshman prasad singh, Kavya ke sopan, Bharathy Bhavan Prakashan, 2017.
3. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.
4. Hindi Niband Sangrah, V&S Publishers, 2015.
5. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.

Web Resources

1. <https://youtu.be/Xxvco3qa284>
2. <https://youtu.be/e9wK-pYfVPc>
3. https://youtu.be/75tHr53f5_o
4. https://youtu.be/eFNM6y_cpjY
5. <https://youtu.be/jHWXWLMxJtw>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course					Hours	Credits		
III	21UHI31GL03		HINDI - III					4	3		
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	3	2	3	2	1	3	2	2.4
CO-2	3	2	3	2	2	3	2	3	2	3	2.5
CO-3	3	2	2	3	1	3	2	3	2	3	2.4
CO-4	2	3	3	2	3	2	3	3	2	1	2.4
CO-5	3	2	2	3	3	2	1	3	2	3	2.4
Mean Overall Score											2.42 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21USA31GL03	SANSKRIT - III	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, the student will be able to	
CO-1	remember Characters and events of Ramayana.	K1
CO-2	understand social ethics and moral duties.	K2
CO-3	apply the values learnt , in day to day life.	K3
CO-4	analyzing the Vedic Philosophy.	K4
CO-5	evaluate and create new words with upasargas.	K5

Unit - I (12 Hours)

Romodantam , Balakandam (1-15)

Unit - II (12 Hours)

Romodantam , Balakandam (15-30)

Unit - III (12 Hours)

Vedas – Vedangas vivaranam

Unit - IV (12 Hours)

Puranas .Upanishands

Unit - V (12 Hours)

Upasargas , Bhavishyat Kaalah

Book for Study

VEDIC LITERATURE, 2019

Books for Reference

1. Parameshwara, Ramodantam, LIFCO Chennai 2018
2. R.S.Vadhyar & Sons , Book – sellers and publishers , Kalpathu ,Palghat – 678003 , Kerala , south India , History of Sanskrit Literature 2019
3. Kulapathy , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007 2018

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credit
III	21USA31GL03		SANSKRIT-III								4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	1	2	2	3	3	3	3	3	2	1	2.3	
CO-2	3	3	2	3	3	2	2	3	3	3	2.7	
CO-3	3	3	1	3	3	1	1	3	3	3	2.4	
CO-4	2	2	1	2	3	2	2	3	2	1	2.0	
CO-5	3	3	2	3	2	2	3	3	3	2	2.6	
Mean Overall Score											2.4	
Result											#	High

Semester	Course Code	Title of the Course	Hours	Credits
III	21UEN32GE03	GENERAL ENGLISH - III	5	3

CO No.	CO-Statements	Cognitive Levels (K-Levels)
	On successful completion of this course, students will be able to	
CO -1	recall the meaning of familiar words in different contexts	K1
CO-2	comprehend the complex written texts by guessing meaning of unfamiliar words using contextual clues	K2
CO-3	use tenses and punctuations appropriately in sentences	K3
CO-4	analyse formal and informal letters to rewrite them meaningfully	K4
CO-5	compare different genres of writing and construct paragraphs	K5 & K6

Unit-I (15 Hours)

1. Suggestions to Develop Your Reading Habit
2. General Writing Skill: Letter Writing – Informal
3. Grammar: Simple Present Tense

Unit-II (15 Hours)

4. The Secret of Success: An Anecdote
5. General Writing Skill: Letter Writing – Formal
6. Grammar: Present Continuous Tense

Unit-III (15 Hours)

7. The Impact of Liquor Consumption on the Society
8. General Writing Skill: Letter to Newspaper
9. Grammar: Simple Past Tense

Unit-IV (15 Hours)

10. Dr. A.P.J. Abdul Kalam: A Short Biography
11. General Writing Skill: Job Application Letter
12. Grammar: Past Continuous Tense

Unit-V (15 Hours)

13. Golden Rule: A Poem
14. General Writing Skill: Circular-Writing
15. Grammar: Simple Future Tense and Future Continuous Tense

Book for Study

Jayraj, S. Joseph Arul et al. *Trend-Setter: An Interactive General English Textbook for Undergraduate Students*. Trinity, 2016.

Books for Reference

1. Malkani, Neelam. *A comprehensive Guide on General English for Competitive Exams*. Agra: Oswal Publications, 2020.
2. Jain, B. B. *Compendium General English*. Agra: Upkar Prakashan, 2010.
3. Aggarwal, R.S. *Quick Learning Objective General English*. India: S Chand, 2006.

4. T. Ferrari, Bernard. *Power Listening: Mastering the Most Critical Business Skill of All*. USA: Penguin Publishers, 2012.
5. Barry, Marian. *Steps to Academic Writing*. USA: Cambridge University Press, 2011.

Web Resources

1. <https://www.nypl.org/events/classes/english>
2. https://www.waywordradio.org/listen/podcast-itunes/?gclid=EAIaIQobChMIrbeRtbP12AIVCYZpCh0-XwnvEAAAYAiAAEgLcjd_BwE
3. <https://eltlearningjourneys.com/2015/05/19/websites-for-learning-english/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code		Title of the Course							Hours	Credits
III	21UEN32GE03		GENERAL ENGLISH - III							5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO-1	2	3	2	2	3	2	3	2	3	2	2.4
CO-2	2	2	3	2	3	3	2	3	2	2	2.3
CO-3	2	3	2	3	2	2	3	2	3	2	2.4
CO-4	2	2	3	2	3	3	2	3	2	3	2.5
CO-5	2	2	2	3	2	2	2	3	2	2	2.2
Mean Overall Score										2.36 (High)	

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33CC05	CORE-5: TAXONOMY OF ANGIOSPERMS	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	perceive the codes of nomenclature and interdisciplinary approaches on classification of angiosperms.	K1
CO-2	comprehend scientific terms and recognise general range of variations in angiosperms.	K2
CO-3	demonstrate specific mastery in recognise, compare and contrast distinctive attributes among the major groups of angiosperms.	K3
CO-4	critique the importance of various plant parts for human health and social economics.	K4
CO-5	equip themselves with skills in writing short species description, illustration, field identification and scientific photography.	K5

Unit I (15 Hours)

History of plant taxonomy. Plant collection, Identification (herbaria and botanical gardens), documentation (keys and flora). Taxonomic hierarchy; Botanical nomenclature: ICN principles, scientific names, ranks, authorship, nomenclatural types, valid publication, rejection of names, priority of publication.

Unit II (15 Hours)

Classification: artificial (Carolus Linnaeus), natural (Bentham & Hooker) and phylogenetic (Engler & Prantle's) and Angiosperm Phylogeny Group (APG). Brief account of cytotaxonomy, chemotaxonomy, molecular taxonomy and numerical taxonomy.

Unit III (15 Hours)

Detailed study and economic importance of the following families (classification based on APG IV, 2016): Basal angiosperms: Nymphaeales - Nymphaeaceae; Magnoliids: Piperales - Aristolochiaceae, Magnoliales - Annonaceae; Monocots: Alismatales - Araceae, Liliales - Liliaceae, Asparagales - Orchidaceae, Commelinales - Pontederiaceae, Poales - Poaceae.

Unit IV (15 Hours)

Eudicots: Rosids: Fabales - Fabaceae, Rosales - Rosaceae, Moraceae, Cucurbitales - Cucurbitaceae; Malpighiales - Euphorbiaceae, Myrtales - Lythraceae, Myrtaceae, Sapindales - Anacardiaceae, Rutaceae, Meliaceae.

Unit V (15 Hours)

Eudicots cont.: Superasterids: Santalales - Loranthaceae, Caryophyllales - Amaranthaceae, Asterids: Ericales - Sapotaceae, Gentianales - Rubiaceae, Apocynaceae, Solanales - Solanaceae, Lamiales - Lamiaceae, Asterales - Asteraceae, Apiales - Apiaceae.

Books for Study

1. Michael G. Simpson 2019. Plant Systematics, 3rd ed., Academic Press, London, UK.
2. Sharma OP. 2009. Plant Taxonomy, Tata McGraw-Hill Education Pvt. Ltd., New Delhi.

Books for Reference

1. SampamurthyAVSS. 2015. Taxonomy of Angiosperms, 2nd ed., I.K. International Pvt. Ltd., NewDelhi.
2. Jeffrey C. 1982. An Introduction to Plant Taxonomy, 2nd ed., Cambridge University Press, New York, USA.

Semester	Course Code	Title of the Course									Hours	Credits
III	21UBO33CC05	CORE-5: TAXONOMY OF ANGIOSPERMS									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	2	2	2	2	3	2	3	2	2	2.3	
CO2	3	3	3	2	2	3	2	2	2	3	2.5	
CO3	3	3	3	2	2	3	3	3	2	2	2.6	
CO4	2	3	3	2	3	2	3	3	3	3	2.7	
CO5	3	3	3	2	3	3	3	3	3	3	2.9	
Mean Overall Score											2.6	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33CC06	CORE-6: PLANT BREEDING AND EVOLUTION	3	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge on objectives and various methods of plant breeding.	K1
CO-2	outline the process of evolution and various theories pertaining to biological evolution.	K2
CO-3	judge which plant breeding methods are appropriate for specific objectives.	K3
CO-4	analyse, evaluate and synthesize information relevant to plant breeding.	K4, K5
CO-5	formulate a plan for the application of plant breeding methods to achieve a specific objective.	K6

Unit I

(9 Hours)

Plant Breeding: History and objectives; genetic basis and important achievements in plant breeding; modes of reproduction in crop plants (asexual, sexual, apomictic)- advantages and limitations, Floral biology in relation to selfing and crossing techniques; Plant Introduction – types and procedures; Centres of origin and domestication of crop plants.

Unit II

(9 Hours)

Selection methods: Mass selection, pure line and clonal selection- merits and demerits; Hybridization: objectives, choice of parents and causes of failure; Incompatibility and male sterility - methods to overcome; Methods of handling segregation material for isolation of superior strains – bulk method and pedigree method of selection; Role of distant hybridization- in crop improvement.

Unit III

(9 Hours)

Inbreeding depression and heterosis: genetic basis and its applications; Steps in the production of single cross, double cross, three-way cross; Polyploidy: induced polyploidy, role of auto and allopolyploids; Mutation and crop improvement.

Unit IV

(9 Hours)

Back crossing: theory and procedure for transferring various types of character; Breeding for disease resistance and drought tolerance; Preservation and utilization of germplasm; Breeding techniques for rice, sugarcane, groundnut and maize; Limitations of conventional breeding; Aspects of molecular breeding.

Unit V

(9 Hours)

Evolution: origin of life, theories of evolution of life forms: Lamarckism and Darwinism. Variations – definition causes and types, mutation (principles of Hugo De Vries). Role of mutation in speciation. Evolution through ages: human evolution. Evidences for evolution.

Text Book

1. Chaudhari, H.K., (1995) Revised Ed., Elementary Principles of Plant Breeding, Oxford & IBH, New Delhi.
2. Chittaranjan K. (2006-07). Genome Mapping and Molecular Breeding in Plants. Vols. I-VII. Springer.

References

1. Chopra, V. L. (1994). Plant breeding- Theory and Practice. Oxford & IBH.
2. Sharma J. R. (1996). Principles and Practice of Plant Breeding, Tata McGraw Hill
3. Sinha, U. and Sinha, S. (1992). Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House Pvt. Ltd, India.

Semester	Course Code	Title of the Course									Hours	Credits
III	21UBO33CC06	CORE-6: PLANT BREEDING AND EVOLUTION									3	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	2	2	3	2	2	3	2	2	2.2	
CO-2	3	2	2	1	2	1	3	3	2	3	2.2	
CO-3	1	2	3	2	3	2	3	2	3	2	2.3	
CO-4	2	2	1	3	1	2	3	2	3	3	2.2	
CO-5	1	2	2	2	3	1	3	2	2	3	2.1	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33CP03	LAB COURSE 3 (TAXONOMY OF ANGIOSPERMS AND PLANT BREEDING)	3	2

Detailed Study:

- Description of plant in technical terms.
- A detailed study of the range of vegetative and floral characters of plants belonging to the families mentioned in the theory part except Orchidaceae.
- Field trip to any place within or outside the state to study the plants in their natural habitats.
- Spot identification (Binomial, Family) of plants included in the theory.
- Field note-book and 5 herbarium sheets of common angiosperms are to be prepared and submitted at the time of Practical Examination.
- Breeding techniques: Emasculation, Layering and Grafting.

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33AO03A	ALLIED-II: CHEMISTRY-I (For B.Sc Botany)	4	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	observe the chemistry of different types of soils and their utility.	K1
CO-2	understand the principles involved in periodicity and chemical bonding.	K2
CO-3	develop the knowledge about various reactions of organic chemistry	K2
CO-4	relate bioinorganic complex molecules with human life	K3
CO-5	apply the various analytical concepts in quantitative analysis.	K4

Unit-I Periodicity and Chemical Bonding

(12 Hours)

Periodicity: classification of elements, division of periodic table into blocks (*s*, *p*, *d*, *f*), atomic radius, ionic radius, ionization energy, electronegativity, electron affinity—trends within a group and periods. General electronic configurations and oxidation states of *s*, *p* and *d*- block element, inert pair effect.

Ionic Bond – definition, examples, condition for the formation of ionic bond, properties of ionic molecules.

Covalent bond – definition, examples, properties of covalent molecules, hybridization, types of hybridization, VSEPR theory: structures of BeCl₂, BF₃, NH₃ and H₂O.

Unit-II Organic Chemistry

(12 Hours)

Classification of organic compounds: (i) Hydrocarbons: aliphatic saturated / unsaturated, cyclic acyclic and aromatic compounds (ii) alkyl and aryl halides (iii) alcohols and ethers (iv) aldehydes, ketones and carboxylic acid and their derivative (v) amines and nitro compounds; nomenclature and examples upto five carbon atoms.

Unit-III Quantitative Analysis

(12 Hours)

Error Analysis: accuracy, precision, errors, determinate and indeterminate errors, eliminating and minimizing error, relative error, absolute error.

Concentration units: mole, molarity, molality, formality, normality, ppm, mole fraction. Primary standard and secondary standard solutions, principle of volumetric analysis, acid–base titration, redox titration, complexometric titration, precipitation titration and indicators.

Unit-IV Agricultural Chemistry

(12 Hours)

Soil types—red soil, black soil, alluvial soil, desert soil, red soil; role of humus: Manures and their importance. Chemical fertilizers: Natural and synthetic fertilizers: NPK fertilizers: manufacture of NPK fertilizers, mixed fertilizers; role of macronutrients and micronutrients: Pesticides: classification insecticides, herbicides and fungicides; Structure of important pesticides: DDT, BHC, 2, 4-D, 2, 4, 5-T; biomass and its utilization; triple revolution India (Green, Blue and White).

Unit-V Coordination and Bioinorganic Chemistry (12 Hours)

Coordinate bond – ligands, classification of ligands, nomenclature of complexes DMG, EDTA ligands and their importance. Structure of $[\text{Ag}(\text{NH}_3)_2]^+$ linear; $[\text{Cu}(\text{NH}_3)_4]^{2+}$ square planar; $[\text{Ni}(\text{Cl})_4]^{2-}$ Td; $[\text{Pt}(\text{CN})_4]^{2-}$ square planar.

Chemistry of haemoproteins, nature of hemoglobin and myoglobin, chemistry of chlorophyll, porphyrin unit and photosynthesis. Nitrogen fixation and carbon cycle.

Books for Study

1. Puri B R, Sharma L R and Kalia K K, *Principles of Inorganic Chemistry*, 33rd Edition, Vishal Publishing Co, Jalandhar Delhi, 2020.

Unit-I Chapter 2 and 5

Unit-V Chapter 26 and 37

Unit III Chapter 40

2. Arun Bahl and Bahl B S, *Advanced Organic Chemistry*, 22nd Edition, S. Chand, New Delhi, 2014.

Unit-II Chapter 4

3. Sharma B K, *Industrial Chemistry*, Goel Publishing Company, New Delhi, 2011.

Unit-IV Chapter 5

Books for Reference

1. Puri B R, Sharma L R and Pathania M S, *Principles of Physical Chemistry*, 23rd Edition, ShobanLal Nagin S, Chand, New Delhi. 1993.
2. Tewari K S and Vishnoi N K, *A Text Book of Organic Chemistry*, 3rd Edition, S. Chand and Company Pvt. Ltd., New Delhi, 2000.
3. Gopalan R, *Elements of Analytical Chemistry*, S. Chand, New Delhi, 1999.

Web Resources

1. https://bansal.ac.in/acc_sample_ioc.pdf
2. https://www.niser.ac.in/sps/sites/default/files/basic_page/Error%20Analysis_2015.pdf



Basics of Inorganic Chemistry



Error Analysis

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course code			Title of the Course						Hours/ week	Credits
III	21UBO33AO03A			ALLIED-II: CHEMISTRY–I (For B.Sc Botany)						4	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO–1	PO–2	PO–3	PO–4	PO–5	PSO–1	PSO–2	PSO–3	PSO–4	PSO–5	
CO–1	2	1	2	3	2	3	1	2	3	2	2.1
CO–2	3	1	2	2	3	3	2	1	3	2	2.2
CO–3	2	2	1	3	2	2	1	2	3	2	2.0
CO–4	3	3	2	1	2	2	2	3	2	1	2.1
CO–5	3	2	2	3	3	2	3	2	2	3	2.5
Mean overall Score											2.2
Result											High

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33AO03B	ALLIED-II: BIOMETRICS AND COMPUTER APPLICATIONS-I	4	2

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO-1	acquire the knowledge of Statistics in biological context	K1
CO-2	describe the concept of matrix	K2
CO-3	compute the system of equation.	K3
CO-4	utilize the statistical diagrams to represent real life problems.	K3
CO-5	analyse the univariate data.	K4

Unit I (12 Hours)

Types of measurements – Interval, ratio, rank order and categorical - Logarithm, Permutation and Combination

Unit II (12Hours)

Solving Equations: Solving a simple linear equation involving one variable and two variables. Matrices - Operation on matrices – Determinants – Inverse – Solving a system of equations of order 3x3 using Cramer's rule and inverse method.

Unit III (12 Hours)

Mathematical modeling: Principle of least squares (concepts only) –Curvilinear regression, $y = ax^2 + bx + c$, $y = ab^x$ and $y = ae^{bx}$.

Unit IV (12 Hours)

Statistics –Introduction -Uses and limitations of Statistics – Collection and classification of data - Frequency table – Frequency graphs – Diagrammatic representation of data - Sampling-Census and sample method - Methods of sampling.

Unit V (12 Hours)

Measures of location: Mean, Median and Mode. **Measures of Dispersion:** Range, Mean deviation, Standard deviation and Coefficient of variation. Skewness and Kurtosis.

Books for Study

- Gupta S.P, Statistical Methods, Sultan Chand & Sons, New Delhi, 43rd Edition 2014
Unit –I - page no 1428-1430
- PA.Navanitham, Business Mathematics and Statistics ,Jai publishers 2015
Unit –II Chapter IV (sec 6,7,8,9,12)

3. Gupta S.P. & Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 12th Edition 2020.
Unit III Chapter 11 (sec 11.2, 11.3)
4. Gupta S.P, Statistical Methods, Sultan Chand & Sons, New Delhi, 43rd Edition 2014
Unit –IV Chapter 1, 2, 3 & 4
Unit –V Chapter 7, 8 & 9

Books for Reference

1. Nageswara Rao G.: Statistics for Agricultural Science, BS Publications, Third Edition, 2018
2. Olive Jean Dunn & Virginia A Clark: Basic Statistics: A primer for the Biomedical Sciences, A John Wiley & Sons, Inc., Publications, Fourth Edition, 2009.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Course Code	Title of the Course									Hours	Credit
III	21UBO33AO03B	ALLIED-II: BIOMETRICS AND COMPUTER APPLICATIONS-I									4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	3	3	2	3	3	3	2	3	3	3	2.8	
CO-2	1	2	2	3	3	2	1	2	3	3	2.2	
CO-3	3	3	2	3	3	1	3	3	2	2	2.5	
CO-4	2	3	2	2	3	3	1	2	3	3	2.4	
CO-5	3	3	3	2	2	3	2	2	3	3	2.6	
Mean Overall Score											2.5 (High)	

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO33AP03B	ALLIED-II: LAB COURSE-1: (BIOMETRICS AND COMPUTER APPLICATIONS I)	2	2

CO No.	CO– Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO-1	find the solutions of the system of equations.	K 1
CO-2	predict the future value by fitting the appropriate curve.	K 2
CO-3	display the frequency table for the given data.	K 3
CO-4	sketch out the frequency curves.	K 3
CO-5	draw and explain the diagrams for the data under study.	K 4

Using the Excel packages the students are asked to solve the following exercises:

1. Solving a system of equations – Inverse Matrix, Cramer's rule.
2. Curve fitting – Straight line, Regression line and second degree.
3. Construction of frequency table – Univariate, Bivariate and Cross tabs.
4. Drawing frequency graphs.
5. Pictorial presentation – Bar diagrams, Pie diagrams etc.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Course Code	Title of the Course									Hours	Credit
III	21UBO33AP03 B	ALLIED-II: LAB COURSE I (BIOMETRICS AND COMPUTER APPLICATIONS I)									2	2
Course Outcomes ↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	3	2	1	2	3	3	3	2	1	1	2	
CO-2	2	3	2	3	3	3	2	1	2	3	2.4	
CO-3	3	2	3	3	2	1	3	2	1	2	2.2	
CO-4	2	3	2	1	3	1	2	3	2	3	2.2	
CO-5	1	2	3	2	1	2	3	1	1	2	1.8	
Mean Overall Score											2.12 (High)	

Semester	Course Code:	Title of the Course	Hours	Credits
III	21UBO34SE01	SEC-1 (WD): MUSHROOM TECHNOLOGY	2	1

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	identify various cultivable species of mushrooms.	K1
CO-2	design various recipe from mushrooms.	K2
CO-3	assess preservation and storage of mushrooms.	K3
CO-4	evaluate and explore the economic viability of mushrooms.	K4
CO-5	prepare the culture techniques of edible mushrooms.	K5

Unit I

(6 Hours)

Introduction - Classification - Edible and Poisonous. Tests for identification - Nutritive value of mushrooms.

Unit II

(6 Hours)

Characteristics of common edible mushrooms Paddy straw, Oyster and milky mushrooms. Life cycle of a common mushroom (Agaricus).

Unit III

(6 Hours)

Culture Techniques – Preparation of spawn, preparation of compost – Spawn running – Harvesting and Marketing.

Unit IV

(6 Hours)

Preservation and storage of mushrooms – Diseases and pests of mushrooms.

Unit V

(6 Hours)

Delicious recipes of mushroom – Economic importance of mushrooms.

Book

1. Nita Bahl (1984). Handbook on Mushrooms, Oxford and IBH Publishing Company

Reference

1. Dubey, RC. (2001) A Textbook of Biotechnology, S.Chand & Co. Ltd.

Semester	Course Code	Title of the Course	Hours	Credits
III	21UBO34SE01	SEC-1 (WD): MUSHROOM TECHNOLOGY	2	1

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	1	2	3	2	2	3	2.3
CO-2	2	2	3	1	2	2	2	2	3	2	2.1
CO-3	1	3	3	2	3	1	2	3	2	3	2.3
CO-4	2	3	2	2	1	2	3	1	2	3	2.2
CO-5	1	3	3	2	1	2	3	2	1	3	2.1
Mean Overall Score											2.2
Result											Medium

Semester	Course Code	Title of the Course	Hours	Credits
III	21UHE24VE03A	PROFESSIONAL ETHICS-I: SOCIAL ETHICS - I	2	1

CO No.	Co- Statements	Cognitive Level
	On completion of this course the graduates will be able to:	
CO-1	know the responsibility of the educated youth.	K1
CO-2	understand the values prescribed under social ethics.	K2
CO-3	apply their minds critically to the various types of cyber crime.	K3
CO-4	analyse the various kinds of political systems.	K4
CO-5	analyse the behaviour of the elected representatives.	K4

Unit-I Introduction to Social Ethics

(6-Hours)

Introduction to social ethics and social responsibility, important role of Social ethics on the various areas, religion influences social changes - secularism. Social ethics and corporate dynamics, forms of social ethics.

Unit-II The Economic and Political System of Today

(6-Hours)

Planned economy and communism – market economy and capitalism- socialism - mixed economy -the emerging market economy - political system- totalitarian system- oligarchic system.

Unit-III Integrity in Public Life National Integration

(6-Hours)

What is Integrity, Public Life, Integrity and Public Life, Integrity in a Democratic State, India as Democratic State, Behavior of a elected representative of India , Noticeable degradation acts of elected Representatives, Suggestions to stem this rot, Types of integrity, Transparency can be a guarantee for integrity.

Unit-IV Cyber Crime

(6-Hours)

Business Ethics, Business ethics permeates the whole organization, Measuring business ethics , The Vital factors highlighting the importance of business ethics , Cyber crime, Strategies in committing Cyber Crimes, Factors aiding Cyber Crime, computer Hacking, Cyber Bullying, Telecommunications piracy, Counter Measures to Cyber Crime, Ethical Hacking.

Unit-V Social Integration

(6-Hours)

Global challenges, The future is with the Educational Youth, Cost of the Sacrifice, Crusaders against corruption, Responsibility of the Educated Youth, Positive Global Scenario, Right to Education, Eradicating gender inequality, Sustainable Human Development , Social Integration, Elimination Crime, Integration with Global Market

Books for Study:

1. Department of Human Excellence, *Formation of Youth*, St Joseph's College(Autonomous), Tiruchirappali -02, 2021

Books for Reference:

1. Ramesh K. Arora, *Ethics, Integrity and Values* by Public Service Paperback ,– 1 January 2014
2. Cunningham, D. *There's something happening here: The new left, the Klan, and FBI counterintelligence*. Berkeley: University of California Press, 2004.
3. Adv. Prashant Mali, *Cyber law & Cyber Crimes simplified* by Cyber Info media Paperback – 1 January 2017.
4. Matthew Richardson, *Cyber Crime: Law and Practice Hardcover – Import*, Wildy publications, 29 November 2019

Web Sources:

<https://cybercrime.gov.in/>

<https://open.lib.umn.edu/sociology/chapter/14-2-types-of-political-systems/>

<https://www.esv.org/resources/esv-global-study-bible/social-ethics/>

https://en.wikipedia.org/wiki/Political_system

Semester	Course Code	Title of the Course	Hours	Credits
III	21UHE34VE03B	PROFESSIONAL ETHICS I: RELIGIOUS DOCTRINE- I	2	1

CO.No.	Co – Statements	Cognitive Level
	On completion of this course, the graduates will be able to:	
CO-1	understand the history of the Catholic Church	K1
CO-2	examine and grasp the Sacraments of the Catholic Church	K2
CO-3	apply the Christian Prayer to their everyday life	K3
CO-4	analyze themselves in the light of Sacraments & Christian Prayer	K4
CO-5	create a harmonious society learning values from all religions	K5 & K6

Unit-I	God of salvation	(6 Hours)
Unit-II	Life & Mission of Jesus Christ	(6 Hours)
Unit-III	The Holy Spirit	(6 Hours)
Unit-IV	Biblical Values	(6 Hours)
Unit-V	Mother Mary	(6 Hours)

Books for Text

Department of Human Excellence, *Life in the Lord: Religious Doctrine*. St. Joseph's College, Trichirappalli-02, 2021.

Books for Reference:

1. *Compendium: Catechism of the Catholic Church*. Bengaluru: Theological Publications in India, 1994.
2. Holy Bible (NRSV).

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UTA41GL04B	Scientific Tamil (SBS, SPS,SCS)	4	3

CO No.	CO- Statements	Cognitive Level (K- level)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	பண்டைத் தமிழர்களின் அறிவியலறிவை அறிந்துகொள்வர்.	K 1
CO-2	பண்டைத் தமிழிலக்கியங்களுள் காணலாகும் அறிவியல் சிந்தனைகளைப் புரிந்துகொள்வர்.	K 2
CO-3	தமிழரின் அறிவியல் மருத்துவத்தையும், நீர் மேலாண்மை அறிவையும் அறிந்துகொள்வர்.	K 3
CO-4	இக்கால இலக்கியங்களுள் அறிவியல்துறை பெற்றுள்ள செல்வாக்கை அறிந்துகொள்வர்.	K 4
CO-5	அறிவியல் கலைச்சொற்களைத் தமிழில் கற்றுக் கொண்டு அறிவியல் தமிழ் வளரத் துணைபுரிவர்.	K 5

அலகு - 1

(12 மணிநேரம்)

தொல்காப்பியம் :

நிலம் தீ நீர் வளி விசும்போடு (தொல்.பொருள் 635)

ஒன்றறிவதுவே (தொல்.பொருள் 571)

புறநானூறு

மண் திணிந்த நிலனும் (புறம்.2)

செஞ்ஞா யிற்றுச் செலவும் (புறம். 30)

அகநானூறு

அம்ம வாழி, தோழி (அகம்.141)

பதிற்றுப்பத்து

நிலம் நீர் வளி விசம்பு என்ற நான்கின் (பதிற்று.14)

நெடுவயின் ஒளிறு மின்னுப் பரந்தாங்கு (பதிற்று.24)

உரைநடைக்கட்டுரை : வியக்க வைக்கும் தமிழரின் அறிவியல்

அலகு- 2

(12 மணிநேரம்)

சித்தர் பாடல்கள்

பதார்த்த குண சிந்தாமணி

குளத்து சலந்தானே கொடிதான (27)

ஏரிசலம் வாதமிகு மதுவே (31)

அருவிநீர் மேக மகற்றுங் (39)

மேவிய சீவன் வடிவது சொல்லிடல் (திருமூலர்)

அணுவில் அணுவினை ஆதிபிராணை (திருமூலர்)

நட்டகல்லைத் தெய்வமென்று (சிவவாக்கியர்)

உரைநடைக்கட்டுரை: தமிழர்களின் மருத்துவ அறிவியல்

அலகு - 3

(12 மணிநேரம்)

திருக்குறள் (2 அதிகாரங்கள்)

வான் சிறப்பு, மருந்து

வலைப்பூக்கள் உருவாக்கல், பராமரித்தல்

புதிய அறிவியல் கலைச்சொல்லாக்கங்களை உருவாக்குதல்

உரைநடைக்கட்டுரை: தமிழ் இலக்கியங்களில் நீர் மேலாண்மையியல்

அலகு- 4

(12 மணிநேரம்)

புதினம்: சொர்க்கத்தீவு – சுஜாதா

நூல் - திறனாய்வு

அறிவியல் புனைவு ஆவணப்படம், திரைப்படம் - திறனாய்வு

உரைநடைக்கட்டுரை: தமிழில் அறிவியல் புனைவுகள்

அலகு - 5

(12 மணிநேரம்)

அறிவியல் கலைச்சொற்கள்

அன்றாட வாழ்வில் அறிவியல் பழமொழிகளைத் தொகுத்தல்

மூலிகைகள், கீரைகள் ஆகியவற்றின் முக்கியத்துவத்தைக் காட்சிப்படுத்துதல்.

தமிழர் அறிவியல் கண்காட்சி நடத்துதல்

உரைநடைக்கட்டுரை: அறிவியல் தமிழின் வளர்ச்சி நிலைகள்

பாட நூல்கள்

1. **அறிவியல் தமிழ்**, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2022
2. சுஜாதா, **சொர்க்கத்தீவு**, விசா பப்ளிகேஷன்ஸ், சென்னை-17, ஒன்பதாம் பதிப்பு, 2009
3. மூர்த்தி அ.கி., **அறிவியல் அகராதி**, மணிவாசகர் பதிப்பகம், சென்னை, 2001

பார்வை நூல்கள்

1. குழந்தைசாமி.வா.செ., **அறிவியல்தமிழ்**, பாரதி பதிப்பகம், சென்னை-17, 6ஆம்பதிப்பு, 2001
2. நெடுஞ்செழியன், **இன்னும் மீதமிழுக்கிறது நம்பிக்கை**, பூவுலகின் நண்பர்கள் வெளியீடு, சென்னை, முதற்பதிப்பு, 2017

3. பரிமேலழகர்(உரை.), திருக்குறள், பாரதி பதிப்பகம், சென்னை-17, ஏழாவது பதிப்பு, 2000.
4. வையாபுரிப்பிள்ளை, பாட்டும் தொகையும், பாரி நிலையம், சென்னை, இரண்டாம் பதிப்பு, 1967.

Semester	Course Code		Title of the Paper							Hours	Credit
IV	21UTA41GL04B		Scientific Tamil (SBS, SPS,SCS)							4	3
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	1	2	3	2	2	3	3	2	2	2	2.2
CO-2	2	2	3	2	2	2	3	2	3	2	2.3
CO-3	1	2	2	3	2	2	2	3	3	3	2.3
CO-4	2	2	3	2	2	3	2	3	3	2	2.4
CO-5	3	1	2	2	2	2	3	2	3	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UFR41GL04	FRENCH – IV	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO-1	recall the vocabulary pertaining to dwelling place.	K1
CO-2	outline crisis management in France.	K2
CO-3	develop a travel diary of your own.	K3
CO-4	simplify the French education system.	K4
CO-5	interpret past tenses in a text.	K5

Unit- I (12 hours)

TITRE:ON FAIT LE MELANGE!

GRAMMAIRE : le présent progressif, les pronoms possessifs, la phrase négative

LEXIQUE : décrire les étapes d'une action, la maison, les tâches ménagères

PRODUCTION ORALE : comprendre le récit d'un voyage

PRODUCTION ECRITE : raconter ses actions quotidiennes

Unit - II (12 hours)

TITRE:A PROPOS DE LOGEMENT

GRAMMAIRE : quelques adjectifs et pronoms indéfinis, les verbes lire, rompre et se plaindre

LEXIQUE : la localisation et le logement, les pièces, meubles et équipement

PRODUCTION ORALE : jeu de rôle –votre ami et vous s'installe dans un nouveau meuble

PRODUCTION ECRITE : décrire votre maison/appartement

Unit- III (12 hours)

TITRE:TOUS EN FORME!

GRAMMAIRE : le passé composé et l'imparfait, le passé récent, l'expression de la durée

LEXIQUE : un souvenir et les événements du passés, le corps humain : extérieur, le corps humain : intérieur

PRODUCTION ORALE : échanger sur ses projets de vacances

PRODUCTION ECRITE : raconter un souvenir

Unit - IV (12 hours)

TITRE:ACCIDENTS ET CATASTROPHES

GRAMMAIRE : les adjectifs et les pronoms indéfinis : rien/ personne/aucun, les verbes dire, courir et mourir

LEXIQUE : savoir les mots et les expressions des catastrophes naturelles, les maladies et les remédies, les accidents, les catastrophes naturelles

PRODUCTION ORALE : comprendre des personnes qui expriment leur accord ou leur désaccord selon un thème donné

PRODUCTION ECRITE : écrivez sur une catastrophe naturelle en articulant la cause et la conséquence

Unit -V (12 hours)

TITRE:FAIRE SES ETUDES A L'ETRANGER/ BON VOYAGE/ LA METEO

GRAMMAIRE : les pronoms démonstratifs neutres, le futur simple, situer dans le temps, moi

aussi/non-plus – moi non/si, les verbes impersonnels, les verbes croire, suivre et pleuvoir
 LEXIQUE : savoir vivre en France, le système scolaire, les formalités pour partir à l'étranger.
 PRODUCTION ORALE : exprimer son opinion sur la météo/parler de l'avenir
 PRODUCTION ECRITE: comparer le système scolaire français et indien

Book for Study

P.Dauda, L.Giachino and C.Baracco, *Generation A2*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *Echo A2*, CLE International, 2^e edition, 2013
2. Régine Mérieux and Yves Loiseau, *Latitudes A2*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Web Resources

1. <https://www.frenchcourses-paris.com/french-travel-journal/>
2. <http://www.saberfrances.com.ar/vocabulary/house.html>
3. <https://www.thoughtco.com/different-past-tenses-in-french-1368902>
4. <https://www.youtube.com/watch?v=JZdwJM7sEY8>
5. <https://www.scholaro.com/pro/Countries/France/Education-System>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code		Title of the Course					Hours		Credits	
IV	21UFR41GL04		FRENCH – IV					4		3	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO–1	3	1	3	2	2	3	2	1	2	2	2.1
CO–2	3	1	2	3	3	3	2	1	3	1	2.2
CO–3	3	2	3	2	2	3	2	1	3	2	2.3
CO–4	3	1	2	2	3	3	3	1	3	3	2.4
CO–5	2	2	3	3	1	3	1	2	3	2	2.2
Mean overall Score											2.24 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHI41GL04	HINDI - IV	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, students will be able to	
CO-1	list out the social conditions prevailed in Modern Period which are depicted in Hindi Literature.	K1
CO-2	discuss the dialects of Hindi language.	K2
CO-3	illustrate the works of some eminent Hindi Writers related to society.	K3
CO-4	analyze the human values expressed in life and literature of Hindi Novelist “Mamatha Kaliyah”.	K4
CO-5	evaluate the film & Literary works in Hindi.	K5

Unit - I (12 Hours)

Computer ka yug
Prathyay
Adhunik Kal - Namakarn
Namakaran

Unit - II (12 Hours)

Vigyan hani/labdh
Paryayvachy Shabdh
Adhunik Kal - Samajik Paristhithiyam
Samanarthy Shabdh

Unit - III (12 Hours)

Nari shiksha
Upasarg
Adhunik Kal – Sahithyik Paristhithiyam
Adhunik kal – Salient Features

Unit - IV (12 Hours)

Review- Book/Film
Paryavaran Pradookshan
Adhunik Kal - Main Divisions
Adhunik Kal - Visheshathayem

Unit - V**(12 Hours)**

Sapnom Kee Home Delivery (Novel)
Anuvad - 4

Books for Study

1. Dr. Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020.
Unit-I Chapters 4
2. M. Kamathaprasad Gupt, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.
Unit-II, III and IV Chapter 2
3. Dr. Sanjeev Kumar Jain, *Anuwad: Siddhant Evam Vyavhar*, Kailash Pustak Sadan, MadhyaPradesh, 2019 **Unit-V** Chapter 2

Books for Reference

1. Hindi Niband Sangrah, V&S Publishers, 2015.
2. Rajeswar Prasad Chaturvedi, Hindi vyakarana, Upakar prakashan, 2015.
3. Ramdev, Vyakaran Pradeep, Hindi Bhavan, 2016.
4. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.
5. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.

Web Resources

1. <https://youtu.be/xmr-DaQ3LhA>
2. <https://youtu.be/xIm-VEmgEg0>
3. <https://youtu.be/ZHuqxWbMtas>
4. <https://youtu.be/HGS63OJuHto>
5. <https://youtu.be/r-i3autqPug>

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credits
IV	21UHI41GL04		HINDI - IV								4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	3	2	3	3	2	3	2	3	1	2.4	
CO-2	3	2	3	3	2	3	2	3	1	2	2.4	
CO-3	3	2	2	3	2	2	1	3	2	3	2.3	
CO-4	3	2	3	1	3	3	2	3	3	2	2.5	
CO-5	3	2	2	3	3	2	3	2	3	3	2.6	
Mean Overall Score											2.44	(High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21USA41GL04	SANSKRIT - IV	4	3

CO No.	CO-Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, the student will be able to	
CO-1	remember and identifying Mahabharatha characters and events.	K1
CO-2	understand human behaviors by studying dramas.	K2
CO-3	apply the morals learnt in day to day life.	K3
CO-4	create new conversational sentences and to Improve self-character (Personality Development).	K4
CO-5	appreciate ancient Sanskrit dramas.	K5

Unit - I (12 Hours)

Sanskrita Vyavahara sahasri vakiya Prayogaha

Unit - II (12 Hours)

Lot Lakaarah , Prqayaogh Kartari Vaakyaani

Unit - III (12 Hours)

Naatakasya Itihaasah Vivaranam, Thuva and Tum Prathiyaha

Unit - IV (12 Hours)

Karnabhaaram , Naatakasya Visistyam

Unit - V (12 Hours)

Sanskrita Rachanani priyogaha

Book for Study

Karnabhavam & Literature Language, 2019 , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007

Books for Reference

1. R.S.Vadhyar & Sons , Book – sellers and publishers , Kalpathu ,Palghat – 678003 , Kerala , south India , History of Sanskrit Literature 2019
2. Kulapathy , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007 2018

3. Samskrita Bharathi , Aksharam 8 th cross , 2nd phase Giri nagar Bangalore Vadatu
sanskritam – Samaskara Binduhu 2019

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credit
IV	21USA41GL04		SANSKRIT-IV								4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	2	3	2	3	2	3	3	2	2.5	
CO-2	2	2	3	2	3	3	3	3	3	2	2.4	
CO-3	3	3	2	3	2	1	1	3	3	3	2.4	
CO-4	2	3	3	3	2	1	3	3	3	2	2.5	
CO-5	2	2	3	2	3	3	3	3	2	3	2.6	
Mean Overall Score											2.48	
Result											# High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UEN42GE04	GENERAL ENGLISH - IV	5	3

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	identify different local and global issues in given passages	K1
CO-2	understand explicit and implicit information given in written texts	K2
CO-3	use appropriate words and punctuations in writing	K3
CO-4	analyse written texts and modify them for better clarity	K4
CO-5	assess the coherence and cohesion of written texts and rewrite them	K5 & K6

Unit-I (15 Hours)

1. Women through the Eyes of Media
2. General Writing Skill: Writing Minutes of a Meeting
3. Grammar: Present Perfect Tense

Unit-II (15 Hours)

4. Effects of Tobacco Smoking
5. General Writing Skill: Note-Taking
6. Grammar: Present Perfect Continuous Tense

Unit-III (15 Hours)

7. Short Message Service (SMS)
8. General Writing Skill: Note-Making
9. Grammar: Past Perfect Tense

Unit-IV (15 Hours)

10. An Engineer Kills Self as Crow Sat on his Head: A Newspaper Report
11. General Writing Skill: Précis Writing
12. Grammar: Past Perfect Continuous Tense

Unit-V (15 Hours)

13. Traffic Rules
14. General Writing Skill: Paragraph Writing
15. Grammar: Future Perfect Tense and Future Perfect Continuous Tense

Book for Study

Jayraj, S. Joseph Arul et al. *Trend-Setter: An Interactive General English Textbook for Under Graduate Students*. Trinity, 2016.

Books for Reference

1. Clark Peter, Roy. *Writing Tools: 50 Essential Strategies for Every writer*. USA: Little, Brown Spark Publishers, 2008.
2. Carnegie, Dale. *The Quick and Easy Way to Effective Speaking*. India: Fingerprint Publishers, 2018.

3. Vaughn, Steck. *Reading Comprehension*. USA: Steck-Vaughn Co, 2014.
4. Birkett, Julian. *Word Power: A Guide to Creative writing*. India: Bloomsbury Academic, 2016.
5. Knight, Dudley. *Speaking with Skill: An Introduction to Knight-Thompson Speechwork*. USA: Methuen Drama, 2016.

Web Resources

1. <https://blog.lingoda.com/en/10-news-sites-to-practice-your-english-reading-skills/>
2. <https://www.espressoenglish.net/how-to-learn-english-for-free-50-websites-for-free-english-lessons/>
3. <https://www.ef.com/wwen/english-resources/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code		Title of the Course								Hours	Credits
IV	21UEN42GE04		GENERAL ENGLISH - IV								5	3
Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	3	2	2	3	2	3	2	3	2	2.4	
CO-2	2	2	3	2	3	3	2	3	2	2	2.3	
CO-3	2	3	2	3	2	2	3	2	3	2	2.4	
CO-4	2	2	3	2	3	3	2	3	2	3	2.5	
CO-5	2	2	2	3	2	2	2	3	2	2	2.2	
Mean Overall Score											2.36	(High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43CC07	CORE-7: CELL BIOLOGY AND GENETICS	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the organization of cells.	K1
CO-2	acquire knowledge on the structure and organization of various cell organelles	K2
CO-3	learn cell cycle and methods of cell division	K2
CO-4	solving problems with relevance to the principles and applications of genetics.	K3
CO-5	acquire the basic knowledge on genomics and proteomics.	K4

Unit I

(12 Hours)

Cell as a unit of structure and function; prokaryotic and eukaryotic; Endosymbiotic theory. Structure, organization and functions of nucleus, mitochondria, chloroplasts, ER, ribosomes, Golgi complex, lysosome and vacuole. Organisation of cytoskeleton.

Unit II

(12 Hours)

Cytoplasmic membrane structure and functions. Cellular mechanisms in development and differentiation. Cell division (mitosis and meiosis), Cell cycle. Mutation – types, causes and detection. Mutant types – lethal, conditional, biochemical; germinal vs somatic mutants, insertional mutagenesis. Special types of chromosome – polytene and lampbrush.

Unit III

(12 Hours)

Mendel's laws of heredity, Modified Mendelian ratios. Multiple alleles. Linkage and crossing over. Sex linked inheritance. Sex determination mechanism. Extra chromosomal inheritance.

Unit IV

(12 Hours)

DNA is the genetic material: Griffith's, Avery et al., and Hershy and Chase. RNA as genetic material. Basic knowledge and applications of genomics and proteomics. Genomics: structural and functional genomics. Plant genome (*Arabidopsis* and *Oryza*), animal (*Homo sapiens*). Human Genome Project - objectives and controversies.

Unit V

(12 Hours)

Population genetics: gene frequency, genepool, Hardy–Weinberg equilibrium. Genetic drift, Gene frequencies – conservation and changes. Selection - natural, artificial, ecological.

Books for Study

1. Verma, P. S. & V. K. Agarwal, 2003, Genetics. S. Chand & Co. Ltd., New Delhi.
2. Gupta, P.K. 2018. Genetics. 5th Edition, Rastogi Publications, Meerut.

Books for References

1. Sinnott, EW, Dunn, LL. & Dobzhansky, T. 1997. Principles of Genetics, Tata McGraw Hill, New Delhi.

2. Freifelder, D. 1993. Essentials of Molecular Biology, Jones & Bartlett, Boston.
3. Gardner, EJ, Simmons, MJ. & Snustad, D. 1991. Principles of Genetics, 8th Edn, John Wiley & Sons, New York.

Semester	Course Code	Title of the Course									Hours	Credits
IV	21UBO43CC07	CORE-7: CELL BIOLOGY AND GENETICS									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	2	2	2.3	
CO-2	2	3	2	3	3	2	3	2	2	2	2.4	
CO-3	2	2	3	2	3	3	3	2	3	3	2.7.	
CO-4	3	3	2	1	2	3	2	3	1	2	2.3	
CO-5	2	3	2	2	3	2	3	2	2	3	2.6	
Mean Overall Score											2.5	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43CC08	CORE-8: ECOLOGY AND CLIMATE CHANGE	4	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the fundamentals of ecology	K1
CO-2	acquire know on various ecosystems and their components	K2
CO-3	understand techniques of community studies	K2
CO-4	apply their skill to manage climate change	K3
CO-5	analyse the biogeochemical cycles and their significance	K4

Unit I (12 Hours)

Introduction to ecology and ecosystem. Ecological factors – physical, edaphic, topographic. Biogeochemical cycles - C, N & P. Plant succession: definition, primary and secondary succession, autogenic and allogenic succession, pioneers and climax communities. Mechanism of plant succession - xerosere.

Unit II (12 Hours)

Autecology and Synecology – definition. Population ecology –definition, size, density, age structure, dispersal and growth. Population interactions – negative and positive. Basic idea of biodiversity – species, genetic, ecosystem and habitat diversity.

Unit III (12 Hours)

Sampling techniques in plant community studies – quadrat and transect methods; species area curve – density, frequency, abundance, dominance of populations; importance value index – construction of phytographs. Phytogeographical zones of India.

Unit IV (12 Hours)

Centres of origin and distribution of species. Patterns of plant distribution - continuous and discontinuous. Continental drift - evidences and impact. Endemic distribution, theories on endemism, age and area hypothesis. Ecotone and edge effect.

Unit V (12 Hours)

Carbon emissions, global warming, climate change, carbon credit, carbon sequestration, blue carbon, alternative energy sources and green energy. Climate change conferences and the role of IPCC and UNFCCC. Anthropause effects on Environment during Covid – 19.

Books for Study

Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition

Books for References

Sharma, P.D. 2010. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition

Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
 Trevor Letcher, 2015. Climate Change, 2nd Ed., Elsevier Publishing.
 Jason Smerdon, 2018. Climate Change: The Science of Global Warming and Our Energy Future, Columbia University Press, New York.

Semester	Course Code	Title of the Course									Hours	Credits
IV	21UBO43CC08	CORE-8: ECOLOGY AND CLIMATE CHANGE									4	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	1	2	3	2	3	2	3	2	2.2	
CO-2	2	3	2	2	1	3	2	2	2	2	2.1	
CO-3	2	3	1	3	3	3	2	3	2	2	2.4	
CO-4	2	2	2	2	3	3	2	3	2	2	2.3	
CO-5	2	2	2	2	3	3	2	2	2	2	2.2	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43CP04	LAB COURSE 4 (CELL BIOLOGY, GENETICS, ECOLOGY AND CLIMATE CHANGE)	3	2

Cell Biology and Genetics:

1. Ultra structure of cell organelles.
2. Study of mitosis in root tips
3. Study of meiosis in anthers
4. Inheritance Patterns – Mendelian and modified Mendelian ratios
5. Linkage Mapping.
6. Estimation of allele frequency in natural (random matting) populations.
7. Isolation and display of polytene chromosomes.
8. Extraction of human genomic DNA from saliva.
9. Estimation of DNA (Colorimetric).

Ecology and Climate Change

1. Chemical analysis of water and Soil –Total hardness, Carbonates and Bicarbonates and Dissolved oxygen.
2. Vegetation Analysis: Quadrat, Line transects, Species Density, abundance and richness. Basal area and relative dominance
3. Green auditing
4. Field trip

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43AO04A	ALLIED-II: CHEMISTRY-II (For B.Sc Botany)	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	recognize the chemistry of natural products.	K1
CO-2	discuss the fundamental aspects of pharmaceutical chemistry.	K2
CO-3	understand the chemical kinetics and thermodynamic properties of the reaction.	K2
CO-4	apply the different types of chromatographic techniques to analyze and to identify the components.	K3
CO-5	classify the types of catalyst and their effects on the reactions.	K4

Unit – I Physical Chemistry

(12 Hours)

Chemical Kinetics: rate, order, molecularity of reactions. Zero order and first order reaction, rate constant derivation, examples, Importance of kinetic study, activation energy, activated complex, Arrhenius equation, factors affecting rate of the reactions.

Thermodynamics: terms ΔE , ΔH , ΔS , ΔG , endothermic, exothermic reactions, conditions for spontaneity of reactions. Laws of thermodynamics (I, II, III definition only).

Unit – II Pharmaceutical Chemistry

(12 Hours)

Classification of drugs: Definitions of: drug, pharmacophore, pharmacognony, pharmacy, harmaco kinetics, pharmaco dynamics, pharmacopoeia (IP, BP, USP). Antibiotics: Pencillin, chloramphenicol, (only the structural properties and SAR): Anaesthetics–general and local anaesthetics: Inhalation anaesthetics (N_2O , $CHCl_3$, haloethane, ethylchloride). Intravenous anaesthetics (thiopental sodium); Cardiovascular Drugs: classification and examples: cardiac glycosides, antihypertensive and anti–hypotensive drugs and sulphonamides –isolation of bioactive molecules from plants by soxhlet method.

Unit – III Chemistry of Natural Products

(12 Hours)

Vitamins–type, sources and deficiency disorders of Vitamins A1 retinol, Vitamin B complex(thiamine–B1, riboflavin–B2, cyclocobalamine–B12), Vitamin C, Vitamin D and Vitamin E Alkaloids: occurrence, classification, physical properties and biological functions, uses of coniine, piperine, nicotine, morphine and quinine alkaloids – Terpenoids: classification, isolation, structure, properties and uses of camphor, citral and α -pinene.

Unit – IV Catalysis

(12 Hours)

Types of catalyst–positive catalyst, negative catalyst and catalyst poison. types of catalysis–homogeneous catalysis, heterogeneous catalysis and autocatalysis – general characteristics of catalytic reactions, autocatalysis. Biocatalysis– enzyme catalyst, kinetics of enzyme catalysis, Michaelis – Menton constant, active sites, turn over number, factors affecting enzyme catalysis; concentration of substrate, temperature, pH and inhibitors.

Unit – V Separation and purification techniques

(12 Hours)

Types of Chromatographic Techniques– TLC – Column – HPLC: Principles, instrumentation, sampling and applications of paper, thin layer, column chromatography and electrophoresis– distillation – steam and vacuum distillation – recrystallization.

Books for Study

1. Puri B R, Sharma L R and Pathania M S, *Principles of Physical Chemistry*, 23rd Edition, New Delhi, Shoban Lal Nagin Chand and Co, 1993.

Unit – I Chapter 23 and 27

Unit–IV Chapter 31

2. Jayashree Ghosh, *A Text Book of Pharmaceutical Chemistry*, 3rd Edition, S. Chand and Company Pvt. Ltd., New Delhi, 2012.

Unit – II Chapter 11

3. Subramanian P S, Gopalan R and Rangarajan K, *Elements of Analytical Chemistry*, S. Chand New Delhi, 2003.

Unit – V Chapter 9

Books for Reference

1. Tewari K S and Vishnoi N K, *A Text Book of Organic Chemistry*, 3rd Edition, S. Chand and Company Pvt. Ltd., New Delhi, 2000.
2. Arun Bahl and Bahl B S, *Advanced Organic Chemistry*, 22nd Edition., S. Chand, New Delhi, 2014.

Web Resources

1. <https://www.youtube.com/watch?v=bYwq5oNZmq4>
2. <https://www.slideshare.net/Kamyaparashar/chemical-kinetics-presentation>



Electrophoresis



Chemical Kinetics

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course code	Title of the Course									Hours/ week	Credits
IV	21UBO43AO04A	ALLIED-II: CHEMISTRY-II (For B.Sc Botany)									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	3	2	2	3	3	2	3	2	2	3	2.5	
CO-2	2	2	1	3	2	2	1	2	3	2	2.0	
CO-3	3	1	2	2	3	3	2	1	3	2	2.2	
CO-4	3	3	2	1	2	2	2	3	2	1	2.1	
CO-5	2	1	2	3	2	3	1	2	3	2	2.1	
Mean overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43AO04B	ALLIED-II: BIOMETRICS AND COMPUTER APPLICATIONS- II	4	2

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO-1	match the real life situations with probability concepts	K1
CO-2	describe the concept of test of significance	K2
CO-3	describe the concept of association of attributes	K2
CO-4	compute correlation and regression	K3
CO-5	analyse the nonparametric test	K4

Unit I (12 Hours)

Probability: Normal distribution – Definition – Properties – Areas under normal curve – Interpreting areas as probabilities – Importance of normal distributions. Confidence interval: Confidence interval for means – between two means, variance and proportion.

Unit II (12 Hours)

Testing of hypothesis: Null hypothesis – Two kinds of errors – Testing of hypothesis based on simple mean – difference between mean – Population proportion – Difference between the population proportion – Chi-square test – Goodness of fit – Test for independence – F-test: Equality of variances.

Unit III (12 Hours)

Correlation and regression: Correlation: Types of correlation – Scatter diagram – Pearson's coefficient of correlation – Rank correlation. Simple regression: Meaning of regression lines – Regression equations y on x and x on y only – Regression coefficient – Simple problems.

Unit IV (12 Hours)

Theory of attributes: Introduction – Notations – Dichotomy – Classes and class frequencies – Consistency of data – Criteria of independence – Yule's coefficient of association – Coefficient of colligation.

Unit V (12 Hours)

Non –Parametric tests: Introduction –Advantages - Sign test- Mann Whitney U test – One sample runs test –Kruskal – Wallis test and Run test for randomness.

Books for Study

1. Gupta S.P, Statistical Methods, Sultan Chand & Sons, New Delhi, 43rd Edition 2014

Unit 1 *Volume II Chapter 2*

Unit 2 *Volume II Chapter 3,*

Unit 3 *Volume I Chapter 10*

Unit 4 *Volume I Chapter 12*

Unit 5 *Volume II Chapter 11*

Books for Reference

1. Nageswara Rao G.: Statistics for Agricultural Science, BS Publications, Third Edition, 2018

2. Olive Jean Dunn & Virginia A Clark: Basic Statistics: A primer for the Biomedical Sciences,

A John Wiley & Sons, Inc., Publications, Fourth Edition, 2009.

Semester	Course Code	Title of the Course									Hours	Credit
IV	21UBO43AO04B	ALLIED-II: BIOMETRICS AND COMPUTER APPLICATIONS-II									4	2
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	2	3	2	2	3	3	2	2	3	2	2.4	
CO-2	3	2	2	3	3	3	2	1	2	3	2.4	
CO-3	2	3	2	3	3	3	2	3	2	3	2.6	
CO-4	3	3	2	2	3	3	1	3	3	2	2.5	
CO-5	3	3	3	3	2	3	3	2	2	3	2.7	
Mean Overall Score											2.52 (High)	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43AP04A	ALLIED-II: CHEMISTRY PRACTICALS (For B.Sc Botany)	2	2

CO No.	CO-Statement	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	know about the handling of chemicals and safety measures in the laboratory.	K1
CO-2	estimate the principle of volumetric analysis and various types of titration.	K2
CO-3	illustrate the theoretical aspects of organic analysis.	K2
CO-4	detect various elements present in the organic compounds.	K3
CO-5	demonstrate various techniques of volumetric analysis.	K4

Unit – I Safety Rules in the Laboratory (4 Hours)

Introduction – personal protection – nature of chemicals – toxic– corrosive–explosive– inflammable, carcinogenic–other hazardous chemicals– philosophy of lab safety – first–aid techniques – general work culture inside the chemistry lab – handling of chemicals and apparatus in the laboratory: storage and handling of chemicals – disposal of chemical wastes – glassware – handling of glassware – handling of different types of laboratory equipment’s like bunsen burner–centrifuge– Kipp’s apparatus.

Unit – II Volumetric Analysis (3 Hours)

Volumetric analysis – principle – standard solutions – normality and molarity – principles of titrations– primary standard and secondary standard solutions– acid–base titration– redox titration–complexometric titration– precipitation titration and example of each with indicators used.

Unit – III Theory of Organic Qualitative Analysis (3 Hours)

Qualitative analysis of organic substances: solubility test in NaHCO_3 – NaOH and HCl – test for saturation and unsaturation– aliphatic and aromatic– acidic– basic and neutral nature– elements test for N, S and halogens.

Unit –IV Volumetric Analysis (25 Hours)

1. Estimation of HCl (Std. oxalic acid x NaOH x HCl).
2. Estimation of NaOH (Std. Na_2CO_3 x HCl x NaOH).
3. Estimation of oxalic acid (Std. FAS x KMnO_4 x oxalic acid).
4. Estimation of FAS (Std. oxalic acid x KMnO_4 x FAS).
5. Estimation of KMnO_4 (Std. $\text{K}_2\text{Cr}_2\text{O}_7$ x FAS x KMnO_4).
6. Estimation of $\text{K}_2\text{Cr}_2\text{O}_7$ by Thio solution.
7. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution.
8. Estimation of zinc (EDTA titration).

9. Estimation of magnesium (EDTA titration).
10. Estimation of hardness of water (EDTA titration).

Unit– V Organic Analysis

(25 Hours)

1. Identification of acidic, basic, phenolic and neutral organic substances.
2. Test for aliphatic and aromatic nature.
3. Test for saturation and unsaturation.
4. Preparation of sodium fusion extract.
5. Detection of N, S, and Cl.

Books for Study

1. Puri B R, Sharma L R and Kalia K K, *Principles of Inorganic Chemistry*, 23rd Edition, Shoban Lal, Nagin Chand and Co, New Delhi, 1993.

Unit–II Chapter 41

2. Gnanapragasam N S and Ramamurthy G, *Organic Chemistry Lab Manual*, 2nd Edition, S. Viswanathan Printers and Publishers (P) Ltd., Chennai, 2007.

Unit–III Part A

3. *Allied Practical Manual*, Department of Chemistry, St. Joseph's College, Tiruchirappalli, 2021. (Private circulation).

Books for Reference

1. Venkateswaran V, Veeraswamy R and Kulandaivelu A R, *Basic Principles of Practical Chemistry*, 2nd Edition, Sultan Chand and Sons, New Delhi, 1997.
2. Furniss B S, *Vogel's Textbook of Practical Organic Chemistry*, 7th Edition, ELBS Longman, London, 1984.

Web Resource

1. <https://www.youtube.com/watch?v=FUo428guKt0>
2. https://www.youtube.com/watch?v=G6_OEa1BjA



Detection of Elements



Acid– Base Titration

Note:

1. Mono–functional compounds are given for organic analysis.
2. Each student is expected to practice the analysis of at least 10 different organic substances.

3. Apart from the TWO CIA tests, one MODEL TEST comprising both volumetric and organic analysis is to be conducted to enable the students ready for semester examination.

Scheme of Valuation

ALLIED-II: CHEMISTRY PRACTICALS

(For B.Sc Botany)

Continuous Internal Assessment (100 marks)

- | | |
|-------------------------------|--|
| 1. Regular Practical Sessions | 50 (Based on his observation and record notes) |
| 2. CIA I + CIA II tests | 50 (conducted for 100 marks each and converted to 25 each) |

Scheme for CIA tests I and II (100 mark each)

I. Analysis 40 marks

- | | |
|--------------------------------------|----------|
| 1. Acid/base/neutral | 5 marks |
| 2. Aliphatic/aromatic | 10 marks |
| 3. Saturated/unsaturated | 10 marks |
| 4. Elements test | |
| a) Test for N present/absent | 5 marks |
| b) Tests for S present/absent | 5 marks |
| c) Tests for halogens present/absent | 5 marks |

II. Volumetric analysis 50 marks

- | | |
|---------------|----------|
| Error upto 2% | 50 marks |
| 1.1–3.0 % | 45 marks |
| 3.1–4.0 % | 40 marks |
| >4.0 % | 20 marks |

III. Observation and Record note–book 10 marks

Scheme for Semester examination 100 marks

I. Analysis 40 marks

- | | |
|--------------------------------------|----------|
| 1. Acid/base/neutral | 5 marks |
| 2. Aliphatic/aromatic | 5 marks |
| 3. Saturated/unsaturated | 5 marks |
| 4. Tests for elements | |
| a) Test for N present/absent | 5 marks |
| c) Tests for S present/absent | 5 marks |
| d) Tests for halogens present/absent | 5 marks |
| 3. Correct procedure | 10 marks |

II. Volumetric analysis 50 marks

- | | |
|---------------|----------|
| Error upto 2% | 50 marks |
| 2.1–3.0 % | 45 marks |
| 3.1–4.0 % | 40 marks |
| 5.0 % | 30 marks |
| >5.0% | 20 marks |

III. Theory behind practical

10 marks

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO43AP04B	ALLIED-II: LAB COURSE-II (BIOMETRICS AND COMPUTER APPLICATIONS II)	2	2

CO No.	CO– Statements	Cognitive Levels (K-Levels)
	On successful completion of this course, students will be able to	
CO-1	acquire the knowledge of basic statistical test	K1
CO-2	understand the t-test, F-test and -test	K2
CO-3	compute correlation and rank correlation	K3
CO-4	utilize statistical hypothesis testing to draw inferences	K3
CO-5	analyse non- parametric test	K4

Using the SPSS software the students are asked to solve the following exercises:

1. Finding Mean and Variance.
2. Finding correlation coefficient, Rank Correlation.
3. T- test
4. F-test
5. Chi-square test
6. Non-parametric tests.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Course Code	Title of the Course									Hours	Credit
IV	21UBO43AP04B	Allied: LAB COURSE 2 (Biometrics and Computer Applications II)									2	2
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5		
CO-1	2	1	2	3	2	1	2	2	3	2	2	
CO-2	3	2	3	2	3	2	2	3	1	2	2.3	
CO-3	2	2	3	2	2	3	3	2	1	3	2.3	
CO-4	3	2	2	2	3	1	2	3	1	3	2.2	
CO-5	1	3	2	2	1	3	2	1	3	2	2	
Mean Overall Score											2.16 (High)	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UBO44SE02	SEC-2 (BS): MUSHROOM TECHNOLOGY	2	1

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	identify various cultivable species of mushrooms.	K1, K2
CO-2	design various recipes from mushrooms.	K3
CO-3	assess preservation and storage of mushrooms.	K4
CO-4	evaluate and explore the economic viability of mushrooms.	K5
CO-5	prepare the culture techniques of edible mushrooms.	K6

Unit I

Introduction - Classification - Edible and Poisonous. Tests for identification - Nutritive value of mushrooms.

Unit II

Characteristics of common edible mushrooms Paddy straw, Oyster and milky mushrooms. Life cycle of a common mushroom (Agaricus).

Unit III

Culture Techniques – Preparation of spawn, preparation of compost. Spawn running – Harvesting and Marketing.

Unit IV

Preservation and storage of mushrooms – Diseases and pests of mushrooms.

Unit V

Delicious recipes of mushroom – Economic importance of mushrooms.

Book

1. Nita Bahl (1984). Handbook on Mushrooms, Oxford and IBH Publishing Company

Reference

1. Dubey, RC. (2001) A Textbook of Biotechnology, S. Chand & Co. Ltd.

Semester	Course Code	Title of the Course									Hours	Credits
IV	21UBO44SE02	SEC-2 (BS): MUSHROOM TECHNOLOGY									2	1
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	1	2	3	2	2	3	2.3	
CO-2	2	2	3	1	2	2	2	2	3	2	2.1	
CO-3	1	3	3	2	3	1	2	3	2	3	2.3	
CO-4	2	3	2	2	1	2	3	1	2	3	2.2	
CO-5	1	3	3	2	1	2	3	2	1	3	2.1	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHE44VE04A	PROFESSIONAL ETHICS–II: SOCIAL ETHICS - II	2	1

CO No.	CO-Statements	Cognitive Level
	On completion of this course the graduates will be able to:	
CO-1	know the value of natural resources and to live in a harmony with nature.	K1
CO-2	comprehend the importance of a healthy life.	K2
CO-3	apply the plans of disaster management in the society.	K3
CO-4	analyse the importance and differences of science and religion.	K3
CO-5	apply counseling skills and solve their problems.	K4

Unit-I Harmony with Nature

(6-Hours)

What is environment, Why should we think of harmony, Principles to conserve environmental resources, Causes of disharmony, The fruits of harmony with nature, Natural Resources, Fruits of disharmony, Economic values and growth, Environmental Ethics, Guidelines to live in harmony with nature, Towards life-centered system for better quality of life. Harmony with animal kingdom.

Unit-II Issues Dealing with Science and Religion (6-Hours)

What is Science, Science and Religion, Social Relevance of Science and Technology, Science and technology for social justice, Difference caused by Science and Technology, Need for indigenous technology, Science and Technology Innovation Policy of India.

Unit-III Public Health (6-Hours)

Health related issues, Health Care in India vs Developed Countries, Health and Heredity, Public Health - Objectives of public health in India, Public Health System in India, Failure on the public health front, Role of the central government, Hospitals Services in India, Health and Abortion, Drug Addiction and Drug abuse

Unit-IV Disaster Management (6-Hours)

Disaster Management, Types of disaster, Plans of disaster management, Technology to manage natural disasters and catastrophes, Rehabilitation and Reconstruction, Human-induced disaster, First Aid, The importance of First-aid.

Unit-V Counselling for Adolescents (6-Hours)

High Risk Behaviours, Developmental Changes in Adolescents, Key Issues of the Adolescents, Need for Counselling, Nature of Counselling, Counselling Goals, Does helping help? The Good and the Bad news. Importance of Career Guidance Counselling.

Books for Study:

1. Department of Human Excellence, *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappali 02, 2021.

Books for Reference:

1. Albert, D. and Steinberg, L, *Judgment and decision making in adolescence*: Journal of Research on Adolescence, page no: 211-224. 2011
2. Larry R. Collins, *Disaster Management and Preparedness*, Lewis Publications, 22 November 2000.
3. Elizabeth B. Hurlock, *Developmental Psychology: A: Life-Span Approach*, New Delhi: Tata McGraw-Hill, 1981, 5th Edition, August 18, 2001.
4. Sangha, Kamaljit. *Ways to Live in Harmony with Nature: Living Sustainably and Working with Passion*. Australia, Woodslane Pty Limited, 2015.

Web Sources:

https://en.wikipedia.org/wiki/Disaster_management_in_India

<https://ndma.gov.in/>

<https://talkitover.in/services/child-adolescent-counselling/>

<https://www.nipccd.nic.in/schemes/adolescent-guidance-centre-19#gsc.tab=0>

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHE44VE04B	PROFESSIONAL ETHICS II: RELIGIOUS DOCTRINE - II	2	1

CO.No.	CO-Statements	Cognitive Level
	On completion of this course, the graduates will be able to:	
CO-1	Understand the history of the Catholic Church	K1
CO-2	Examine and grasp the Sacraments of the Catholic Church	K2
CO-3	Apply the Christian Prayer to their everyday life	K3
CO-4	Analyze themselves in the light of Sacraments & Christian Prayer	K4
CO-5	Create a harmonious society learning values from all religions	K5 & K6

Unit-I	The Catholic Church	(6 Hours)
Unit-II	Sacraments of Initiation	(6 Hours)
Unit-III	Sacraments of Healing & at the Service of Community	(6 Hours)
Unit-IV	Christian Prayer	(6 Hours)
Unit-V	Harmony of Religions	(6 Hours)

Books for Text

Department of Human Excellence, *Life in the Lord: Religious Doctrine*. St. Joseph's College, Trichirappalli 02, 2021.

Books for Reference:

1. *Compendium: Catechism of the Catholic Church*. Bengaluru: Theological Publications in India, 1994.
2. Holy Bible (NRSV).

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53CC09	CORE-9: BIOPHYSICS AND BIOSTATISTICS	5	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the field of biophysics with reference to bioenergetics	K1
CO-2	understand the principles of statistics and know the method of calculation	K2
CO-3	learn to apply physical principles to biological systems	K3
CO-4	apply the statistical principles to solve the biological problems	K3
CO-5	analyse the measures of central value and standard deviation	K4

Unit I (15 Hours)

Biophysics: Photobiology - electromagnetic spectrum, visible range of spectrum, solar energy and photosynthesis. Influence of light on Phytochrome and its effect on root growth. Phototropin, its significance in plant growth. Fluorescence. Bioluminescence. Phosphorescence.

Unit II (15 Hours)

Bioenergetics - energy and work. Laws of thermodynamics – concept of entropy and enthalpy. Gibbs's free energy – energy transduction in biological systems. High-energy compounds – ATP bioenergetics and energy coupled reactions. Radioactivity - structure of an atom, isotopes, types of radiations, application of radioactive isotopes in biological studies, detection of radiation, autoradiography.

Unit III (15 Hours)

Biostatistics: Data - primary & secondary; variable - discrete & continuous. Population and sample, sampling techniques, classification of data, frequency distribution - discrete, continuous and cumulative; parts of a statistical table – advantages of classification of data. Presentation of data - histogram, frequency polygon, frequency curve, Ogive curve, bar charts - simple, multiple, subdivided, pie diagram.

Unit IV (15 Hours)

Measures of central values: mean, median, mode. Measures of dispersion: range, mean deviation, standard deviation, coefficient of variation – Skewness. Correlation - definition – types – methods of studying correlation: scatter diagram method and Karl Pearson's coefficient of correlation for simple and linear data. Regression: definition – regression lines.

Unit V (15 Hours)

Probability - definition, binomial, poisson and normal distributions. Tests of significance. General procedure – large sample testing & small sample testing: t-Test, Chi-square test and F test.

Books for Study

1. Cleri Fabrizio. 2016. The physics of living systems. Springer International Publishing.

Books for References

1. Mishra, S. R. 2010. Textbook of Photobiology. Discovery Publishing Pvt. Ltd. New Delhi.

2. S.P. Gupta, 2008. Elementary Statistical Methods, Sultan Chand & Sons, New Delhi

Semester	Course Code	Title of the Course									Hours	Credits
V	21UBO53CC09	CORE-9: BIOPHYSICS AND BIOSTATISTICS									5	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	2	2	2	3	2	2	1	2	2.2	
CO-2	2	3	1	2	3	3	2	2	2	2	2.2	
CO-3	2	3	1	2	2	2	2	2	1	2	1.9	
CO-4	2	2	2	2	1	2	2	2	1	2	1.8	
CO-5	2	2	1	3	3	2	3	2	2	2	2.3	
Mean Overall Score											2.1	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53CC10	CORE-10: MICROBIOLOGY AND IMMUNOLOGY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the various types of microbes in an environment and their importance.	K1
CO-2	comprehend the structure and function of immune system in humans.	K2
CO-3	demonstrate the role of microorganisms in food processing and spoilage, soil fertility and sewage disposal	K3
CO-4	identify the defense mechanism against infection in humans.	K4
CO-5	assess role of microorganisms in industrial processing of microbial products	K5

Unit I (15 Hours)

Microbiology: History, Development and Classification (Outline). Whittaker's five kingdom concept, Bergey's Manual of Systematic Bacteriology (outline). Morphology, cell structure, cell wall chemistry, growth, nutrition and reproduction of bacteria. Viruses: structure, classification and reproduction - lytic and lysogenic cycle. A brief account on Rickettsias, Chlamydia, Mycoplasmas, Viroids and Prions.

Unit II (15 Hours)

Culture of microorganisms: Pure cultures, batch and continuous cultures. Methods of Preservation of microorganisms. Microorganisms and Human diseases: Food borne (Botulism), water borne (Cholera), air borne (Tuberculosis), vector borne (malaria) and contact diseases (AIDS) and SARS. Control of microorganisms – physical, chemical and biological methods.

Unit III (15 Hours)

Soil Microbes and Their Roles, Improvements in Soil Fertility, Nitrogen Fixing Bacteria and Their Role in Nitrogen Cycle, Phosphate Solubilization. Mycorrhizae. Plant-Microbes Interactions: Ectomycorrhizae and Endomycorrhizae. Food microbiology: Types of food spoilage and methods of food preservation. Dairy microbiology: Fermented dairy products. Industrial microbiology: Fermentation and Industrial production of alcohol and antibiotics.

Unit IV (15 Hours)

Immunology: Immune system - adaptive, innate, humoral and cellular immunity. Origin, structure and immunological role of primary lymphoid organs (bone marrow and thymus) and Secondary lymphoid organs (Spleen, lymph nodes, Payer's patches, tonsils and appendix).

Unit V (15 Hours)

Origin and role of immune cells (Leucocytes and lymphocytes). Lymph: composition and functions. Antibody types, study of IgG, its structure and immunological role. Virus encounter human system.

Books for Study

1. Pelczar J Chan ECS and Krieg, R. 1999. Microbiology, Tata McGraw Hill, New Delhi.
2. Sullia SB and Shantharam S 2005. General microbiology. Oxford & IBH

Books for References

1. Dubey RC and Maheshwari DK. 2004. A text book of microbiology.S.Chand New Delhi.
2. Casida LE, 2005. Industrial Microbiology.New Age International.

Semester	Course Code	Title of the Course									Hours	Credits
V	21UBO53CC10	CORE-10: MICROBIOLOGY AND IMMUNOLOGY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	2	2	2.3	
CO-2	2	3	2	2	1	2	3	2	2	2	2.1	
CO-3	2	2	3	2	2	3	3	2	3	1	2.3	
CO-4	3	3	2	1	1	3	2	2	1	2	2.1	
CO-5	2	3	2	2	3	1	3	2	1	3	2.4	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53CP05	LAB COURSE 5 (BIOPHYSICS, BIOSTATISTICS, MICROBIOLOGY AND IMMUNOLOGY)	4	3

Biophysics

1. Separation of cell and tissue components by centrifugation
2. Separation of pigments by Paper chromatography
3. Absorption spectrum of macromolecules and pigments – UV, FTIR

Biostatistics

1. Sampling by Random Number Table
2. Data Collection
3. Classification of Data: Discrete, continuous and cumulative.
4. Statistical diagrams: Histogram, Frequency curve, Bar chart and Ogive curve
5. Measures of Central Values: Mean, Median and Mode
6. Measures of Dispersion: Range, Mean Deviation and Standard Deviation.

Microbiology

1. Preparation of common media (Nutrient agar & Potato dextrose agar).
2. Staining of Bacteria (Simple & Grams staining).
3. Isolation and enumeration of microbes in soil and water (serial dilution).
4. Study of motility by Hanging Drop.
5. Pure cultures of bacteria – Streak plate, Pour plate and Spread plate.
6. Microbiology of milk (Phosphatase and MBRT)
7. Antibiosis - Kirby Baur method

Immunology

1. Blood grouping
2. WIDAL- test for typhoid
3. RPR- test for syphilis
4. RF- test for rheumatoid arthritis
5. Immunoelectrophoresis – Demo
6. ELISA – Demo

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53ES01A	DSE-1: MOLECULAR BIOLOGY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the structural, organization and function of prokaryotic and eukaryotic genome.	K1
CO-2	acquire knowledge on mechanism and influences on genetic code and its perpetuation.	K1
CO-3	comprehend the basic cellular and molecular events.	K2
CO-4	apply the knowledge acquired to study the molecular mechanisms.	K3
CO-5	analyse the principles of gene regulation.	K4

Unit I (15 Hours)

Organisation of genome – prokaryotic and eukaryotic. Linear and circular DNA molecules. Mutations – types, causes and detection. Mutant types – lethal, conditional, biochemical, germinal vs somatic mutants, insertional mutagenesis. Basic idea about mobile genetic elements - IS elements and transposons.

Unit II (15 Hours)

DNA replication: General features, enzymology, detailed mechanism (initiation, elongation and termination). DNA damage: damages caused by alkylation, UV, gamma and X-rays. DNA repair: excision, double-strand break, mismatch and SOS mechanisms.

Unit III (15 Hours)

Transcription: The Central Dogma, Genetic code, RNA polymerase, promoters, enhancers, silencers, general transcription factors and the mechanism of transcription (initiation, elongation and termination) in prokaryotes and eukaryotes. Post-transcriptional events (splicing, capping and polyadenylation).

Unit IV (15 Hours)

Translation: Organization of mRNA, genetic code and its characterization, ribosome and rRNA, amino acyl synthetase, tRNA and amino acid activation. Mechanism of initiation elongation and termination. Translation factors, post-translation processing.

Unit V (15 Hours)

Gene regulation: Basic principles of transcriptional regulation- positive and negative; inducible and repressible; activators and repressors. The lac operon (positive and negative control), the trp operon (repression-derepression and attenuation), riboswitches, mRNA stability, RNA interference, microRNAs.

Books for Study

1. Freifelder, D.1993. Essentials of Molecular Biology, Jones & Bartlett, Boston.
2. Gupta PK 2005. Molecular Biology and Genetic Engineering, Rastogi Publications, Meerut.

Books for References

1. De Robertis & De Robertis. 1990. Cell and Molecular Biology, Saunders College, Philadelphia, USA.
2. Elliott WH & Elliott DC. 2005. Biochemistry and Molecular Biology, 3rd Ed. Oxford University, Oxford.

Semester	Course Code	Title of the Course									Hours	Credits
V	21UBO53ES01A	DSE-1: MOLECULAR BIOLOGY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	1	2	3	1	2	3	3	2.2	
CO-3	2	2	2	3	1	2	2	3	2	2	2.1	
CO-4	3	2	2	1	3	3	1	3	2	3	2.4	
CO-5	2	3	2	3	1	3	2	3	2	1	2.2	
Mean Overall Score											2.3	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53ES01B	DSE-1: BIOINFORMATICS AND BIONANOTECHNOLOGY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	study the basic elements of interface, concepts between biology and nanotechnology.	K1
CO-2	outline the basics of sequence alignment and analysis.	K2
CO-3	classify different types of biological databases.	K3
CO-4	explain the synthesis approaches for nanomaterial and its characterization.	K4
CO-5	construct various types of nanomaterial for application and evaluate the impact on environment.	K5, K6

Unit I (15 Hours)

Bioinformatics: Introduction, Aim, Scope and Research areas of Bioinformatics. Branches of Bioinformatics. Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System - NCBI, PUBMED, EBI, EMBL, gene bank etc.

Unit II (15 Hours)

Database searches for homology using BLAST and FASTA and interpretation of the results to derive biological significance of the queried DNA/protein sequences. Alignment of protein and DNA sequences using algorithm software to deduce homology and interpretation of data.

Unit III (15 Hours)

Nanotechnology: Origin, scope and importance. Nanoparticles – definition. Principles: quantization effects - inverse relationship between size and reactive surface area. Properties: surface effects, the effects of size, shape, surface and bulk composition, and solubility and persistence.

Unit IV (15 Hours)

Essentials of nanostructure generation: top-down vs. bottom-up. Chemical and physical self assembly. Physical, chemical and biogenic synthesis of nanomaterials – biomimetics, green plants, and microorganisms. Role of biomolecules - reducing and/or capping agents: proteins, viruses and carbohydrates, Preparation and characterization of nanoparticles (UV, FTIR, SEM, DLS and zeta potential, X-ray diffraction).

Unit V (15 Hours)

Targeted nanoparticles: active and passive targeting. Application: medicine, manufacturing & materials, delivery vehicles, cancer therapy, tissue engineering, fluorescent biological labels, biological assays, nano-imaging, biosensors, micromanipulation techniques, metabolic engineering and gene therapy, environmental management; nanotechnology in agriculture; Interactions of nanoparticles, uptake, transport and toxicity.

Books for Study

1. Sharon, M. & Sharon, M 2012. Bio-Nanotechnology - Concepts and Applications, CRC Press.
2. Rastogi, S.C., Mediratta, N. and Rastogi. P. (2004). Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice Hall of India, Pvt. Ltd., New Delhi.

Books for References

1. Attwood, T. K. and Parry-Smith, D. J. (2001). Introduction to Bioinformatics Delhi. Pearson Education (Singapore) Ptd. Ltd.
2. Jain K.K. Nanobiotechnology molecular diagnostics: Current techniques and application (Horizon Bioscience) 2006 Taylor & Francis 1st edition.
3. Volker Mailander and Katharina Landfester 2009 Interaction of nanoparticles with cells. *Biomacromolecules*, 10 (9): 2379 – 2400. DOI:10.1021/bm900266r.

Online Resources

- 1) <http://ieet.org/index.php/IEET/more/bionanotechnology20141007> Institute of Ethics & Emerging Technologies
- 2) <https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html>
- 3) <http://www.particle-works.com/applications/controlled-drug-release/Applications>
- 4) <https://jnanobiotechnology.biomedcentral.com/articles/10.1186/1477-3155-2-3> DOI: 10.1186/1477-3155-2-3
- 5) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3865110/>
- 6) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419715/>

Semester	Course Code	Title of the Course									Hours	Credits
V	21UBO53ES01B	DSE-1: BIOINFORMATICS AND BIONANOTECHNOLOGY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	3	2	1	2	2	3	2	1	2	2.1	
CO-2	2	3	2	2	2	2	3	2	2	3	2.3	
CO-3	2	2	3	2	1	2	2	3	2	2	2.1	
CO-4	1	2	2	3	2	2	3	2	3	2	2.2	
CO-5	1	2	2	3	2	2	3	2	1	3	2.1	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53ES02A	DSE-2: RESEARCH METHODOLOGY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	obtain knowledge on basic concepts in research.	K1
CO-2	understand the objective of research.	K2
CO-3	evaluate the significance of databases and citation index.	K3
CO-4	plan basic research and the research process.	K4
CO-5	acquire skill in writing research articles and formatting the papers.	K5

Unit I (15 Hours)

Foundations of Research: Meaning, Objectives, Motivation, Utility. Characteristics of scientific method. Understanding the language of research – Concept, Construct, Definition, Variable. Research Process.

Unit II (15 Hours)

Structure of thesis and research article. Literature collection: Books, Research articles and e-resources. Manuscript for publication and proof correction. Structure and components of research proposal, National and International funding sources.

Unit III (15 Hours)

Bibliometrics: definition and relevance; Bibliometrics databases, h-index, SNIP, Page Rank, Impact Factor and evaluation. The use of bibliometrics in research: Citation Research, Science Citation Index. Plagiarism, Tailored Research and Retraction. Indian Patent Act.

Unit IV (15 Hours)

Research Design: Concept and Importance in Research. Features of a good research design. Experimental Design: Concept of Independent and group research.

Unit V (15 Hours)

Interpretation of Data and Paper Writing, Layout of a Research Paper, Journals in Life Science, Impact factor of Journals, Ethical issues related to publishing.

Books for Study

1. Kothari, C. R. 2014. Research Methodology-Methods & Techniques. WishwaPrakashan
2. Misra, R. P, 2000. Research Methodology - A Handbook, Concept Pub. Company, New Delhi.
3. Pillai and Bagavathi, 2008 Statistics, S. Chand& Company Ltd, New Delhi

Books for Reference

1. Gupta, SP. 1990. Statistical Methods, Sultan Chand & Sons, New Delhi.
2. NageswaraRao, G. 1983. Statistics for Agricultural Science Oxford & IBH, New Delhi
3. Gupta, SC. 2013. Fundamentals of statistics, Himalaya Publishers, Mumbai.

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53ES02A	DSE-2: RESEARCH METHODOLOGY	5	3

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	2	3	2	2	3	2	2.4
CO-2	2	3	2	3	2	2	3	2	2	1	2.2
CO-3	2	2	3	2	1	3	3	2	3	1	2.2
CO-4	3	3	2	3	1	3	3	2	3	1	2.4
CO-5	2	2	2	2	1	2	2	2	2	1	1.8
Mean Overall Score											2.2
Result											High

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53ES02B	DSE-2: BIOPESTICIDES	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	study the importance of appropriate control measures for managing insect pests in crops.	K1
CO-2	acquire knowledge on present use of biopesticides as part of integrated pest management.	K2
CO-3	illustrate the mass production techniques of microbial biopesticides.	K3
CO-4	analyze how to use the variable biopesticide methods for managing different kinds of pests.	K4
CO-5	design various types of biopesticide formulations.	K5

Unit I (15 Hours)

Biological control of insect pests: scope and principles, factors affecting biological control. Biopesticides: introduction, importance and classification– living creatures to control pests – weeds for controlling pest. Pest Control in Organic Farming. Application methods of biopesticides.

Unit II (15 Hours)

Botanical pesticides: present status and future prospects; opportunities for botanical pesticides in crop rotation; multiple cropping for controlling pests, Trap Crops. Plants as a source of natural pesticides: Neem, Chrysanthemum, Pongamia, Garlic, Turmeric, Tobacco and Citronella.

Unit III (15 Hours)

Biocontrol agents: Isolation, identification, mode of action and mass production of *Pseudomonas fluorescens* (bacterial agent), *Trichoderma viride* (fungal agent).

Unit IV (15 Hours)

Biological pesticides: isolation, identification. Bacterium as biopesticide (*Bacillus thuringiensis*) - production and field applications. Fungus as biopesticide (*Entomophaga* - *Beauveria bassiana*). Insect as biopesticide (Reduviid predators - *Rhynocoris kumarii*, *R. fuscipes*, *R. marginatus*). *Trichogramma*. Virus as biopesticide (Baculovirus - NPV). Virulence, pathogenicity and symptoms of entomopathogenic nematodes.

Unit V (15 Hours)

Production methods of biopesticides: liquid culture fermentation and solidstate fermentation – Types of biopesticide formulations: dry inoculum, granules, pellets, capsules, wettable powder and liquid formulations. Impediments and limitation in production and use of biopesticide.

Books for Study

1. Ghosh GK, 2000, Biopesticide and Integrated pest Management, A P H Publishing Corporation, New Delhi.
2. Bhattacharyya P. and Purohit SS, 2008. Organic Farming: Biocontrol and Biopesticide Technology, Agro House, Jodhpur, Rajasthan. ISBN: 978-81-7754-369-8.
3. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing.

Books for References

1. Krishna Chandra, Greep and Srivathsa, 2005, Bio Control Agents & Biopesticides,
2. D. Dent, 2000, Insect Pest Management 2nd Ed, ABI Publishers, UK

Semester	Course Code:	Title of the Course									Hours	Credits
V	21UBO53ES02B	DSE-2: BIOPESTICIDES									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	3	2	2	2	2	2	3	2	2.2	
CO-2	2	3	2	1	2	2	3	2	2	3	2.2	
CO-3	2	2	3	2	1	2	3	2	2	2	2.1	
CO-4	1	2	2	2	2	2	3	2	3	2	2.1	
CO-5	1	2	2	3	2	2	3	2	1	3	2.1	
Mean Overall Score											2.14	
Result											High	

Semester	Course Code:	Title of the Course	Hours	Credits
V	21UBO53SP01	SELF PACED LEARNING: ECONOMIC BOTANY	-	2

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	learn the origin and history of various crop plants.	K1
CO-2	understand the cultivation of various economically important crops.	K2
CO-3	acquire knowledge on the binomial nomenclature and morphology of economic crops.	K3
CO-4	acquire the skill for preparation plant-based products.	K4
CO-5	produce beverages and narcotics from specific plants.	K5

Unit I: Cereals and Legumes (15 Hours)

Origin and History, Botanical description, Cultivation, Harvesting and uses of Cereals and Legumes: Wheat, Rice, Maize, Black gram, Redgram, Chick pea and Pigeon pea.

Unit II: Vegetables and Fruits (15 Hours)

Origin and History, Botanical description and economic importance of Vegetables and Fruits: Apple, Banana, Mango, Brinjal, Tomato and Potato.

Unit III: Spices and Condiments (15 Hours)

Origin and History, Botanical description, Cultivation and uses of Spices and Condiments: Pepper, Cardamom, Clove, Chilly, Coriander and Turmeric.

Unit IV: Beverages Plants, Fibres and Timber (15 Hours)

Origin and History, Botanical description, Cultivation, Processing and uses of Beverages plants: Tea, Coffee and Cocoa. Fibers and Timber: Cotton and Jute, Teak, Rosewood, and Mahogany.

Unit V: Oil Yielding Plants (15 Hours)

Origin and History, Botanical description, Harvesting, Extraction and uses of Fatty oils and Vegetable Fats: Sun flower, Soya bean, Coconut and Gingelly. Medicinal Plants: Rauwolfia, Chinchona and Digitalis.

Books for Study

1. Kochhar, SL. 2012. Economic Botany in Tropics. MacMillan & Co. New Delhi, India.
2. Panday, BP. 2000. Economic Botany. S Chand Publishing Company. New Delhi. India

Books for References

1. Wickens, GE. 2001. Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
2. Chrispeels, MJ. And Sadava, DE. 2003. Plants, Genes and Agriculture. Jones & Bartlett Publish

Semester	Course Code:	Title of the Course									Hours	Credits
V	21UBO53SP01	SELF PACED LEARNING: ECONOMIC BOTANY									-	2
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	1	2	3	1	2	3	3	2.2	
CO-3	2	2	2	3	1	2	2	3	2	2	2.1	
CO-4	3	2	2	1	3	3	1	3	2	3	2.4	
CO-5	2	3	2	3	1	3	2	3	2	1	2.2	
Mean Overall Score											2.3	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
V	21UBO53EG01	GENERIC ELECTIVE-1: LANDSCAPE DESIGNING	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	know about the brief history, divisions, classification and structure of horticultural plants.	K1, K2
CO-2	acquire knowledge on plant growth processes and stages of plant growth.	K3
CO-3	develop practical skills in micro propagation techniques.	K4
CO-4	apply techniques of flower decoration and importance of economic cultivation crops as self-employment.	K5
CO-5	design propagation methods and propagation through various specialized underground structures.	K6

Unit I

(12 Hours)

Importance of scope of horticulture – Divisions of horticulture famous gardens in world & India; Tools & Implements used in horticulture. Vegetative Propagation: Cutting, Layering, Grafting and Budding, advantages and disadvantages of vegetative propagation.

Unit II

(12 Hours)

Nursery: definition, objectives and scope, Preparation of Nursery beds. Transplantation – steps and Methods. Bonsai – Training, Terrarium, Mulching and Topiary techniques. Lawn making and maintenance, water garden, glass house, rockery, hanging baskets. Parks: components, types. Xeriscaping.

Unit III

(12 Hours)

Gardening; definition, objectives and scope. Designing outdoor garden – hedges, edges, fences, terrace garden/roof garden, Fruit garden, Vegetable garden: Tomato, brinjal, and snake guard, Medicinal plant: Layout model outdoor college garden. Designing Indoor gardening – Foliage plants, flowering plants. Layout model indoor kitchen garden.

Unit IV

(12 Hours)

Horticultural Crops - Conservation and Management. Varieties and cultivars of various horticultural crops. IPR issues. National, International and Professional Societies. Sources of Information on Horticulture. Post-Harvest Management of Horticultural Crops. Field Visit; Horticultural Department.

Unit V

(12 Hours)

Floriculture: Cultivation of commercial flower crops – Rose, Jasmine and Chrysanthemum. Flower decoration – Dry and wet decoration. Fruit crops: Induction of flowering, flower thinning, fruit setting, fruit development. Cultivation of important fruit crops - Mango, Grapes, Sapota and Guava. Economics of cultivation Crops: Cardamom, pepper, ginger, turmeric and clove.

Books for Study

1. Acquaah, G. 2002. Horticulture: Principles and Practices. Pearson Education, Singapore.
2. Bose, TK., Maiti, RG., Dhua, RS. and Das, P. 1999. Floriculture and Landscaping. NayaProkash, Calcutta.

Books for Reference

1. Ashman, M. A. and Puri, G. 2002. Essential soil science- A clear and concise introduction to soil science. Blackwell scientific publishers, London.
2. SubbaRao, N. S. 1997. Biofertilizers in Agriculture and Forestry. India Book House Limited, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
3. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. International Book Distributory Co.

Semester	Course Code	Title of the Course									Hours	Credits
V	21UBO53EG01	GENERIC ELECTIVE-1: LANDSCAPE DESIGNING									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	3	3	2	2.5	
CO-2	2	3	2	3	2	2	3	2	3	3	2.5	
CO-3	2	3	2	3	2	3	2	2	3	2	2.4	
CO-4	3	3	3	3	2	3	2	3	2	2	2.6	
CO-5	2	2	3	2	3	3	2	3	2	3	2.5	
Mean Overall Score											2.5	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
V	21USS54SE03	SEC-3: SOFT SKILLS	2	1

POs (Programme outcomes)

- To provide a focused training on soft skills for students in colleges for better job prospects
- To create and interface between industries and educational institutions in order to match the expectations of employers and abilities of the employees
- To bring a transformation in interpersonal and societal living guided by value laden principals
- To explore and analyze personal attributes that enhance the individual's Interactions, Job Performance and Career Prospects
- To foster teamwork (synergy) that increases productivity and brings benefits to the individuals and the society

PSOs (Programme Specific Outcomes)

After the successful completion of the course, students will learn:

- the various concepts of communication skills as job seekers
- to write a Professional resume as required by the employers
- to demonstrate interview skills and actively participate in GD preparations and presentations in peer groups
- to discover various aspects of self and set short term and long term goals for successful career and creates a congenial atmosphere
- to have access to solve simple and day to day Arithmetic problems and Verbal and Non- verbal reasoning formulas

Cos (Course Outcomes)

Upon completion of the course, Students will:

- be keen on developing and sustaining Soft Skills required of an educated youth
- be trained to present the best of themselves as job seekers to deal with any problem and conflict situations
- be able to transfer the skills learnt for concrete outcomes and increased productivity of companies
- be able to develop people skills, life skills that are required to be a good human in the long run and set a living standard
- be embedded with Employability skills such as "communication", "teamwork", "initiative", "enterprise", the attributes of "reliability", "balance between work -life", "commitment" and continuous learning

Module 1: Effective Communication

Definition of communication, Barriers of Communication, Verbal and Non-verbal Communication; Self introduction matrix, Conversation Techniques, Good manners and Etiquettes, Introduction to Professional Communication, Professional Grooming and Presentation Skills and exercises

Module II: Resume Writing & Interview skills

Resume Writing: Basic Resume Formats. Types of Resume - Chronological, Functional and Mixed Resume, Steps in preparation of Resume, Sample objectives, Model Resumes.
Interview Skills: Preparation for interview, Common interview questions, Attitude, Body Language, Mock interviews and Practicum, Figuring out common interview questions and answers

Module III: **Group Discussion:** Definition of GD. The salient features of GD, Factors that influence GD, Outcome of GD, Tips for success in GD, Parameters of GD, Essential Points for GD preparation, GD Topics, Model GD and Practicum.

Module IV: **Personal Effectiveness:** Self Discovery: Personality, Traits of Personality; Personality Tests; Intelligence and Skill Assessment Form. **Goal Setting:** Goal setting Process, Questionnaires & Presentations

Module V: **Numerical Ability:** Average, Percentage; Profit and Loss, Area, Volume and Surface Area. (Simple Interest, Compound Interest; Time and Work, Pipes and Cisterns; Time and Distance, Problems on Trains, Illustrations, Boats and Streams; Illustrations-Optional)

Module VI: **Test of Reasoning - Verbal Reasoning:** Series Completion, Analogy. **Non-Verbal Reasoning**

Text Book

Melchias G, Balaiah John, John Love Joy (Eds), 2018. Straight from the Traits: Securing Soft Skills, SJC, Trichy.

References

Aggarwal, R.S. 2010. *A Modern Approach to Verbal and Non Verbal Reasoning*. S.Chand, New Delhi. Covey, Stephen. 2004. *7 Habits of Highly effective people*, Free Press. Egan, Gerard. (1994).

The Skilled Helper (5th Ed). Pacific Grove, Brooks/Cole.

Khera ,Shiv 2003. *You Can Win*. Macmillan Books , Revised Edition.

Melchias G, Balaiah John, John Love Joy (Eds), 2018. *Winners in the Making: A primer on soft skills*. SJC, Trichy.

Other books

Murphy, Raymond. 1998. *Essential English Grammar*. 2nd ed., Cambridge University Press. Sankaran, K., & Kumar, M. *Group Discussion and Public Speaking*. M.I. Pub, Agra, 5th ed., Adams, Media.

Trishna's 2006. *How to do well in GDs & Interviews*, Trishna Knowledge Systems.

Yate, Martin. 2005. *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63CC11	CORE-11: PLANT PHYSIOLOGY	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	compile the underlying principles of various physiological processes of plants.	K1
CO-2	discuss various mineral nutrients in plants.	K2
CO-3	assess the mechanism of photosynthesis and respiration.	K3
CO-4	evaluate the various plant growth substances and their physiological effects.	K4
CO-5	predict the seed dormancy and photoperiodism.	K5

Unit I (12 Hours)

Water, Mineral and Solute: Uptake and Transport. Molecular Structure and properties of water. Diffusion and osmosis – osmotic pressure, turgor pressure and significance of osmosis. Plasmolysis and its importance. Mechanism of absorption of water – passive and active absorption. Ascent of sap – theories on absorption. Absorption, mechanism and transport of mineral salts. Transpiration – types, mechanism, significance and factors affecting transpiration.

Unit II (12 Hours)

Mineral nutrition: plant nutrients – essential and non-essential elements – micro and macro nutrients. Source, physiological role and deficiency symptoms of minerals. Hydroponics and aeroponics. Nitrogen metabolism: importance of nitrogen to plants. Sources of nitrogen, nitrogen cycle, nitrogen, ammonium assimilation and transamination.

Unit-III (12 Hours)

Photosynthesis: Photosynthetic apparatus and pigment system, Emerson Enhancement Effect and two pigment systems, Antenna complexes and reaction centers, Photosynthetic electron transport system and its mechanism, photophosphorylation and types – cyclic, non-cyclic and pseudocyclic pathway of carbon, CO₂ fixation - C₃, C₄ and CAM plants.

Unit IV (12 Hours)

Respiration: Definition, types of respiration: Glycolysis (EMP pathway), Krebs cycle, Terminal oxidation, Electron transport chain (modern view) and oxidative phosphorylation. ATP synthesis, Photorespiratory carbon, Oxidative cycle, Pentose Phosphate pathway: its significance, Respiratory Quotient.

Unit V (12 Hours)

Plant Growth: Plant growth substance: discovery and physiological effects of Auxin, Gibberellins and cytokinins. Growth inhibitor hormone: Ethylene and Absciscic acid. Physiology of flowering: Photoperiodism and Phytochrome, Vernalisation: techniques and mechanism. Seed dormancy and germination: physiological and biochemical changes.

Books for Study

1. Verma V. 2007. Text book of Plant Physiology, Ane Books India, New Delhi
2. Jain V.K. 2006. Fundamentals of Plant Physiology, 18th ed. Chand & Co.
3. Pandey, SN & Sinha, BK. 2006. Plant Physiology, 4th Ed. Vikas Publishing House Ltd.

Books for References

1. Noggle and Fritz, 1976. Introductory Plant Physiology, Prentice Hall, New Delhi.
2. Bajjal BD & Ravisharma, 1981. A Textbook of Plant Physiology, Shiva Lal Agarwal
3. Salisbury, F.B. & Ross, CN. 1995. Plant Physiology. CBS Publishers, New Delhi

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63CC11	CORE-11: PLANT PHYSIOLOGY									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	2	2	1	2	3	1	2	3	2.1	
CO-2	2	2	3	1	2	3	2	2	3	2	2.2	
CO-3	1	3	2	2	3	1	2	3	2	3	2.2	
CO-4	2	3	2	3	1	2	3	1	2	3	2.3	
CO-5	1	3	3	2	2	2	3	2	1	3	2.2	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63CP06	LAB. COURSE 6: PLANT PHYSIOLOGY	3	1

Detailed Study:

1. Effect of temperature on membrane permeability.
2. Osmosis – Thistle funnel, potato osmoscope.
3. Determination of water potential and solute potential.
4. Determination of root pressure and sap exudation.
5. Effect of environmental factors on the rate of transpiration.
6. Extraction and separation of leaf pigments.
7. Effect of light and CO₂ on photosynthesis.
8. Aerobic respiration – Ganong's respiroscope.
9. Ascent of sap – Balsam plant experiment.
10. Measurement of lipase activity.
11. Demonstration experiments:
 - i. Phototropism,
 - ii. Geotropism,
 - iii. Arc Auxanometer,
 - iv. Dialatometer
 - v. Hydroponics

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63CC12	CORE-12: GENETIC ENGINEERING AND BIOTECHNOLOGY	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	define the principles and application of intellectual property rights.	K1
CO-2	understand the principles of genetic engineering.	K2
CO-3	learn the types and application of cloning vectors.	K3
CO-4	study and analyze different types of gene transfer methods.	K4
CO-5	design protocol for plant tissue culture.	K5

Unit I (12 Hours)

Basic principle and important steps in recombinant DNA Technology. *Agrobacterium*-mediated gene transfer and Crown gall disease. Steps in Methods to generate desired foreign genes: isolation of prokaryotic gene by restriction enzymes and of eukaryotic gene by cDNA synthesis. Joining DNA molecules: ligases, linkers and homopolymers.

Unit II (12 Hours)

Cloning vectors: natural vectors - *E. coli* plasmids; *in vitro* vectors – pBR; cosmids; single-stranded DNA vectors - M13; and shuttle vectors - *E. coli*; Yeast shuttle vector. Selectable markers. Gene cloning strategies: cDNA library and genomic library.

Unit III (12 Hours)

Methods of gene transfer to bacteria, plants and animals: Ca-transfection, microinjection, electroporation, shotgun, lipofection, somatic cell nuclear transfer, and embryonic stem cells.

Unit IV (12 Hours)

Various methods of Plant Tissue Culture and Applications. Protoplast fusion technology. Applications of plant tissue culture in agriculture and forestry. Transgenic plants against herbicide, insects, drought and salinity. Genetic Use Restriction Technology. Anti-sense RNA technology and the FlavrSavr tomato.

Unit V (12 Hours)

Production technology of plantibodies and monoclonal antibodies by hybridoma technology. Gene therapy. Cloning animals (therapeutic and reproductive). Xenografting. Release of GMOs: *Bt* brinjal in India. Concerns of genetic engineering. IPRs – meaning, types (IP, Copyrights & Patents). Arguments for and against patenting genes and life forms.

Books for Study

1. Bernard R Glick and Jack J Pasternak. 2001. Molecular biotechnology-principles and applications of recombinant DNA, (2nd Edition), ASM Press, Washington, D.C.
2. Old, RW and Primrose, SB. 2001. Principles of Gene Manipulation-an introduction to genetic engineering, Black Well Science Ltd., New York.

Books for References

1. Gamborg, OL and Phillips, GC. 1995. Plant cell, Tissue and Organ culture, Narosa publishing House, New Delhi.
2. George, EF and Sherrington, PD. 1984. Plant propagation by Tissue culture, Exegetics Limited, London.
4. JD Watson, M Gilman, J Witkowski and M Zoller 1992. Recombinant DNA (2nd Edition), WH Freeman Co., New York.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63CC12	CORE-12: GENETIC ENGINEERING AND BIOTECHNOLOGY									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	3	2	3	2	2.5	
CO-2	2	3	2	3	2	2	3	2	2	3	2.4	
CO-3	2	2	3	2	3	3	3	2	3	1	2.4	
CO-4	3	3	3	3	1	3	3	3	3	1	2.6	
CO-5	1	2	2	2	3	1	2	2	2	3	2.0	
Mean Overall Score											2.38	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63CP07	LAB. COURSE 7 (GENETIC ENGINEERING, BIOTECHNOLOGY AND BIOCHEMISTRY)	3	1

Detailed Study:

Genetic Engineering, Biotechnology

1. Culture media and sterilization techniques
2. Generation of In vitro plants
3. Embryo culture
4. Callus induction and differentiation
5. Somatic embryogenesis.
6. Micropropagation and Synthetic seeds

Biochemistry

7. Qualitative estimation of sugars.
8. Estimation of total lipids (gravimetric).
9. Estimation of amino acids.
10. Determination of strength of amino acids.
11. Quantitative estimation of total protein.
12. Effect of pH/temperature on enzyme activity
13. Estimation of total phenolics

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63ES03A	DSE-3: BIOCHEMISTRY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge about chemical and molecular foundations of life.	K1
CO-2	compile the structure, properties and roles of carbohydrates, proteins and lipids.	K2
CO-3	analyze the structure, function and acid base properties of amino acids.	K3
CO-4	critique the role of vitamins and enzymes in biological systems.	K4
CO-5	evaluate the importance of secondary metabolites to mankind.	K5

Unit I (15 Hours)

Carbohydrates: Classification of carbohydrates; Stereochemistry of simple sugars; α , β -glycosidic linkages, Structure and properties of monosaccharide (glucose, fructose, mannose), disaccharide (maltose, lactose, sucrose) and oligosaccharides; Polysaccharides: Chemical structure and functions of starch, glycogen, plant cell wall and bacterial cell wall.

Unit II (15 Hours)

Lipids: Classification, structure, properties and synthesis of lipids; Saturated and Unsaturated fatty acids; Structure and function of phospholipids, glycolipids; cholesterol-biological importance; Membranes and fluid mosaic model.

Unit III (15 Hours)

Amino acids: Structure & properties, Non-protein amino acids and their functions; Proteins: classification, peptide bond, structure- primary, secondary, tertiary (collagen), quaternary and the forces stabilizing protein structure.

Unit IV (15 Hours)

Enzymes: biocatalysts – definition and characteristics, IUB classification; principles of catalysis, activation energy, transition state, active site and Michaelis-Menten equation; Mode of action - Lock & Key and Induced Fit models; Factors affecting enzyme action – pH, temperature, substrate & enzyme concentration; Enzyme regulation by inhibition: competitive, non-competitive & feedback.

Unit V (15 Hours)

Secondary metabolites and their functions in plants: Terpenoids: N- containing metabolites (alkaloids), Phenolics: classification, properties and significance; Shikimic acid and mevalonic acid pathway; Synthesis of alkaloids from amino acids.

Books for Study

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 13: 978-1-4641-0962-1 / ISBN: 10:1-4292-3414-8.
2. Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63ES03A	DSE-3: BIOCHEMISTRY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	2	2	2	3	1	3	3	2	2	2	2.2	
CO-2	3	2	2	1	2	2	3	1	2	3	2.1	
CO-3	1	2	3	2	3	2	3	2	3	2	2.3	
CO-4	1	2	2	3	1	2	3	2	2	3	2.1	
CO-5	2	2	1	2	3	2	3	2	2	3	2.2	
Mean Overall Score											2.2	
Result											# High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63ES03B	DSE-3: AGRICULTURAL BOTANY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the scope and importance of various branches of agriculture.	K1
CO-2	gain knowledge in agricultural development at global level.	K2
CO-3	acquire skills of various crops cultivation in india.	K3
CO-4	classify various agricultural operational procedures of various crops.	K4
CO-5	prioritize various harvesting procedures.	K5

Unit I: Introduction to Agriculture

(15 Hours)

Agriculture – Definition – Importance and scope - Branches of agriculture- Agronomy – Definition – Meaning and scope. National and International Agricultural Research Institutes. Indian economy – National income.

Unit II: History of Agriculture Development

(15 Hours)

Evolution of human beings and agriculture – Era of civilization- Importance of Neolithic civilization - History of Agricultural development in world and India – Agriculture in ancient India – Development of scientific Agriculture - Stages of agriculture development - Chronological agricultural technology development in India.

Unit III: Crop Classification and Crop Production

(15 Hours)

Crops and their classification–Major crops of India and TamilNadu-Economic importance. Major soil types of India and Tamil Nadu. Factors affecting crop production – climate - edaphic- biotic - physiographic and socioeconomic factors - Agricultural seasons of India and Tamil Nadu. Tillage – Definition - Types- Objectives - Modern concepts of tillage.

Unit IV: Basic Agricultural Operations

(15 Hours)

Seed treatment. Nursery. Sowing methods. Germination – Factors affecting germination. Plant population and geometry - effect on growth and yield. After cultivation – Thinning - Gap filling. Weeds – Definition – Beneficial and Harmful effects of weed. Irrigation and its role on plant growth. Manures and fertilizers – Time and methods of application.

Unit V: Harvesting and Storage

(15 Hours)

Maturity symptoms of field crops – methods of harvesting – Cleaning and drying -methods of storage. Current stream of developments

Books

1. Sudhagar Rao, G.B., M. Thiruppathi., C.Ravikumar and K.P.Senthilkumar, 2015.Basic Agronomy, Manibharathi Publications, Chidambaram.
2. Chandrasekaran, B., K. Annadurai and E. Somasundaram. 2010. A Textbook of Agronomy. New Age International Publishers, New Delhi.

REFERENCES

1. Balasubramanian, P. and SP.Palaniappan. 2010. Principles and Practices of Agronomy. Agrobios.Jodhpur - 342 002.
4. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
5. Panda, S.C. 2010. Agronomy. Agro bios (India), Jodhpur - 342 002.
6. Yellamananda Reddy, T. and SankaraReddi, G.H. 2010. Principles of Agronomy. Kalyani Publishers, New Delhi.

E-RESOURCES

1. http://www.dphu.org/uploads/attachements/books/books_2248_0.pdf
2. <https://www.scribd.com/doc/119183030/principles-of-agronomy-and-agrometerology>
3. <http://www.newagepublishers.com/samplechapter/001757.pdf>
4. [http:// www.sun.worldcat.org/title/principles of agronomy/oclc/689265](http://www.sun.worldcat.org/title/principles of agronomy/oclc/689265)

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63ES03B	DSE-3: AGRICULTURAL BOTANY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	3	2	2	3	2	2	1	2.2	
CO-3	2	2	3	2	3	3	3	2	3	2	2.4	
CO-4	3	3	2	3	1	3	3	2	3	1	2.4	
CO-5	2	2	1	2	1	2	2	1	2	1	1.6	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63ES04A	DSE-4: MEDICINAL BOTANY	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire the knowledge about understanding of principle and efficacy of various Indian system of medicines.	K1
CO-2	learn the identification, pharmacological importance and processing of medicinal plants based on their classification and characterization.	K2
CO-3	analyze the suitable conservation method for medicinal plants using modern biotechnology tools to ensure the sustainable utilization.	K3
CO-4	evaluate the medicinal plants based drug efficacy and its various applications for different ailments	K4
CO-5	create new methods for identification and characterization of drug adulteration and formulations for the human welfare.	K5

Unit I

Medicinal Plants: History, Scope and Importance. Traditional medicinal systems: Ayurvedha, Siddha, Naturopathy, Aromatherapy and Acupuncture. Definition of drug classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical and pharmacological.

Unit II

Ethnobotany: definition, major tribes of South India and their ethno botanical heritage. Ethnobotany and conservation of plants with special reference to India. Mythology and conservation of ecosystems (sacred groves). Role of ethnic groups in conservation of medicinal plant genetic resources. Endangered taxa and forest management.

Unit III

Cultivation, collection and preparation of natural drugs macroscopic (physical and organoleptic characters), therapeutic and pharmaceutical characterization of the following medicinal plants: *Adathoda vasica*, *Aloe vera*, *Centella asiatica*, *Piper nigrum*, *Allium sativum*, *Curcuma longa*, *Ocimum sanctum* and *Catharanthus roseus*. Conservation of endangered and endemic medicinal plants using Plant Tissue Culture.

Unit IV

Drugs from leaves (Eucalyptus), flower (Eugenia), fruits and seeds (Coriander), roots (Withania), underground stem (Ginger), bark (Cinchona) and wood (Ephedra). Cultivation and utilization of selected medicinal plants *Bacopa monnieri*, *Cassia senna*, *Andrographis paniculata*, *Gloriosa superba*, *Phyllanthus amarus* and *Rauvolfia serpentina*.

Unit V

Drug adulteration and types. Drug evaluation: physical, chemical and biological. Quality control of herbal drugs. Role of NMPB, AYUSH and CDRI.

Books for Study

1. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. (2003). Pharmacognosy. NiraliPrakashan, Pune.

Books for References

1. Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
2. Harbourne, J. B. (1998). Phytochemical methods: A Guide to Modern Techniques of Plant Analysis (3rd edition). Chapman and Hill Co., New York.
3. Joshi, S.G. (2001). Medicinal plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63ES04A	DSE-4: MEDICINAL BOTANY									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	1	3	3	3	1	2	2	2.3	
CO-2	2	2	3	2	2	1	3	3	2	3	2.3	
CO-3	3	3	3	2	3	1	3	3	2	3	2.6	
CO-4	3	1	3	2	3	2	3	1	2	2	2.2	
CO-5	2	3	2	2	3	1	1	2	3	3	2.2	
Mean Overall Score											2.32	
Result											High	

Semester	Course Code:	Title of the Course	Hours	Credits
VI	21UBO63ES04B	DSE-4: BIOLOGICAL TECHNIQUES	5	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the various micro techniques in biology.	K1
CO-2	learn the principles and applications of microscopy.	K2
CO-3	construct immunological techniques and applications.	K3
CO-4	distinguish and identify techniques used to preserve organisms in museum.	K4
CO-5	prepare biofertilizers and animal rearing.	K5

Unit I (15 Hours)

Microtechniques - selection of material, fixation, fixation images- acid and basic. Preparation of permanent slide-Dehydration process, Infiltration of wax, embedding, sectioning (microtome), mounting. Leaf clearing, smear and squash techniques.

Unit II (15 Hours)

Stains: Classification- single, double, triple staining. Florescent image processing Nuclear, cytoplasmic, cell wall stains and their rationale. Herbarium – collection, drying, pasting of plant specimen, Protection of Herbarium- importance.

Unit III (15 Hours)

Techniques of the preparation of vertebrate skeletons and transparency preparations (Alizarian red) cartilage staining, museum techniques: dry and wet preparation. Taxidermy Arthropod squash. Blood grouping ABO and Rh, blood smear preparation. Haemocytometer.

Unit IV (15 Hours)

Earthworm and its types. Preparatory methods of vermiculture techniques. Vermin compost – panchakavia; fish extract, Economic and ecological importance of vermicompost. Biofertilizers-Cultivation of Spirulina and Scenedesmus. Animal rearing: albino rats, rabbits and fruit fly.

Unit V (15 Hours)

PCR - principles, technique and applications- Types of PCR –Reverse Transcriptase (RT) Blotting techniques-Northern. DNA finger printing and barcoding. Immunological test - WIDAL, RPR, RF and ELISA.

Books for Study

1. Yadav, P.R. 2006. Biological Techniques, Discovery Publishing House, New Delhi.
2. Swargiary, A. 2017. Biological Tools & Techniques, Kalyani Publishers, New Delhi.

Books for Reference

1. Ramakrishnan, S. 2012. Manual of Medical Laboratory Techniques, Jaypee Brothers Medical Publishers, New Delhi.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63ES04B	DSE-4: BIOLOGICAL TECHNIQUES									5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	3	2	1	2	2	3	2	1	2	2.1	
CO-2	2	3	2	2	3	2	3	2	2	1	2.2	
CO-3	2	2	3	2	1	2	2	3	2	2	2.1	
CO-4	1	2	2	3	2	1	3	2	3	2	2.1	
CO-5	1	2	2	3	2	2	3	2	2	3	2.2	
Mean Overall Score											2.1	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63EG02	GENERIC ELECTIVE-2: SOLID WASTE MANAGEMENT	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	Understand the types of solid waste and their importance.	K1
CO-2	Acquire knowledge on decomposition of organic matters.	K2
CO-3	Learn the technology of vermicomposting and their applications.	K3
CO-4	Learn the Mushroom cultivation technique and their medicinal values.	K4, K5
CO-5	Know the methods of composting and their importance.	K6

Unit-I (12 Hours)

Definition-scope and importance of solid waste management-Types of solid wastes: garbage, rubbish, agricultural, hospital and domestic wastes. Collection-transport and processing of solid wastes.

Unit-II (12 Hours)

Composting techniques: Types of composting, anaerobic and aerobic composting, Factors affecting aerobic composting, Techniques for effective aerobic composting, Salient features of selected small-scale aerobic composting techniques-Role of microbes in composting

Unit-III (12 Hours)

Solid waste management - methods of solid waste management - open dumping, land filling, incineration, pyrolysis Biogas production-mechanism of methane gas formation. Factors affecting methane formation Utilization of Biogas.

Unit-IV (12 Hours)

Vermicomposting-Earthworm and its characteristics-internal anatomy-digestive, excretory, respiratory and reproductive systems. Preparatory methods of vermiculture. Economic and ecological importance of vermicompost and vermi wash.

Unit-V (12 Hours)

Mushroom culture - Characteristics of common edible mushrooms - Nutritive value of mushrooms. Culture techniques-preparation of spawn - Preparation compost-spawn running and harvesting. Preservation and storage. Recipes of mushroom.

Books for Study

1. Dubey, RC. 2009. A Text book of microbiology, S. Chand & Co. Ltd, New Delhi.

Books for Reference

1. NIIR Board. 2004. The Complete Technology Book on Biofertilizers and Organic Farming, National Institute of Industrial Research.
2. David, SV. and Kumaraswamy, T. 1998. Elements of Economic Entomology. Popular Book Depo, Chennai.

3. Mohoney, R. 1966. Lab Techniques in Zoology. Butterworth, UK.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO63EG02	GENERIC ELECTIVE-2: SOLID WASTE MANAGEMENT									4	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	3	2	1	2	2	3	2	2	2	2.3	
CO-2	2	3	2	2	3	2	3	2	2	1	2.2	
CO-3	2	2	3	2	2	3	2	3	2	2	2.3	
CO-4	1	3	2	3	2	1	3	2	3	2	2.2	
CO-5	1	2	2	3	2	3	3	2	2	3	2.3	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO64SE04	SEC-4 (WS): HERBAL TECHNOLOGY	2	1

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	Obtain the knowledge about understanding of Preparation of Herbal based remedies using various types of medicinal plant raw materials.	K1
CO-2	Learn the current trade status and role of medicinal plants in socio economic growth.	K2
CO-3	Study and Investigate the disease curing ability medicinal plants in various ailments.	K3
CO-4	Evaluate and Analyze the market value of herbal based formulations and products in pharmaceutical industries.	K4
CO-5	Create new drug formulations using therapeutically valuable plant materials for the healthy life of society.	K5, K6

Unit-I

(6 Hours)

Herbal decoction preparation: *Andrographis paniculata*, *Tinospora cordifolia*, *Alpinia officinarum*, *Hygrophila auriculata* and *Adathoda vasica*.

Unit-II

(6 Hours)

Herbal powder preparation: *Withania somnifera*, *Cyanodon dactylon*, Anti diabetic FTN Sooranam, *Kaphasura kudineer* Sooranam.

Unit-III

(6 Hours)

Herbal massage oil preparation: *Pindathylam*, Herbal bath conditioner preparation: *Nalankumavu*, *Panchakarbam*. Preparation of Herbal Face pack.

Unit-IV

(6 Hours)

Herbal hair oil preparation: *Neelibirikathi*. Herbal cream preparation: *Mathanthylam*. Herbal health drinks preparation: *Mathulaimanabaku* (*Punica granatum* and *Hibiscus Rose Milk*).

Unit-V

(6 Hours)

Preparation of herbal tea, herbal soup, herbal sweet and herbal cosmetics. Preparation of Herbal Mosquito Repellent. Flowers Salad.

Semester	Course Code	Title of the Course									Hours	Credits
VI	21UBO64SE04	SEC-4 (WS): HERBAL TECHNOLOGY									2	1
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO-1	3	2	3	1	3	3	3	1	2	2	2.3	
CO-2	3	2	3	3	3	1	2	3	3	2	2.5	
CO-3	3	3	3	2	3	2	3	3	2	3	2.7	
CO-4	3	1	3	2	3	2	3	1	2	2	2.2	
CO-5	2	3	2	2	3	1	2	2	3	3	2.3	
Mean Overall Score											2.40	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UBO63CE01	COMPREHENSIVE EXAMINATION	-	2

Unit-I:

Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Plant diseases and defense mechanism. Ecology and Evolutionary trends. Binomial nomenclature, Numerical Taxonomy and Chemotaxonomy, Tissues, totipotency, properties of wood; Microsporogenesis, megasporogenesis, double fertilization and polyembryony.

Unit-II:

Cell Biology - Cell as a unit structure and function, Cell division: Mitosis and Meiosis Chromosomal behaviour and their cytological significance; Mendelian Genetics- linkage and crossing over, Chromosome mapping, Human genome project; Protein synthesis and gene expression, DNA replication; Polyploidy and mutations in crop improvement. Heterosis and Inbreeding Depression; theories of evolution and variations in speciation

Unit-III:

Photosynthesis: mechanism and importance, Nitrogen Metabolism. Physiology of seed dormancy and germination, Plant growth Regulator, Phytochrome and its role. Biopolymers- carbohydrates, proteins and lipids; Enzyme kinetics and Mode of enzyme action. Secondary metabolites- Alkaloids, phenolics and terpenoids. Bioenergetics, redox potential and coupled reaction, photobiology.

Unit-IV:

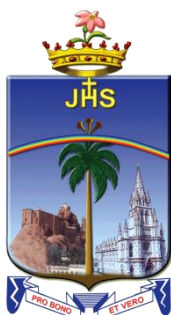
Whittaker's five kingdom concept, food spoilage and preservation, Role of microbes in waste water treatment, Biofertilizer, protoplast culture, Somatic hybrid and Cybrids. Synthetic seeds and their application, Vectors in gene cloning – Plasmids, Cosmids, Bacteriophages, fermentation as a biochemical process, Microbial Single Cell Protein (SCP) production, humoral and cellular immunity, Antibody types and immunological role.

Unit-V:

Sampling techniques, Central values (mean, mode, median), T-test, Chi square Test; Concept of Ecosystem, Method of studying plant communities, Vegetation types of India, Biotic interactions – Succession and its types, Biogeochemical cycles. Ethnobotany- scope and Tribes of Tamil Nadu, Conservation – in situ and ex situ conservation.

M.Sc. BOTANY
LOCF SYLLABUS – 2021

SCHOOLS OF EXCELLENCE
WITH CHOICE BASED CREDIT SYSTEM (CBCS)



DEPARTMENT OF BOTANY
SCHOOL OF BIOLOGICAL SCIENCES
ST.JOSEPH'S COLLEGE (AUTONOMOUS)

Special Heritage Status Awarded by UGC
Accredited at A⁺⁺ Grade (IV Cycle) by NAAC
College with Potential for Excellence by UGC
DBT-STAR & DST-FIST Sponsored College
Tiruchirappalli - 620 002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) POSTGRADUATE COURSES

St. Joseph's College (Autonomous), a pioneer in higher education in India, strives to maintain and uphold the academic excellence. In this regard, it has initiated the implementation of five "Schools of Excellence" from the academic year 2014 – 15, to meet and excel the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system enhances the optimal utilization of both human and infrastructural resources. It also enhances academic mobility and enriches employability. The School system preserves the identity, autonomy and uniqueness of every department and reinforces Student centric curriculum designing and skill imparting. These five schools adhere to achieve and accomplish the following objectives.

Optimal utilization of resources both human and material for the academic flexibility leading to excellence.

Students experience or enjoy their choice of courses and credits for their horizontal mobility.

The existing curricular structure as specified by TANSCH and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice based credit system.

Human excellence in specialized areas

Thrust in internship and / or projects as a lead towards research and

The multi-discipline nature of the School System caters to the needs of stake-holders, especially the employers.

Credit system:

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The credits and hours of each course of a programme is given in the table of Programme Pattern. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses, a student must earn a minimum of 110 credits as mentioned in the programme pattern table. The total number of minimum courses offered by the Department is given in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

Outcome –Based Education (OBE): is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs):

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Programme Educational Objectives (PEOs): The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC)

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE)

Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

DSE: Four courses are offered, one course in each semester.

Note: To offer **one DSE**, a minimum of two courses of equal importance / weightage is a must.

One DSE Course in semester two is offered as interdisciplinary/common course among the departments in a School (Common Core Course) at the PG level.

Generic Elective Courses

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Two GE Courses are offered, one each in semesters II and III. The GE course offered in semester II is within the school level and the GE in semester III is Between Schools level

The Ability Enhancement Courses (AEC)

One Main discipline related Ability Enhancement Course for 3 credits is offered for a PG programme by the Department.

Skill Enhancement Courses (SECs)

These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme.

One SEC is offered in semester II as a compulsory course on Soft Skills, offered by the Department of Human Excellence, common to all the students of PG programme.

Self-paced Learning: It is a course for two credits. It is offered to promote the habit of independent/self learning of Students. Since it is a two credit course, syllabus is framed to complete within 45 hours. It is not taught in the regular working hours.

Comprehensive Examinations: A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL and etc.

Course Coding:

The following code system (10 alphanumeric characters) is adopted for Post Graduate courses:

21	PXX	N	XX	NN/NNX
Year of Revision	PG Department Code	Semester number.	Part Category	running number/with choice

N:- Numerals X :- Alphabet

Part Category

CC - Core Theory

CP- Core Practical

IS- Internship

SP- Self Paced Learning

CE- Comprehensive Examination

PW- Project Work & viva-voce

Electives Courses

ES – Department Specific Electives

EG- Generic Electives

EC - Additional core Courses for Extra Credits (If any)*

Ability Enhancement Courses

AE – Ability Enhancement Course

SE – Skill Enhancement Course – Soft skills

CW - SHEPHERD & Gender Studies (Outreach)

CIA AND SEMESTER EXAMINATION

Continuous Internal Assessment (CIA):

Distribution of CIA Marks	
Passing Minimum: 50 Marks	
Library Referencing	5
3 Components	35
Mid-Semester Test	30
End-Semester Test	30
CIA	100

MID-SEM & END-SEM TEST

Centralised – Conducted by the office of COE

1. Mid-Sem Test & End-Sem Test: (2 Hours each); will have Objective and Descriptive elements; with the existing question pattern PART-A; PART-B; PART-C and PART D.
2. One of the CIA Component II/III for UG & PG will be of 15 marks and compulsorily a online objective multiple choice question type.
3. The online CIA Component must be conducted by the Department / faculty concerned at a suitable computer centre.
4. The one marks of PART-A of Mid-Sem and End-Sem Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS.
5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.

Duration of Examination must be rational; proportional to teaching hours 90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS	Lower Order Thinking			Higher Order Thinking			Total %
	K1	K2	K3	K4	K5	K6	
SEMESTER EXAMINATIONS	15	20	35	30			100
MID / END Semester TESTS	12	20	35	33			100

QUESTION PATTERN FOR SEMESTER EXAMINATION	
SECTION	MARKS
SECTION-A (No choice ,One Mark) THREE questions from each unit (15x1 =15)	15
SECTION-B (No choice ,2-Marks) TWO questions from each unit (10x2 =20)	20
SECTION-C (Either/or type) (7- Marks) ONE question from each unit (5x7 =35)	35
SECTION-D (3 out of 5) (10 Marks) ONE question from each unit (3x10 =30)	30
Total	100

BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.				Max Mark : 100			
K- LEVELS	K1	K2	K3	K4	K5	K6	Total Marks
SECTIONS							
SECTION–A (One Mark, No choice) (15x1 =15)	15						15
SECTION-B (2-Marks, No choice) (10x2=20)		10					20
SECTION-C (7- Marks) (Either/or type) (5x7=35)			5				35
SECTION-D (10 Marks) (3 out of 5) (3x10=30) Courses having only K4 levels				3			30
Courses having K4 and K5 levels One K5 level question is compulsory				2	1		
(Courses having all the 6 cognitive levels One K5 and K6 level questions can be compulsory				1	1	1	
Total	15	20	35	30			100

QUESTION PATTERN FOR MID/END TEST		
SECTION		MARKS
SECTION–A (No choice, One Mark) (7x1 =7)		7
SECTION-B (No choice , 2-Marks) (6x2 =12)		12
SECTION-C (Either/or type) (7- Marks) (3x7 =21)		21
SECTION-D (2 out of 3) (10 Marks) (2x10=20)		20
Total		60

BLUE PRINT OF QUESTION PAPER FOR MID/END TEST								
DURATION: 2. 00 Hours.				Max Mark: 60.				
K- LEVELS	K1	K2	K3	K4	K5	K6	Total Marks	
SECTIONS								
SECTION –A (One Mark, No choice) (7 x 1 = 7)	7							07
SECTION-B (2-Marks, No choice) (6 x 2 = 12)		6						12
SECTION-C (Either/or type) (7-Marks) (3 x 7 =21)			3					21
SECTION-D (2 out of 3) (10 Marks) (2x10=20) Courses having only K4 levels				2				20
Courses having K4 and K5 levels One K5 level question is compulsory				1	1			
Courses having all the 6 cognitive levels One K6 level question is compulsory					1	1		
Total Marks	07	12	21	20				60
Weightage for 100 %	12	20	35	33				100

Assessment pattern for two credit courses.

S. No.	Course Title	CIA	Semester Examination	Total Marks
1	Self Paced Learning Course	25 + 25 = 50	50 Marks MCQ (COE)	100
2	Comprehensive Examinations	25 +25 = 50	50 Marks (MCQ) (COE)	100
3	Internship	100	--	100
4	Field Visit	100	--	100
5	Ability Enhancement Course (AEC) for PG (3 credits)	50 (Three Components)	50 (COE) Specific Question Pattern	100
Assessment Pattern for Courses in Part - IV				
6	Value Education Courses and Environmental Studies	50	50 Marks (For 2.00 hours) (COE)	100
7	Skill Enhancement Courses(SECs)	50 marks (by Course in-charge) 50 Marks (by an External member from the Department)		100
8	SEC: SOFT SKILLS (For UG and PG)	100	(Fully Internal)	100

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) respectively. These two are calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$	$WAM \text{ (Weighted Average Marks)} = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$
<p>Where,</p> <p>C_i is the Credit earned for the Course i</p> <p>G_i is the Grade Point obtained by the student for the Course i</p> <p>M_i is the marks obtained for the course i and</p> <p>n is the number of Courses Passed in that semester.</p>	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

- i) The classification of final results shall be based on the CGPA, as indicated in Table-2.
- ii) For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99 and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good', and 'Above Average' respectively.
- iii) A Pass in SHEPHERD will continue to be mandatory although the marks will not count for the calculation of the CGPA.
- iv) Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
Below 50	0	RA

Table-2: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	RA	Re-appearance

Credit based weighted Mark System is adopted for the individual semesters and cumulative semesters in the column 'Marks secured' (for 100)

Declaration of Result

Mr./ MS. _____ has successfully completed the Post Graduate in _____ programme. The candidate's Cumulative Grade Point Average (CGPA) is _____ and the class secured is _____ by completing the minimum of 110 credits.

The candidate has also acquired _____ (if any) extra by attending MOOC courses.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes(POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment is done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

Mapping	<40%	$\geq 40\%$ and < 70%	$\geq 70\%$
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Mean Scores of COs = $\frac{\text{Sum of values}}{\text{Total No.of POs \& PSOs}}$		Mean Overall Score = $\frac{\text{Sum of Mean Scores}}{\text{Total No.of COs}}$	
Result	Mean Overall Score	< 1.2	# Low
		≥ 1.2 and < 2.2	# Medium
		≥ 2.2	# High

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes (POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment is done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

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Mean Scores of COs = $\frac{\text{Sum of values}}{\text{Total No.of POs \& PSOs}}$		Mean Overall Score = $\frac{\text{Sum of Mean Scores}}{\text{Total No.of COs}}$	
Result	Mean Overall Score	< 1.2	# Low
		≥ 1.2 and < 2.2	# Medium
		≥ 2.2	# High

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value-driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

- Graduates will be able to accomplish professional standards in the global environment.
- Graduates will be able to uphold integrity and human values.
- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to apply assimilated knowledge to evolve tangible solution to emerging problems.
2. Graduates will be able to analyze and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professional and entrepreneurs upholding human values.
5. Graduates imbued with ethical values and social concern will be able to understand and appreciate cultural diversity, social harmony and ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Graduates are prepared to be creators of new knowledge in the field of life sciences, causing innovation and entrepreneurship, employable in various sectors such as private, government, and clinical /biomedical research organizations.
2. Graduates are trained to study and evolve the biomolecular mechanisms for the life processes in health and diseases.
3. Graduates are groomed to carry on research in biology on chemical basis, by exploring their knowledge independently.
4. Graduates are encouraged to design and conduct experiments, to analyze and interpret biological problems behind the research.
5. Graduates ought to have the ability of effectively communicating the findings of Biological sciences with existing knowledge ethically.

M.Sc BOTANY					
PROGRAMME STRUCTURE					
Sem.	Specification	No. of Courses	No. of Hours	Credits	Total Credits
I-IV	Core Courses : Theory	11	54	46	67
I-IV	Core Courses : Practical	7	23	20	
III	Field Visit	-	-	1	
II	Self-paced learning	1	-	2	2
IV	Comprehensive Examination	1	-	2	2
IV	Project work & Viva Voce	1	7	7	7
I-IV	Discipline Specific Elective	4	20	16	16
I	Ability Enhancement Course	1	4	3	3
II	Skill Enhancement Course (Soft Skills)	1	4	3	3
III	Generic Elective IDC (WS)	1	4	3	3
IV	Generic Elective IDC (BS)	1	4	3	3
II-IV	Online courses (MOOC)	3	-	(6)	(6)
I-IV	Outreach Programme	-	-	4	4
	Total		120		110(6)

M.Sc. BOTANY							
PROGRAMME PATTERN							
Course Details					Scheme of Exams		
Sem	Code	Course Title	Hrs	Cr	CIA	SE	Final
I	21PBO1CC01	Plant Diversity-I: Thallophytes and Bryophytes	5	4	100	100	100
	21PBO1CC02	Plant Diversity-II: Pteridophytes, Gymnosperms & Paleobotany	5	4	100	100	100
	21PBO1CC03	Plant Anatomy, Embryology and Morphogenesis	5	4	100	100	100
	21PBO1CP01	Laboratory Course-1: Thallophytes, Bryophytes, Pteridophytes, Gymnosperms And Palaeobotany	4	4	100	100	100
	21PBO1CP02	Laboratory Course-2: Plant Anatomy, Embryology And Morphogenesis	2	2	100	100	100
	21PBO1ES01A	DSE-1: Ecology and Phytogeography	5	4	100	100	100
	21PBO1ES01B	DSE-1: Forestry and Wood Science					
	21PBO1AE01	AEC : Horticulture and Landscape designing	4	3	50	50	50
Total			30	25			
II	21PBO2CC04	Plant Physiology	6	6	100	100	100
	21PBO2CC05	Biochemistry	5	5	100	100	100
	21PBO2CP03	Laboratory Course -3: Plant Physiology	3	3	100	100	100
	21PBO2CP04	Laboratory Course -4: Biochemistry	3	3	100	100	100
	21PBO2SP01	Self-Paced learning: Plant Breeding and Evolution	-	2	50	50	50
	21PBO2ES02A	DSE-2: Biophysics and Instrumentation	5	4	100	100	100
	21 PBO2ES02B	DSE-2: Plant Pathology					
	21PSS2SE01	SEC: Soft skills	4	3	100	-	100
	21PBO2EG01	GE- 1(WS): Medicinal Botany	4	3	100	100	100
		Extra Credit courses (MOOC)-1	-	(2)			
	Total		30	29(2)			
III	21PBO3CC06	Plant Systematics	5	5	100	100	100
	21PBO3CP05	Laboratory Course -5: Plant Systematics	4	3	100	100	100
	21PBO3CC07	Research Methodology	5	4	100	100	100
	21PBO3CC08	Pharmacognosy	4	3	100	100	100
	21PBO3CP06	Laboratory Course -6: Research Methodology	3	2	100	100	100
	21PBO3ES03A	DSE-3: Organic Farming	5	4	100	100	100
	21PBO3ES03B	DSE-3: Bioinformatics and Bionanotechnology					
	21PBO3EG02	GE-2 (BS): Horticulture and Landscaping	4	3	100	100	100
	21PBO3FV01	Field Visit		1	100	-	100
		Extra Credit Courses (MOOC)-2		(2)			
Total			30	25(2)			
IV	21PBO4CC09	Microbiology and Immunology	5	5	100	100	100
	21PBO4CC10	Genetic Engineering and Biotechnology	5	5	100	100	100
	21PBO4CC11	Cell and Molecular Biology	4	3	100	100	100
	21PBO4CP07	Laboratory Course- 7: Microbiology, Immunology, Genetic Engineering And Biotechnology	4	3	100	100	100
	21PBO4ES04A	DSE-4: Intellectual Property Rights	5	4	100	100	100
	21PBO4ES04B	DSE-4: Genetics					
	21PBO4PW01	Project work & Viva voce	7	5	100	100	100
	21PBO4CE01	Comprehensive Examination	-	2	50	50	50
		Extra Credit courses (MOOC)-3		(2)			
	Total		30	27(2)			
I-IV	21PCW4OR01	Outreach programme (SHEPHERD)		4			
Total (Four Semesters)			120	110(6)			

*The courses with a scheme of Exam 50 in CIA and SE will be converted to 100 for grading.

GENERIC ELECTIVE -1: 2nd Semester Within school (WS)- Offered to students belong to other Departments in the School							
Course Details					Scheme of Exams		
School	Course Code	Course Title	Hrs	Cr	CIA	SE	Final
SBS	21PBI2EG01	Herbal Technology	4	3	100	100	100
	21PBT2EG01	Medical Biotechnology	4	3	100	100	100
	21PBO2EG01	Medicinal Botany	4	3	100	100	100
SCS	21PCA2EG01	Applied Statistics using R	4	3	100	100	100
	21PMA2EG01	Mathematical Foundations	4	3	100	100	100
	21PCS2EG01	Mobile Adhoc Networks (MANET)	4	3	100	100	100
SLAC	21PEN2EG01A	Indian Literature in Translation	4	3	100	100	100
	21PEN2EG01B	English Literature For Competitive Examinations					
SMS	21PCO2EG01	Supply Chain Management	4	3	100	100	100
	21PEC2EG01	Labour Economics	4	3	100	100	100
	21PHR2EG01	Organizational Behaviour	4	3	100	100	100
	21PCC2EG01	Stress Management	4	3	100	100	100
SPS	21PCH2EG01	Industrial Products	4	3	100	100	100
	21PPH2EG01A	Solar Energy and Utilization	4	3	100	100	100
	21PPH2EG01B	Renewable Energy Resources	4	3	100	100	100

GENERIC ELECTIVE -2: 3rd Semester Between schools (BS)- Offered to students in the Departments belong to other Schools (Except the school offering the course)							
Course Details					Scheme of Exams		
School	Course Code	Course Title	Hrs	Cr	CIA	SE	Final
SBS	21PBI3EG02	First Aid Management	4	3	100	100	100
	21PBT3EG02	Food Technology	4	3	100	100	100
	21PBO3EG02	Horticulture and Landscaping	4	3	100	100	100
SCS	21PCA3EG02	Web Design	4	3	100	100	100
	21PMA3EG02	Operations Research	4	3	100	100	100
	21PCS3EG02	Advances in Computer Science	4	3	100	100	100
	21PDS3EG02	Deep Learning	4	3	100	100	100
SLAC	21PEN3EG02	English for Effective Communication	4	3	100	100	100
SMS	21PCO3EG02	Basics of Taxation	4	3	100	100	100
	21PEC3EG02	Managerial Economics	4	3	100	100	100
	21PHR3EG02	Counselling and Guidance	4	3	100	100	100
	21PCC3EG02	Dynamics of Human Behaviour in Business	4	3	100	100	100
SPS	21PCH3EG02	Health Science	4	3	100	100	100
	21PPH3EG02A	Physics for Competitive Exam	4	3	100	100	100
	21PPH3EG02B	Nano Science	4	3	100	100	100

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1CC01	CORE-1: PLANT DIVERSITY-I: THALLOPHYTES AND BRYOPHYTES	5	4

CO. No.	CO- Statements	Cognitive Levels (K- levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge about the structure, reproduction and life cycle of Algae, Fungi, Lichen and Bryophytes.	K1
CO-2	learn the major classes and types of Algae, Fungi, Lichen and Bryophytes and their variations in life cycles and life history.	K2
CO-3	recognize the economic importance and biomedical applications of Algae, Fungi, Lichen and Bryophytes.	K3
CO-4	comprehend the structural organization of gametophyte and sporophyte in different classes of Bryophytes.	K 4
CO-5	apply the ICT tools for identification of lower plants.	K5 & K6

Unit-I: (15 Hours)

Algae: Phycology- Introduction and brief history, Algology in India (Contributions of eminent Indian Algologists, Classification of algae (F. E. Fritsch, 1945), Types of Life cycle. General characteristics, thallus organization, occurrence, reproduction and economic importance of algae.

Unit-II: (15 Hours)

Chlorophyta: Detail study of structure, reproduction and life cycle of *Chlamydomonas*, *Volvox*, *Cladophora*, *Ulva*, *Caulerpa*, *Oedogonium* and *Spirogyra*. **Phaeophyta:** Detail study of structure, reproduction and life cycle of *Ectocarpus*, *Padina* and *Sargassum*. **Rhodophyta:** Detail study of structure, reproduction and life cycle of *Batrachospermum*, *Gracillaria* and *Polysiphonia*. Centric and Pinnate Diatoms.

Unit-III: (15 Hours)

Fungi: General features, occurrence and distribution, Mode of nutrition and reproduction in fungi (vegetative, asexual and sexual), Classification of fungi (Ainsworth, 1973; Alexopoulos and Mims, 1979). General characters of major divisions-Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Ecology of fungi, Spore dispersal mechanisms, Economic importance of fungi.

Unit-IV: (15 Hours)

Heterothallism; parasexuality; sex hormones in fungi; interrelationship of Myxomycetes, Oomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, Fossil Fungi. Lichens - Classification of Lichens (Hale, 1969), Nature of association of phycobionts and mycobionts, structure and reproduction in *Usnea*, Economic and ecological importance of lichens, Identification of lichens: MATLAB software, Image processing techniques.

Unit-V:**(15 Hours)**

Bryophyta: Classification (Rothmaler, 1951), general and reproductive characters of major classes, Distribution of bryophytes, Comparative study of gametophytes and sporophytes of major classes: Hepaticopsida: *Marchantia*, *Porella*, Anthocerotopsida: *Anthoceros*, *Notothylus*, Bryopsida: *Sphagnum*, *Polytrichum*. Economic importance of bryophytes.

Books for Study

1. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
2. Vashishta, B. R. and Sinha, A. K. 2007. Botany for Degree Students - Fungi. S. Chand, New Delhi.

Books for Reference

1. Hale, Jr. M. E., 1983, Biology of Lichens. Edward Arnold, Mayland.
2. Alexopoulos, C. J. and Mims, C. W. 1979. Introductory Mycology. Wiley Eastern Ltd., NY.
3. Bessey, E. A. 1979. Morphology and Taxonomy of Fungi. Vikas Pub, NewDelhi.

Semester	Course Code					Title of the Course					Hours	Credits
I	21PBO1CC01					CORE-1: PLANT DIVERSITY-I: THALLOPHYTES AND BRYOPHYTES					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	3	2	2	1	2	2	2	2	2	2.2	
CO-2	2	3	2	2	1	2	2	2	2	3	2.1	
CO-3	2	2	3	2	2	2	2	2	2	1	2.0	
CO-4	2	2	2	3	2	2	2	2	2	3	2.2	
CO-5	2	2	2	2	3	1	2	2	2	2	2.2	
Mean Overall Score											2.1	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1CC02	CORE-2: PLANT DIVERSITY-II: PTERIDOPHYTES, GYMNOSPERMS & PALEOBOTANY	5	4

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge on fossilization and geological period.	K1
CO-2	understand and analyse the characteristic features of lower vascular plants.	K2 & K3
CO-3	comprehend the economic importance of Pteridophytes and Gymnosperms.	K4
CO-4	apply interrelationships to form the life cycle patterns.	K5
CO-5	create the evolutionary trends and classification of organism.	K6

Unit-I: (15 Hours)

Pteridophytes - General characters, Reimer's classification (1954) and life cycle. Theories of origin of sporophyte, Telome concept, Sporangium development - eusporangiate and leptosporangiate type, Apogamy and Apospory. Detailed account on stelar and soral evolution in Pteridophytes, Heterospory and seed habit.

Unit-II: (15 Hours)

Morphology, anatomy, reproduction and evolution of gametophytes and sporophytes of the following genera: *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Alsophila* and *Marsilea*.

Unit-III: (15 Hours)

Gymnosperms - General characters, Classification of gymnosperms (Sporne, 1965). Phylogeny and comparative study of Cycadopsida, Coniferopsida and Gnetopsida. Salient features of Pteridospermales, Bennettitales, Pentaxylales, Cycadales, Cordaitales, Coniferales and Gnetales. Economic importance of gymnosperms.

Unit-IV: (15 Hours)

A general account on distribution, morphology, anatomy, reproduction and life cycle of the following genera: Cycadopsida – *Cycas*; Coniferopsida -*Taxus*; Gnetopsida - *Gnetum*.

Unit-V: (15 Hours)

Palaeobotany - Geological time scale, fossilization and types of fossil, Carbon dating. Indian fossil flora – Rajmahal hill flora and the Deccan Intertrappean flora. Detailed study of the fossil forms: Pteridophytes –*Rhynia*, *Lepidodendron* and *Calamites*; Gymnosperms - *Lyginopteris*, *Williamsonia* and *Cordaite*.

Books for Study

1. Sharma, O.P. 2017. Pteridophyta, McGraw Hill Education, New York.
2. Bhatnagar, S.P. and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.

Books for Reference

1. Rashid.A. 2007. An Introduction to Pteridophyta, Vikas publications, NewDelhi.
2. Johri , RM, Lata S , Tyagi K (2005), A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.
3. Vasista PC, Sinha AK and Anilkimar. 2005. Botany for degree students, Gymnosperms, S Chand, NewDelhi.

Semester	Course Code		Title of the Course								Hours	Credits
I	21PBO1CC02		CORE-2: PLANT DIVERSITY-II: PTERIDOPHYTES, GYMNOSPERMS & PALEOBOTANY								5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	2	2	1	2	2	2	3	2	2.1	
CO-2	2	2	2	1	1	2	1	2	2	2	1.7	
CO-3	2	2	2	2	1	1	2	2	2	2	1.8	
CO-4	3	2	2	1	2	2	2	2	2	2	2.1	
CO-5	2	3	2	2	1	3	2	2	2	1	2.0	
Mean Overall Score											1.94	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1CC03	CORE-3: PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS	5	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge about the tissues of stem, root and leaves in plants.	K1
CO-2	describe the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.	K2
CO-3	attain basic knowledge of the structure and development of male and female gametophytes in plants.	K3 & K4
CO-4	Compare and determine the structure and development of dicot and monocot embryos.	K5
CO-5	integrate the morphogenesis, endosperm development and polyembryony.	K6

Unit-I: (15 Hours)

General account on theories of organization of shoot and root apical meristem, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem, Cambium – origin, cellular structure, cell division, storied and non-storied types. Cambium in budding and grafting - wound healing role. Trichomes, periderm and lenticels.

Unit-II: (15 Hours)

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem (Dicot and Monocot), Origin of lateral roots, Root stem transition, Anatomy of Dicot and Monocot leaf. Leaf abscission, stomata types, nodal anatomy, petiole anatomy, vascularization of flower and seedling.

Unit-III: (15 Hours)

Microsporangium – Microsporogenesis, Microspores – morphology, ultrastructure, Microgametogenesis, Pollen-Stigma Incompatibility, Methods to overcome incompatibility. Megasporangium – Megagametogenesis, Female gametophyte – Monosporic, Bisporic and Tetrasporic, Nutrition of embryo sac and fertilization.

Unit-IV: (15 Hours)

Endosperm – Types, haustoria, Cytology and physiology and functions of endosperms, Embryo development - Dicot and Monocot, Nutrition of embryo. Polyembryony - Causes, Apomixis - Causes, Apospory - Their role in plant improvement programs and seed development.

Unit-V: (15 Hours)

Morphogenesis- Definition, morphogenesis and its relation to morphology, Turing's diffusion reaction theory, Morphogenetic factors - growth regulators, genetic and environment, polarity. Molecular basis of morphogenesis, Cellular level morphogenesis, Asymmetric divisions and their significance, Morphogenesis at tissue level - Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vitro* and *in vivo* and in wounds. Plant galls and their importance in morphogenesis.

Books for Study

1. Fahn, A. 1989. Plant Anatomy. Maxwell Pvt. Ltd., Singapore.

2. Bhojwani, S. S. and Bhatnagar, S. P. 1981. Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd., New Delhi.

Books for Reference

1. Bard, J. 1990. Morphogenesis. Cambridge University Press, London.
2. Agarwal, S. B. 1990. Embryology of Angiosperms - a fundamental approach, Sahitya Bhawan, Agra.
3. Pandey, B. P. 1989. Plant Anatomy. S. Chand and Co. Ltd., New Delhi.

Semester	Course Code					Title of the Course					Hours	Credits
I	21PBO1CC03					CORE-3: PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	2	2	3	2	2	2	2	2.3	
CO-2	2	3	2	2	1	2	3	2	2	2	2.1	
CO-3	2	2	3	2	1	3	3	2	3	1	2.2	
CO-4	3	3	2	1	1	3	2	2	1	2	2.1	
CO-5	2	3	2	2	3	2	3	2	2	3	2.6	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credit
I	21PBO1CP01	LABORATORY COURSE 1: THALLOPHYTES, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY	4	4

Algae:

Ulva, Caulerpa, Padina, Sargassum, Batrachospermum, Gracilaria, Nostoc and Oscillatoria.

Fungi:

Plasmodiophora, Rhizopus, Fusarium, Pilobolus, Xylaria, Aspergillus, Penicillium, Agaricus and Peziza.

Lichen:

Usnea, Parmelia.

Bryophytes:

Reboulia, Anthoceros, Pogonatum and Polytrichum

Pteridophytes:

Psilotum, Lycopodium, Selaginella, Equisetum, Alsophila and Marsilea.

Gymnosperms:

Cycas, Cupressus, Gnetum.

Palaeobotany:

Rhynia, Lepidodendron, Calamites, Lyginopteris, Williamsonia, Cordaites.

Field Trip and Report submission.

Semester	Course Code	Title of the Paper	Hours	Credit
I	21PBO1CP02	LABORATORY COURSE 2: PLANT ANATOMY, EMBRYOLOGY AND MORPHOGENESIS	2	2

Plant Anatomy and Embryology

- Study of cambium - non storied and storied.
- Study the anomalous primary and secondary features in *Aristolochia* and *Bignonia*.
- Micrometry of xylem elements.
- Study of leaf anatomy-structure, stomata, trichomes, types of stomata, study of pollen morphotypes (Malvaceae and Asteraceae)
- Isolation of different stages of embryo and polyembryony in citrus, Jamun (*Syzygium cumini*)
- Tests for pollen viability using stains and *in vitro* germination, Pollen germination using hanging drop technique.

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1ES01A	DSE-1: ECOLOGY & PHYTOGEOGRAPHY	5	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	describe the basic concepts of ecosystem and energy flow.	K1
CO-2	apply the knowledge gained on population dynamics to manage social dynamics.	K2 & K3
CO-3	evaluate the causes and consequences of climate change.	K4
CO-4	analyse the importance of biodiversity to human development.	K5
CO-5	create strategies to conserve local biodiversity.	K6

Unit-I: (15 Hours)

Introduction to ecology, Ecosystem structure and dynamics - food chain and food webs, energy flow. Mineral cycling (C, N & P). Plant succession – types and mechanism, Concept of climax vegetation, ecological indicators. Characteristics and dynamics of population- population size, growth, density and age structure.

Unit-II: (15 Hours)

Greenhouse effect - global warming, global climatic changes and consequences. Climate change conferences - role of UNFCCC and IPCC. Paris 2015 COP21: legality and respective capabilities, long-term goal, mitigation, carbon markets, transparency, compliance, adaptation. Carbon economy and carbon credits.

Unit-III: (15 Hours)

Biodiversity: types - species, genetic, ecosystem and habitat. Importance of genetic diversity with reference to crops and farm animals. Preserving the crop genetic resources-germplasm collections and the Svalbard Global Seed Vault. Centres of origin of diversity - Vavilov's and FAO's.

Unit-IV: (15 Hours)

Conservation: approaches - *in situ* and *ex situ* and their evaluation. Biodiversity - importance, assessment, loss and conservation. World organization for conservation of biodiversity, biodiversity act (2002), Red List categories of IUCN, means and ways for conservation.

Unit-V: (15 Hours)

Phytogeography: geographical history, continental drift hypothesis, land bridges and shifting of poles. Phytogeographic regions of India. Theory on plant distribution - Age and area theory, Tolerance. Concepts of endemism and hotspots, invasive and exotic species.

Books for Study

Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.

Books for References

1. Sharma, P.D. 2010. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
2. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.
3. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
4. Alexander von Humboldt, Aime Bonpl and, Stephen T. Jackson (eds.) 2013. Essay on the Geography of Plants, University of Chicago Press.

Semester	Course Code					Title of the Course					Hours	Credits
I	21PBO1ES01A					DSE-1: ECOLOGY & PHYTOGEOGRAPHY					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	2	2	2	3	2	2	2	2	2.2	
CO-2	2	3	2	2	3	3	2	2	2	2	2.3	
CO-3	2	3	2	2	2	2	2	2	2	2	2.1	
CO-4	2	2	3	2	2	2	2	2	2	3	2.2	
CO-5	2	2	2	3	3	2	3	2	2	2	2.3	
Mean Overall Score											2.22	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1ES01B	DSE-1: FORESTRY AND WOOD SCIENCE	5	4

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	outline the physical, chemical and mechanical properties of commercial wood.	K1 & K2
CO-2	acquire knowledge on wood substitution.	K3
CO-3	evaluate the raw materials needed for industries.	K4
CO-4	conserve and plan sustainable utilization of forests resources.	K5
CO-5	relate the gained skills for careers in the forest service and wood processing industry.	K6

Unit-I: (15 Hours)

World and Indian forest scenario; Forest types of India; Factors that influences forest and forest protection. Rare and endangered species. Conservation strategies; Exotics and its significance; Silviculture - principles and practices; Genetic Engineering and its application in forestry; remote sensing and GIS in forestry.

Unit-II: (15 Hours)

Forest Resources and utilization; Forest products; Forest laws and policies, people and Forest; Social and community forestry; Forest industries; Role of social forestry in cottage industry; Role of forestry in Indian economy. Biomass conversion strategies-energy plantations.

Unit-III: (15 Hours)

Nature and properties of wood - physical, chemical, mechanical and anatomy of wood, Durability of wood, Wood seasoning and preservation. Defects and abnormalities of wood; types of commercial wood species of India.

Unit-IV: (15 Hours)

Wood deterioration - fungi, insects and other agents; Wood protection - Practical methods for preserving and protection, Chemical processing of wood.

Unit-V: (15 Hours)

Composite wood: adhesives - manufacture, properties and uses; manufacture and uses of plywood, fibre boards and particle boards. Present status of composite wood, paper and rayon industries. Present position of supply of raw materials to industries and wood substitution.

Books for Study

1. Franz F. P. Kollmann, Wilfred A. Jr. Cote. 2012. Principles of Wood Science and Technology: I Solid Wood, Springer.
2. J. L. Bowyer, R. Shmulsky and J. G. 2007. Haygreen. Forest Products and Wood Science: An Introduction, Blackwell Publishing Professional.
3. De Vere Burton L. 2000. Introduction to Forestry Science, Delmar publishers, NY

Books for Reference

1. Jha, L. K. 1996. Forestry for rural development, APH Publishing Corporation, New Delhi.
2. Negi, S. S. 1994. India's Forests, Forestry and Wildlife, Indus Publishing Co., New Delhi.

Semester	Course Code					Title of the Course					Hours	Credits
I	21PBO1ES01B					DSE-1: FORESTRY AND WOOD SCIENCE					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	3	2	2	3	2	2	1	2.2	
CO-3	2	2	3	2	1	3	3	2	3	1	2.2	
CO-4	3	3	2	3	2	3	2	2	3	2	2.5	
CO-5	2	3	2	3	1	2	3	2	3	1	2.4	
Mean Overall Score											2.4	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
I	21PBO1AE01	AEC: HORTICULTURE AND LANDSCAPE DESIGNING	4	3

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	learn the brief history, divisions, classification and structure of horticultural and production of horticultural crops.	K1 & K2
CO-2	highlight the aesthetics of horticulture and post-harvest handling of techniques and marketing.	K3
CO-3	analyse plant growth environment in relation with soil, nutrients, fertilizers and nursery techniques.	K4
CO-4	design propagation methods and propagation through various specialized underground structures.	K5
CO-5	develop practical skills in micro propagation techniques, bonsai, topiary techniques and wet and dry flower decorations.	K6

Unit-1: (12 Hours)

Importance and scope of horticulture, Divisions of horticulture, Famous gardens in world & India; Tools & Implements used in horticulture, Plant Propagation: Vegetative Propagation - Cutting, Layering, Grafting & Budding. Cultural practices: Thinning, Training, Trimming & Pruning.

Unit-II: (12 Hours)

Role of tissue culture in Horticulture; Hydroponics. Nursery: definition, objectives and scope and building up of infrastructure for nursery, Preparation of Nursery beds, Transplantation – steps and Methods, Techniques of Bonsai, terrarium and topiary.

Unit-III: (12 Hours)

Cultivation Crops: Cardamom, pepper, ginger, and turmeric, Post-harvest and Conservation management, IPR issues, Import and export marketing. Floriculture: Cultivation of commercial flower crops – Rose, Orchids and *Anthurium*– economic important vegetable and fruit crops; citrus, banana, and cucurbits. Flower decoration – Dry and wet decoration.

Unit-IV: (12 Hours)

Gardening: Definition, objectives and scope, different types of gardening. Principles, methods and types of gardens and garden implements, Designing outdoor garden– hedges, edges, fences, trees, climbers, rockeries, arches, Roof garden, Indoor gardening and kitchen garden.

Unit-V: (12 Hours)

Lawn making and maintenance, water garden – cultivation of water plants, common water plants, glass house, Ornamental plants, hanging basket establishment and plant protection measures. Parks: components, types of parks, Xeriscaping. Field Visit to Horticultural station.

Books for Study

1. Subba Rao, N. S. 1997. Biofertilizers in Agriculture and Forestry. India Book House Limited, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
2. Bose, T. K., Maiti, R. G., Dhua, R. S. and Das, P. 1999. Floriculture and Landscaping. Naya Prokash, Calcutta.

Books for Reference

1. Acquaah, G. 2002. Horticulture principles and practices (2nd.ed.), Pearson Education (Singapore) Pvt. Ltd.
2. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. International Book Distributory Co.

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO1AE01					AEC: HORTICULTURE AND LANDSCAPE DESIGNING					4	3
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	2	2	3	3	2	3	2	2.5	
CO-2	2	3	2	3	3	2	3	2	3	3	2.6	
CO-3	2	3	3	2	3	3	3	2	3	2	2.6	
CO-4	3	3	3	3	2	3	3	3	2	2	2.7	
CO-5	2	2	3	2	3	3	2	3	2	3	2.5	
Mean Overall Score											2.6	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2CC04	CORE-4: PLANT PHYSIOLOGY	6	6

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	Gain a cognizance of the metabolic and physiological process unique to plants.	K1
CO-2	Impart an insight into the various plant water relations and mineral nutrition.	K2
CO-3	Comprehend the interaction between the environment and plant growth and development.	K3
CO-4	Assimilate with critical insight and in-depth analysis of main themes of plants physiology at the molecular level.	K4
CO-5	Demonstrate testable hypotheses, design targeted experiments, analyze data and present in a scientific manuscript.	K5 & K6

Unit-I (18 Hours)

Water and Plant cells: Diffusion and osmosis, water potential. Water balance of plants: absorption by roots, transport through the xylem, transpiration. Mineral nutrition: essential nutrients, deficiencies, plant disorders. Solute transport: passive and active transport, molecular basis of inter and intra cellular uptake and transport. Pattern, pathway and mechanism of translocation in the phloem.

Unit-II (18 Hours)

Photosynthesis: The light reactions- nature of light, properties and various roles of pigments, organisation of photosynthetic apparatus and light absorbing antenna systems, molecular basis of electron transport and its coupling to ATP synthesis. The carbon reactions- The Calvin-Benson cycle, photorespiration, inorganic carbon concentrating mechanisms (The C₄ carbon cycle, Crassulacean Acid Metabolism), and carbon allocation (starch and sucrose).

Unit-III (18 Hours)

Respiration: Glycolysis, gluconeogenesis and their regulation. Oxidation of pyruvate and the Citric Acid cycle. Pasteur effect, anaplerotic reactions, amphibolic nature of the Citric Acid cycle. Oxidative pentose phosphate pathway and its roles. Respiratory chain complexes and oxidative phosphorylation, internal and external NAD(P)H dehydrogenase, alternative oxidase. Non phosphorylating mechanisms and their roles. Bottom-up regulation of plant respiration. The Glyoxylate cycle.

Unit-IV (18 Hours)

Nitrogen in the environment; assimilation of nitrate and ammonium - GS- GOGAT; biological nitrogen fixation. Plant responses to light signals: the phytochromes and the blue-light responses

(cryptochromes, phototropins and zeaxanthin). Biosynthesis, metabolism, transport, physiological and developmental effects of auxin, gibberellin, cytokinin, ethylene and abscisic acid.

Unit-V

(18 Hours)

Flowering and fruit development: Floral evocation, Circadian rhythm, photoperiodism, vernalisation. Physiology of fruit development and ripening. Physiology of seed development, maturation, dormancy, germination and tropisms. Ageing and senescence-types and physiological/ biochemical changes. Abiotic stress (drought, heat and salinity): Plant responses and mechanisms of tolerance.

Books for Study

1. William G. Hopkins and Norman P.A. Huner 2009. Introduction to Plant Physiology - 4th ed. John Wiley & Sons, Inc.USA.
2. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy, 2015. Plant Physiology. 6th Ed., Sinauer Associates.

Books for Reference

1. Noggle, G.R. and Fritz, G.J. 2001, Introductory Plant Physiology, Prentice-Hall, India.
2. Devlin, R.M., 2000, Plant Physiology, Affiliated East West Press Pvt.Ltd.
3. Epstein, E., 2000, Mineral Nutrition in Plants-Principles and Perspectives, Wiley.
4. Frank B. Salisbury & Cleon W. Ross, 1992, Plant Physiology 4th Edition, Wadsworth Publishing Co., Belmont.

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2CC04					CORE-4: PLANT PHYSIOLOGY					6	6
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO1	3	3	3	2	2	3	3	3	2	3	2.7	
CO2	3	3	3	2	2	3	3	3	2	2	2.6	
CO3	3	3	3	3	3	3	3	3	2	3	2.9	
CO4	3	3	3	2	2	3	3	3	2	2	2.6	
CO5	3	3	3	3	3	3	3	3	3	3	3	
Mean Overall Score											2.76	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2CC05	CORE-5: BIOCHEMISTRY	5	5

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	describe the classification and structural organization of proteins.	K1
CO-2	identify the enzyme kinetics and illustrate the regulatory process.	K2
CO-3	apply basic principles of chemistry to biological systems.	K3
CO-4	infer the metabolism of amino acids and its regulation.	K4
CO-5	design biochemical techniques to carry out experiments.	K5 & K6

Unit-I: (15 Hours)
 Carbohydrates: Homoglycans: chemical structure and functions of starch, glycogen, cellulose, dextrin and inulin. Heteroglycan: chemical structure and functions of agar, alginic acid (sea weed polysaccharide), glycosaminoglycans, proteoglycans, glycoproteins and pectins. Glycocalyxoligo saccharide. Over view of metabolism of carbohydrate.

Unit-II: (15 Hours)
 Lipids and Biomembranes: Triglycerides, phosphoglycerols, derived lipids- steroids, prostaglandins, spingolipids, leukotrienes and lipopoly saccharides. Structure of membrane model, lipid bilayer. Structure of membrane proteins and membrane receptors: adrenalin receptors, acetylcholine receptors and insulin receptors. Over view of metabolism of lipids.

Unit-III: (15 Hours)
 Amino acids and peptides: Amino acids: general structure and classification. Glutathione: structure, metabolism and function. Biology of cyclosporin. Metabolism of phenylalanine and tyrosine; glycine, cysteine and methionine. Over view of metabolism of vitamins.

Unit-IV: (15 Hours)
 Proteins: The peptide bond and primary structure. Secondary structure, domain, motif and backbone folding. Tertiary structure and stabilizing forces in collagen. Quaternary structure of haemoglobin and its regulatory features. Protein sequencing strategies - chemical and enzymatic. Ramachandran plot.

Unit-V: (15 Hours)
 Enzymes: Principles of catalysis, activation barrier and energy changes in reaction profile, initial velocity and principles of enzyme kinetics: Michaelis-Menten Equation, K_M and V_{Max} measurements - LB blot; active site organization; and role of cofactors/vitamins. Enzyme regulation: pH, temperature and substrate concentration. Inhibitions and regulation of glutamine synthetase. Industrial applications of enzymes.

Books for Study

1. Stryer Lubert, 2005, Biochemistry, W.H. Freeman & Co., NY.
2. Lehninger, Principles of Biochemistry by Nelson, D. L., Lehninger, A. L., & Cox, M. M.(2008), 5th Edition, ISBN: 978-0-230-22699-9, Publisher: W. H. Freeman and Company, New York, p: 677-878.
3. Biochemistry by Donald Voet, Judith G. Voet, Publisher: John Wiley & Sons (2011), Fourth Edition, ISBN-10: 0071737073, ISBN-13: 978-0071737074.

Books for Reference

1. Caret et al., 1993, Inorganic, Organic and Biological Chemistry, WMC Brown, USA
2. Biochemistry Seventh Edition by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, 74 Publisher: W. H. Freeman; Seventh Edition (December 24, 2010).

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2CC05					CORE-5: BIOCHEMISTRY					5	5
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	3	3	2	1	2	3	2	2	3	2.3	
CO-2	1	3	2	2	2	3	3	1	2	3	2.1	
CO-3	2	2	3	2	3	2	3	3	2	1	2.3	
CO-4	3	1	3	3	1	2	2	2	3	2	2.2	
CO-5	1	3	2	2	2	2	3	1	2	3	2.1	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2CP03	LABORATORY COURSE 3: PLANT PHYSIOLOGY	3	3

Experiments

1. Determination of water potential (Shardakov's method).
2. Determination of solute potential.
3. Hills reaction.
4. Estimation of total acidity in CAM plants.
5. Apparent photosynthesis.
6. Effect of CO₂ concentration on photosynthesis
7. Effect of quality of light on photosynthesis
8. Estimation of total free aminoacids and proline.
9. In vivo assay of NR and NiR.
10. Estimation of IAA.
11. Estimation of starch by perchloric method.
12. Estimation of nitrogen (Nessler's method).
13. Determination of activity of peroxidase and lipase

Semester	Course Code	Title of the Course	Hours	Credit
II	21PBO2CP04	LABORATORY COURSE 4: BIOCHEMISTRY	3	3

Experiments

1. Estimation of glycogen / total polysaccharides
2. Estimation of hexosamine
3. Determination of total proteins (Bradford's / Lowry's)
4. Study of Enzyme Kinetics (experiments with acid phosphatase)
5. Effect of temperature on enzyme activity.
6. Effect of [S] on enzyme activity; measurement of V_{\max} and K_m .
7. Estimation of Ascorbic acid (Calorimetric /volumetric)
8. Estimation of Phenolics (Folin –Ciocalteu)
9. Estimation of Tannins (Folin-Denis / Vanillin hydrochloride)
10. Estimation of cholesterol
11. Thin Layer Chromatography
12. Native-PAGE

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2SP01	SELF-PACED LEARNING: PLANT BREEDING AND EVOLUTION	-	2

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	outline the progress made in the field of plant breeding.	K1
CO-2	comprehend the principles, techniques, modes of reproduction in crops and applications of plant breeding.	K2
CO-3	demonstrate the theories of evolution.	K3
CO-4	analyse the hybridization techniques.	K4 & K5
CO-5	Test the knowledge on heterosis, mutation and polyploidy.	K6

Unit-I:

Plant Breeding: Historical aspect of plant breeding and genetic basis. Breeding methods- sexual, asexual and apomitic reproduction. Floral Biology in relation to selfing and crossing techniques. Centres of diversity and origin of cultivated plants. Role of National and International Institutes.

Unit-II:

Hybridization: Objectives, Choice of parents, problems and causes of failure of hybridization. Incompatibility and sterility, Methods of handling genetic consequence of hybridization, method of handling segregation material for isolation of superior strains - Bulk method and pedigree method of selection. Role of interspecific and intergeneric hybridization in plant improvement.

Unit-III:

Inbreeding depression and heterosis: Genetic basis and application in plant breeding. Steps in the production of single cross, double cross, three way cross; induced polyploidy in plant breeding; role of auto and allopolyploidy, Heteroploids; Mutation and crop improvement. Population genetics: Hardy-Weinberg principle; gene frequencies and the factors that change it.

Unit-IV:

Back Crossing: Theory and procedure for transferring various types of character. Preservation and utilization of germplasm. Breeding of rice, sugarcane, groundnut and maize. Application of biotechnology to plant breeding - embryo rescue, somaclonal variation, doubled haploid, protoplast fusion and transgenic.

Unit-V:

Evolution: Origin of life, theories of evolution of life forms: Lamarkism, Darwinism and Speciation. Variations-Definition, causes and types, Mutations (Principles of Hugo de'veries), Role of mutations in speciation. Evidences for evolution, adaptive radiation, biological evolution. Impact of evolution on human life.

Books for Study

1. Chaudhari, R. C. 2017. Introductory Principles of Plant Breeding, Kindle Edition.
2. Singh, P. 2017. Fundamentals of Plant Breeding, Kalyani Publishers,
3. Manokaran, K. V. 2010. Essentials of Plant Breeding. PHI Learning Private Limited Publishers.

Books for Reference

1. Brown, PC and Campos, H. 2014. Introduction to Plant Breeding. 2nd Edition, Wiley Blackwell Publishers.
2. Izak Bos and Caligari, P. 2007. Selection Methods in Plant Breeding. Springer.

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2SP01					SELF-PACED LEARNING: PLANT BREEDING AND EVOLUTION					-	2
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	3	2	2	2	2	3	3	1	2	2.3	
CO-2	2	3	2	2	3	2	3	2	3	1	2.3	
CO-3	2	3	2	3	1	2	3	3	2	3	2.4	
CO-4	1	3	2	3	2	2	3	2	3	2	2.3	
CO-5	2	2	2	3	2	2	3	2	3	3	2.4	
Mean Overall Score											2.4	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2ES02A	DSE-2: BIOPHYSICS AND INSTRUMENTATION	5	4

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge on various types of centrifugation, spectroscopy and tracer techniques.	K1 & K2
CO-2	relate the importance of biophysics in modern biology.	K3
CO-3	explain the laws of thermodynamics.	K4
CO-4	evaluate and illustrate the concept of redox potential in biological system.	K5
CO-5	integrate various types of microscopy and their applications.	K6

Unit-I: (15 Hours)

Introduction to biophysics, its importance in modern biology. Bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.

Unit-II: (15 Hours)

Biophotonics: Redox potential, Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system. Osmosis and osmotic pressure, the role of osmosis in cell volume regulation. Theiso, hypo, and hypertonic solutions, their influence on the cell. Ionic diffusion. Active and passive bioelectric properties of membranes.

Unit-III: (15 Hours)

Microscopy: Bright field microscopy-magnification, resolving power, contrast. Dark field microscopy, phase-contrast microscopy, fluorescent microscopy, electron microscopy (SEM and TEM). Electrophoresis: AGE, PAGE, SDS-PAGE.

Unit-IV: (15 Hours)

Centrifugation: Principle, procedure and application. Types of centrifugation- density gradient centrifugation, ultracentrifugation and differential centrifugation. Chromatography: Principles, instrumentation, and applications of Paper, thin layer, column chromatography, gas chromatography, HPTLC and GC-MS.

Unit-V: (15 Hours)

Spectrophotometry: principles and instrumentation of UV/Vis, Atomic absorption spectrophotometer (AAS), NMR, ESR. Tracer techniques: Important stable radioisotopes and their uses in research. Radiation hazards and precautions in handling radioisotopes. Measurement of radioactivity- autoradiography, GM counter and scintillation counter.

Books for Study

1. Banerjee, PK (2008) Introduction to Biophysics, S. Chand, New Delhi.
2. McMahon, G. (2007) Analytical Instrumentation: A Guide to Laboratory, Portable and Miniaturized Instruments. John Wiley & Sons, Ltd. ISBN: 9780470027950.

Books for Reference

1. Roy R.N. A text book of Biophysics. New Central Book Agency Pvt. Ltd, Calcutta.
2. Upadhyay, Upadhyay & Nath Biophysical Chemistry. Himalaya Publ. House, Bangalore.
3. Mohan Arora Biophysics. Himalaya Publishing House, Bangalore.

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2ES02A					DSE-2: BIOPHYSICS AND INSTRUMENTATION					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	3	2	1	2	2	3	2	1	2	2.1	
CO-2	2	3	2	2	3	2	3	2	2	1	2.2	
CO-3	2	2	3	2	1	2	2	3	2	2	2.1	
CO-4	1	2	2	3	2	1	3	2	3	2	2.1	
CO-5	1	2	2	3	2	2	3	2	2	3	2.2	
Mean Overall Score											2.1	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2ES02B	DSE-2: PLANT PATHOLOGY	5	4

CO. No.	CO-Statements	Cognitive Levels (K- levels)
On successful completion of this course, students will be able to		
CO-1	acquire knowledge on pathogenesis and disease establishment in plants	K1
CO-2	learn the process of plant pathogenesis and disease establishment	K2
CO-3	recognize the effect of Microbe infection on host physiology	K3
CO-4	comprehend the various different types of disease control mechanism	K4
CO-5	familiarize the concepts in plant immunity and various defence mechanism in plants	K 5 & K6

Unit-I: (15 Hours)
 Concept of plant disease – definitions of disease, disease cycle and pathogenicity. General symptoms and Classification of plant diseases. History of Plant Pathology with special references to Indian work.

Unit-II: (15 Hours)
 Pathogenesis- pathogens and their mode of dissemination, pre-penetration, penetration and post penetration changes. Role of Chemical Weapons (Enzymes, Toxins and Growth regulators) in disease development.

Unit-III: (15 Hours)
 Effect of infection on physiology of host viz. photosynthesis, respiration, carbohydrate metabolism, nitrogen metabolism, phenols, shikimic acid pathway, importance of phenol oxidation in plant diseases.

Unit-IV: (15 Hours)
 Plant diseases: causal organisms, symptoms, disease cycle and control measures for the following diseases: White rust of Crucifers, Bacterial blight of paddy, yellow vein Mosaic of Bhindi, covered smut of Barley, Spike disease in Sandal. Integrated Disease Management (IDM) –Plant diseases control: Cultural, physical, chemical and biological methods.

Unit-V: (15 Hours)
 General concepts on plant immunity: morphological, structural defence mechanisms and biochemical defence mechanisms, pre-existing defence mechanisms. Phytoalexins, defence through induced synthesis of proteins and enzymes. Molecular Basis of Defence Mechanism: Signal Transduction, Recognition of the pathogen by the host, transmission of the alarm signal to the host defence providers.

Books for Study

1. Singh, RS. 2018. Introduction to Principles of Plant Pathology, 4th ed. Scientific International, Bengaluru, India.
2. Mehrotra, RS and Aggarwal, A. 2017. Plant Pathology. McGraw Hill Publisher Co. Ltd., New Delhi.

Books for Reference

1. Sharma PD. 2001. Microbiology and plant pathology, Rastogi publications, Meerut.
2. Rangasamy G. 1998. Diseases of crop plants in India. Prentice- Hall of India, New Delhi.
3. Mukherjee KG and Jayanti Bhasin, 1986. Plant diseases of India. Tata MacGraw-Hill, New Delhi.
4. Harsfall JG and Cowling EB. 1979. Plant Disease, an Advanced Treatise. Academic Press, NY.

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2ES02B					DSE-2: PLANT PATHOLOGY					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	2	2	2	2	3	3	3	2	2	2.3	
CO-2	2	3	2	2	2	3	2	2	2	3	2.3	
CO-3	2	2	2	2	2	3	3	2	2	2	2.5	
CO-4	2	2	2	2	2	3	3	3	2	2	2.2	
CO-5	2	2	3	2	2	2	3	3	2	2	2.3	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
II	21PSS2SE01	SEC: SOFT SKILLS	4	3

Programme Specific outcomes (PSOs)

After the successful completion of the course, students will learn:

- The dynamics of effective and professional communication skills and put them into daily use.
- To write a Professional resume using creative methods of online platforms.
- the dynamics of interview skills and GD preparations and presentations in public platforms and present the best of themselves as job seekers.
- To understand, analyze and express their personality styles and personal effectiveness in various environments.
- To learn and update themselves with the required knowledge in Numerical ability and Test of Reasoning for competitive examinations.

Course outcomes (COS)

On successful completion of this course, students will be able to:

- exposed and trained in various nuances of Soft Skills in a Professional manner responding to the requirements of national and international market
- synthesize the knowledge and practical skills learnt to be personal effective in any managerial positions
- construct plans and strategies to work for better human society
- illustrate the problems at work and home and design solutions and maintain a balance of work and home
- connect on a continuum and maintain growth and sustainability and creativity in employment that increases in productivity, profit for individuals and the society.

Module 1: Effective Communication & Professional communication

Effective communication: Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication. JOHARI Window as a tool of effective communication.

Professional Communication: The Art of Listening, The passage, Kinesthetic, Production of Speech, Speech writing, Organization of Speech, Modes of delivery, Conversation Techniques, Good manners and Etiquettes, Different kinds of Etiquettes, Politeness markers.

Module II. Resume Writing & Interview Skills

Resume Writing: Meaning and Purpose. Resume Formats. Types of s Resume. Functional and Mixed Resume, Steps in preparation of Resume, Model resumes for an IT professional Chronological, Types of interviews, Creative resumes using online platforms

Interview Skills: Common interview questions, Dos and Don'ts for an interview, Attitude, Emotions, Measurement, Body Language, Facial expressions, Different types of interviews, Telephonic interviews, Behavioral interviews and Mock interviews (Centralized).

Module III: Group Discussion & Team Building

Group Discussion: Group Discussion Basics, GD as the first criterion for selecting software testers, Essentials of GD, Factors that matter in GD, GD parameters for evaluation, Points for GD Topics, GD Topics for Practice, Tips for GD participation. Video shooting of GD presentation & Evaluation (Centralized)

Team Building: Characteristics of a team, Guidelines for effective team membership, Pedagogy of team building, Team building skills. Team Vs Group – synergy, Types of synergy, Synergy relates to leadership, Stages of Team Formation, Broken Square-Exercise, Leadership, Leadership styles, Conflict styles, Conflict management strategies & Exercises

Module IV: Personal Effectiveness

Personal Effectiveness: Self Discovery: Personality, Characteristics of personality, kinds of self, Personality inventory table, measuring personality, intelligence and Exercises

Self Esteem: Types -High & Low self-esteem, Ways of proving self-esteem, Hypersensitive to criticism, activities. **Goal setting:** Goal setting process, Decision making process & Exercises.

Stress Management: Identifying stress, Symptoms of stress, Responding to Stress, Sources of stress, Coping with stress and Managing stress.

Module V: Numerical Ability

Average, Percentage, Profit and Loss, Problems of ages, Simple Interest, Compound Interest, Area, Volume and Surface Area, Illustration, Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Illustrations, Boats and Streams, Calendars and Clocks.

Module VI: Test of Reasoning

Verbal Reasoning: Number series, letter series, coding and decoding, logical sequence of words, Assertion and Reasoning, Data Sufficiency, Analogy, Kinds of relationships.

Non-Verbal Reasoning: Completion of Series, Classification, analogical, Pattern comparison, Deduction of figures out of series, Mirror Reflection Pattern, Hidden figures, Rotation pattern, Pattern completion and comparison, Sense of direction, Blood relations.

Text cum Exercise book

1. Melchias G, Balaiah John, John Love Joy (Eds), 2018. *Winners in the Making: A primer on soft skills*. SJC, Trichy.

Books for References

1. Aggarwal, R.S. *Quantitative Aptitude*, S.Chand & Sons.
2. Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non Verbal Reasoning*. S.Chand & Co, Revised Edition.
3. Covey, Stephen. (2004). *7 Habits of Highly effective people*, Free Press.
4. Egan, Gerard. (1994). *The Skilled Helper* (5th Ed). Pacific Grove, Brooks/Cole.

5. Khera ,Shiv (2003). *You Can Win*. Macmillan Books , Revised Edition.

Other Text Books

- * Murphy, Raymond. (1998). *Essential English Grammar*. 2nd ed., Cambridge University Press.
- * Prasad, L. M. (2000). *Organizational Behaviour*, S.Chand & Sons.
- * Sankaran, K., & Kumar, M. *Group Discussion and Public Speaking* . M.I. Pub, Agra, 5th ed., Adams Media.
- * Schuller, Robert. (2010) . *Positive Attitudes*. Jaico Books.
- * Trishna's (2006). *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
- ** Yate, Martin. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

Semester	Course Code	Title of the Course	Hours	Credits
II	21PBO2EG01	GENERIC ELECTIVE 1 (WS): MEDICINAL BOTANY	4	3

CO. No.	CO- Statements	Cognitive Levels (K- levels)
On successful completion of this course, students will be able to		
CO-1	obtain the knowledge about understanding of principle and treatment methods of various Traditional system of medicines.	K1 & K2
CO-2	comprehend the current trade status and role of medicinal plants in socio economic growth.	K3
CO-3	investigate the suitable conservation method for medicinal plants using modern biotechnology tools to ensure the sustainable utilization.	K4
CO-4	evaluate the Ethno botany knowledge based drug products efficacy and its various applications in drug industries.	K 5
CO-5	create new drug formulations using therapeutically valuable phytochemical compounds for the healthy life of society.	K6

Unit I:

(12 Hours)

Key Historical events, Scope and importance of medicinal plants. Traditional medicinal systems: Siddha, Ayurvedha, Homeopathy, Chinese medicine, Unani, Naturopathy and Aromatherapy. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants.

Unit II:

(12 Hours)

Classification of herbal drugs based on the Alphabetical, Morphological, Taxonomical, Chemical and pharmacological. Collection and processing of herbal raw materials for drugs preparation-Post Harvesting care, Drying, Dressing, Packing and Storage. Conservation and mass propagation of important medicinal plants through *In vitro* propagation methods. Role of NMPB, CDRI and CIMAP on medicinal plants conservation and research development. WHO regulation and Guidelines for quality control and trade of herbal medicine.

Unit III:

(12 Hours)

Ethnobotany - concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Role of ethnobotany in modern Medicine Medico-Ethnobotanical sources – Eg. Contribution of Kani Tribes. Ethnobotany and plant genetic resources conservation of medicinal plants with special reference to India. Major tribes of South India and their ethno botanical knowledge.

Unit IV:

(12 Hours)

Phytotherapeutic compounds of medicinal plants - Alkaloids, Glycosides, Terpenoids, Tannins, Flavonoids and Phenols. Patent guidelines for Phytotherapeutic compounds. Identification and utilization of the medicinal herbs in curing various ailments – *Catharanthus roseus* (Anti-cancer), *Aegle marmelos* (Cardiotonic), *Withania somnifera* (Drugs acting on nervous system), *Cardiospermum halicacabum* (Anti-rheumatic) and *Centella asiatica* (Memory booster), *Phyllanthus emblica* (Rejuvenating) and *Phyllanthus niruri* (Hepato-protective).

Unit V:**(12 Hours)**

Medicinally useful plant parts: Root – *Hemidesmus indicus* and *Rauvolfia serpentina*; Rhizome – *Acorus calamus* and *Curcuma longa*; Stem- *Tinospora cordifolia* and *Santalum album*; Bark – *Terminalia arjuna* and *Saraca asoca*; Leaf – *Andrographis paniculata* and *Cynodon dactylon*; Flowers – *Crocus sativus* and *Syzygium aromaticum*; Fruits - *Piper longum* and *Terminalia chebula*; Seeds – *Azadirachta indica* and *Trigonella foenum-graecum*.

Books for Study

1. Evans, 2009. Pharmacognosy, Elsevier Publications, Edinburgh.
2. James Green, 2000 Herbal Medicine-Maker's Handbook, Crossing Press, U.S.
3. Weiss, Rudolf Fritz 2000 Herbal Medicine, 2nd Edition Thieme Medical Publishers
4. Kokate CK, Purohit AP and Gokahale, 2006. Pharmacognosy, Nirali Prakashan.
5. Somasundara, S 1997. Maruththuva Thavaraiyal, Ilangovan Padhippagam, Palayamkottai.
6. Cultivation of Medicinal and Aromatic crops by A.A. Farooqui and B.S. Sreeramu (2004).
7. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
8. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd Edn. Agrobios, India.
9. Quality control and evaluation of Herbal Drugs by Pulok.K. Mukarjee (2019).

Web Resources

1. <http://www.gallowglass.org/jadwiga/herbs/preparations.html>
2. <http://shawnacohen.tripod.com/thetribaltraditions/id51.html>
3. <http://www.vasundharaorissa.org/Research%20Reports/GlobalisationAndMedicinalplantsOfOrissa.pdf>
4. http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

Semester	Course Code					Title of the Course					Hours	Credits
II	21PBO2EG01					GENERIC ELECTIVE 1 (WS): MEDICINAL BOTANY					4	3
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	1	3	3	3	1	2	2	2.3	
CO-2	3	2	3	3	3	1	2	3	3	2	2.5	
CO-3	3	3	3	2	3	2	3	3	2	3	2.7	
CO-4	3	1	3	2	3	2	3	1	2	2	2.2	
CO-5	2	3	2	2	3	1	1	2	3	2	2.1	
Mean Overall Score											2.36	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3CC06	CORE-6: PLANT SYSTEMATICS	5	5

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	perceive interdisciplinary approaches on classification of angiosperms.	K1
CO-2	gain confidence and proficiency in evaluating comparative data and in making sound taxonomic judgements.	K2
CO-3	demonstrate specific mastery in recognise, compare and contrast distinctive attributes among the major groups of angiosperms.	K3
CO-4	acquire the vital skills for conducting extensive field and herbarium studies.	K4 & K5
CO-5	equip themselves with skills in writing short species description, illustration, field identification and scientific photography.	K6

Unit-I: (15 Hours)

Overview of Plant Systematics - Phenetics (artificial, natural classification) and Cladistics (Phylogenetic systematics): terms and concepts, taxon selection, character analysis, cladogram construction, cladogram analysis - Angiosperm Phylogeny Group classification: principles of APG system, short version of APG I, APG II and APG III, detailed version of APG IV.

Unit-II: (15 Hours)

Taxonomic hierarchy: principal ranks - species concept and infraspecific categories (subspecies, varieties and forms) - genus concept and infrageneric categories (subgenus, section and series) - family concept and infrafamily categories (subfamily, tribe and sub tribe).

Unit-III: (15 Hours)

Botanical nomenclature: ICN principles; scientific names; authorship; nomenclatural types; valid publication; priority of publication; conservation of names; retention and rejection; taxonomic revision; synonyms; names of hybrids and cultivated plants.

Unit-IV: (15 Hours)

Plant identification: field inventory; herbarium techniques, Flora (e-flora), monographs; journals; taxonomic key. Systematic evidence: morphology; anatomy; palynology; embryology; cytology; phytochemistry.

Unit-V:**(15 Hours)**

Molecular systematics: Plant genomes- nuclear, chloroplast and mitochondria. Molecular markers, generating molecular data, restriction site mapping, gene sequencing, analysis of molecular data, alignment of sequences, methods of phylogeny reconstruction.

Books for Study

1. Michael G. Simpson. 2019. Plant Systematics - 3rd ed., Academic Press, New York, USA.
2. Crawford, D.J. 2003. Plant Molecular Systematics, Cambridge University Press, Cambridge, UK.
3. Heywood, VK & Moore, DM. 1984. Current Concepts in Plant Taxonomy, Academic Press, London.

Books for Reference

1. Grant, WF. 1984. Plant Biosystematics, Academic Press Inc., Canada.
2. Harborne, JB. & Turner, BL. 1984. Plant Chemosystematics, Academic Press, London.
3. Hillis, DM, Moritz, C & Mable, BK. 1996. Molecular Systematics, Sinauer Associates, Sunderland, USA.

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3CC06					CORE-6: PLANT SYSTEMATICS					5	5
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO1	3	3	2	2	2	3	3	3	2	2	2.5	
CO2	3	3	3	2	3	3	3	3	3	3	2.9	
CO3	3	3	3	2	3	3	3	3	3	3	2.9	
CO4	3	3	3	3	3	3	3	3	3	3	3.0	
CO5	3	3	3	2	2	3	3	3	3	3	2.8	
Mean Overall Score											2.82	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3CP05	LABORATORY COURSE 5: PLANT SYSTEMATICS	4	3

PRACTICALS:

1. Exercise in key making.
2. Binomial identification using Flora.
3. Study and submission of digital description of the following families with reference to their South Indian representatives and minimum of one member each to be described, dissected and sketched to scale (classification based on APG IV, 2016):

BASAL ANGIOSPERM: Nymphaeales - Nymphaeaceae

MAGNOLIIDS: Peperales - Aristolochiaceae

MONOCOTS: Alismatales - Araceae, Hydrocharitaceae, **Commelinales** – Commelinaceae, **Poales** - Cyperaceae

EUDICOTS: Ranunculales - Menispermaceae

ROSIDS: Malpighiales - Passifloraceae, **Sapindales** - Meliaceae, **Brassicales** - Cleomaceae

SUPERASTERIDS: Santalales - Loranthaceae, **Caryophyllales** - Caryophyllaceae, Aizoaceae

ASTERIDS: Solanales - Convolvulaceae, **Lamiales** - Scrophulariaceae, Acanthaceae, Verbenaceae

4. Exercise in the important Articles of the Code.
5. Cladogram construction and analysis.
6. Submission of herbaria of any five plant species.
7. Field trip report.

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3CC07	CORE-7: RESEARCH METHODOLOGY	5	4

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	Obtain knowledge on basic concepts in Research and in Biostatistics.	K1
CO-2	Acquire knowledge on sampling techniques, evaluate literature, collection of data and thesis writing..	K2
CO-3	Analyze the significance of databases and Citation Index.	K3
CO-4	Acquire skill in writing research articles and formatting the papers.	K4
CO-5	Solve and statistically analyse the data of variables	K5 & K6

Unit-I: (15Hours)

Research - types, objectives and approaches. Census method, Sample -types; Sampling techniques. Hypothesis: definition, characteristics, types, significance. Methods of collecting data: primary and Secondary- merits and demerits, Code of research ethics. Literature collection: Books, Research articles and e-resources.

Unit- II (15Hours)

Structure of thesis & research article. Journals in Life Sciences, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Software. Manuscript for publication and proof correction. Structure and components of research proposal, National and International funding sources.

Unit-III: (15Hours)

Bibliometrics: definition and relevance; Bibliometrics databases, h-index, SNIP, Page Rank, Impact Factor and evaluation. The use of bibliometrics in research: Citation Research, Science Citation Index. The Institute for Scientific Information (ISI), Thomson Reuter's Webmetric and ORCID. Tailored Research and Retraction. Indian Patent Act.

Unit-IV: (15Hours)

Biostatistics: Introduction. Classification of data; Frequency Distribution: Discrete, Continuous and Cumulative Frequency Distributions; Tabulation of data; Diagrammatic and graphical representation of data: Bar Charts: Simple, Multiple & Sub divided, Histogram, Frequency polygon, Ogive curve, Pie diagram. Measures of Central values: Mean, Median and Mode. Measures of Dispersions: Range, Mean deviation and Standard deviation.

Unit-V: (15Hours)

Skewness and Kurtosis. Probability: Binomial, Poisson and Normal distributions. Correlation: types, methods. Regression analysis, Large sample (Z), small sample testing: Test of Significance; t-test, chi-square and F test. ANOVA - one and two way, Duncan Multiple Range Test. Principles of experimental design - randomization, replication, local control, size and shape of the plot, CRD, RBD.

Books for Study

1. Kothari, C. R. 2014. Research Methodology-Methods & Techniques. WishwaPrakashan.
2. Misra, R. P, 2000. Research Methodology - A Handbook, Concept Pub. Company, NewDelhi.
3. Pillai and Bagavathi, 2008 Statistics, S. Chand& Company Ltd, NewDelhi.

Books for Reference

1. Gupta, SP. 1990. Statistical Methods, Sultan Chand & Sons, NewDelhi.
2. Nageswara Rao, G. 1983. Statistics for Agricultural Science Oxford & IBH, NewDelhi
3. Gupta, SC. 2013. Fundamentals of statistics, Himalaya Publishers,Mumbai.

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3CC07					CORE-7: RESEARCH METHODOLOGY					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	2	2	3	2	2	3	2	2.4	
CO-2	2	3	2	3	2	3	2	3	2	1	2.3	
CO-3	2	2	3	2	1	3	3	2	3	1	2.2	
CO-4	3	3	2	3	2	3	3	2	3	2	2.6	
CO-5	2	2	3	2	1	3	2	3	2	1	2.1	
Mean Overall Score											2.4	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3CC08	CORE-08: PHARMACOGNOSY	4	3

CO. No.	CO- Statements	Cognitive Levels (K- levels)
After the successful completion of the course, student will be able to		
CO-1	acquire the knowledge about understanding of Principle and Treatment methods of various Traditional system of medicines.	K1 & K2
CO-2	learn the identification, pharmacological importance and processing of medicinal plants based on their classification and characterization.	K3
CO-3	analyze the suitable conservation method for medicinal plants using modern biotechnology tools to ensure the sustainable utilization.	K4
CO-4	evaluate the medicinal plants based drug efficacy and its various applications for different ailments	K5
CO-5	create new drug formulations using phytochemical compounds for the healthy life of society.	K6

Unit-I (12 Hours)

Traditional and alternative system of medicine-Principle, practice, short history and merits of herbal medicine- Siddha, Ayurveda, Homeopathy, Chinese medicine, Unani, Naturopathy, Aromatherapy and acupuncture. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants.

Unit-II (12 Hours)

Classification of crude drugs - alphabetical, taxonomical, morphological, chemical, pharmacological (therapeutic). Medicinal plants - Mass Cultivation methods for sustainable utilization, Collection and processing of herbal raw material for drugs Preparation-Post Harvesting care, Drying, Dressing, Packing and Storage. Conservation and mass propagation of important medicinal plants through *In vitro* propagation methods.

Unit-III (12 Hours)

Medicinally useful plant parts: Root –*Hemidesmus indicus*, *Withania somnifera* and *Rauvolfia serpentina*; Rhizome - *Zingiber officinalis*, *Acorus calamus* and *Curcuma longa*; Stem- *Tinospora cordifolia*, *Santalum album*; Bark – *Terminalia arjuna*, *Cinnamomum verum* and *Saraca asoca*; Leaf – *Adhatoda vasica*, *Ocimum sanctum* and *Cynodon dactylon*; Flowers – *Crocus sativus*, *Syzygium aromaticum* and *Leucus aspera*; Fruits – *Phyllanthus emblica*, *Piper longum* and *Terminalia chebula*; Seeds – *Azadirachta indica*, *Trigonella foenum-graecum* and *Ricinus communis*.

Unit-IV (12 Hours)

Herbal preparation methods - bolus, capsules, compresses, creams, decoctions, extracts, infusions, herbal tea, ointments, massage oils, medicinal vinegar, poultice & plasters, powders, salves, syrups, tinctures, tonic, maceration and baths and bathing remedies and

dry extract (pills or capsules). Application of herbal formulations for the treatment of certain diseases- Jaundice, Fever, Cardiac, Infertility, Diabetics, Blood pressure, Skin care and Respiratory diseases.

Unit-V

(12 Hours)

Pharmaceutical plant products- alkaloids, glycosides, terpenoids, tannins, flavonoids, lipids, proteins. Nutraceuticals, cosmeceuticals, pharmaceuticals - fibre, sutures, surgical dressings, adaptogens, rasayana. Drug adulteration and methods of evaluation-physical, chemical and microscopic. NMPB, CDRI, CIMAP, CIPLA; WHO regulation and Guidelines for quality control and trade of herbal medicine.

Books

1. Evans, 2009. Pharmacognosy, Elsevier Publications, Edinburgh.
2. James Green, 2000 Herbal Medicine-Maker's Handbook, Crossing Press, U.S.
3. Weiss, Rudolf Fritz 2000 Herbal Medicine, 2nd Edition Thieme Medical Publishers
4. Kokate CK, Purohit AP and Gokahale, 2006. Pharmacognosy, NiraliPrakashan.
5. Somasundara, S 1997. Maruththuva Thavaraiyal, Ilangovan Padhippagam, Palayamkottai
6. Cultivation of Medicinal and Aromatic crops by A.A. Farooqui and B.S. Sreeramu (2004)
7. Quality control and evaluation of Herbal Drugs by Pulok.K. Mukarjee (2019)

Online Resources

1. <http://www.gallowglass.org/jadwiga/herbs/preparations.html>
2. <http://shawnacohen.tripod.com/thetribaltraditions/id51.html>
[http://www.vasundharaorissa.org/Research%20Reports/Globalisation And](http://www.vasundharaorissa.org/Research%20Reports/Globalisation%20And)
3. http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3CC08					CORE-08: PHARMACOGNOSY					4	3
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	1	3	3	3	1	2	2	2.3	
CO-2	2	2	3	1	2	1	3	3	2	3	2.2	
CO-3	3	3	3	2	3	2	3	3	2	3	2.7	
CO-4	3	1	3	2	3	2	3	1	2	2	2.2	
CO-5	2	3	2	2	3	1	1	2	3	2	2.1	
Mean Overall Score											2.30	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3CP06	LABORATORY COURSE 6: RESEARCH METHODOLOGY	3	2

Research Methodology

1. Sampling
2. Collection of data
3. Classification of data
4. Diagrammatic representation of data
5. Measures of central value
6. Measures of dispersion
7. Test of significance
8. Bibliometrics
9. H-Index

Pharmacognosy

1. Chromatographic separation of amino acids (paper) and lipids (TLC).
2. Spectrophotometry: Standard graphs for proteins. (BSA), Glycine and Glucose.
3. Sampling
4. Classification of data.
5. Diagrammatic representation of data.
6. Measures of Central values.
7. Measures of dispersion.
8. Test of significance.
9. Identification and uses of locally available medicinal plants parts – Leaf: *Andrographis paniculata*, *Cardiospermum helicacabum* and *Cymbopogon citratus*. Rhizome: *Acorus calamus*, *Alpinia galanga* and *Curcuma longa*. Tubers: *Asparagus racemosus*, *Gloriosa superba* and *Withania somnifera*. Root: *Hemidesmus indicus*, *Vetiveria zizanioides* and *Achyranthus aspera*. Flower: *Syzygium aromaticum*, *Cassia auriculata* and *Hibiscus rosa-sinensis*. Bark: *Cinnamomum verum*, *Terminalia arjuna* and *Saraca asoca*. Seeds: *Ocimum basilicum*, *Trigonella foenum-graecum*, and *Trachyspermum ammi*. Fruits: *Piper longum*, *Ficus racemosa* and *Garcinia gummi-gutta*.
10. Preparation of aqueous, methanolic and ethanolic leaf extracts of medicinal plants using soxhlet apparatus.
11. TLC separation of plant components.
12. Antimicrobial screening of bioactive principles of medicinal plants.
13. Preparation of ointment using plant materials.
14. Preparation of rejuvenating herbal foods.
15. Qualitative analysis of phytochemicals (Brinda *et al.*, 1981).

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3ES03A	DSE-3: ORGANIC FARMING	5	4

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	summarize the aims and objectives of organic farming and identify the regulations governing organic farming.	K1 & K2
CO-2	apply the acquire knowledge about organic Certification process and procedure.	K3
CO-3	integrate the skill to become an entrepreneur.	K4
CO-4	check the practices involved in maintaining soil fertility and plant productivity.	K5
CO-5	plan a proper pest management strategy for various crops.	K6

Unit- I (15 Hours)

Concepts and scope of organic farming, Requirements for organic farming, Farm components for an organic farm. Conversion to organic farming- Process, green card systems and subsidies. Fundamentals of Livestock farming, animal behavior, Poultry management.

Unit-II (15 Hours)

Types of Farming, Concept of different cropping systems in relation to Organic Farming (Inter cropping), nutrient uptake and balanced nutrient supply, organic manure, green and liquid manure, biofertilizers and their method of use, Compost: decomposition, manure – Types vermicompost: Scope and importance, use of vermi castings in organic farming, Potentials and constraints for vermiculture in India.

Unit-III (15 Hours)

Soil formation, types of soil according to composition, methods of increasing soil productivity and fertility, Cultivation of crops with organic inputs: field crops and leguminous crops. Plant protection measures: integrated pest and disease management, biopesticides, treatment methods, importance of neem in organic agriculture.

Unit-IV (15 Hours)

Organic crop production methods- sugarcane, mango, ginger, medicinal and ornamental crops. Green labels, Bio-fuel crops. Integrated Nutrient Management (INM) and Integrated Plant Nutrient Supply System (IPNS). Organic produce quality considerations, certification, accreditation process, marketing and Economics.

Unit-V (15 Hours)

National and international status of organic farming. Agencies and institutions related to organic farming. Organic Food Quality and Human Health. Entrepreneurship Development- Concept, characteristics and approaches. Income generation activities: Apiculture, Mushroom production, Organic milk production.

Books for Study

1. S.P. Palaniappan and K. Annadurai. 2007 Organic Farming – Theory and Practice. Scientific Publishers (India).
2. Lakshmi, Narasaiah M. 2010. Agriculture and Water Management. Discovery publishing House, New Delhi

Books for Reference

1. P.K. Gupta. 2012. Vermicomposting for sustainable Agriculture. Agrobios.
2. N. Kumar. 2010. Introduction to Horticulture. Oxford & Ibh Publishing Co. Pvt. Ltd.
3. Kristensen, P., Taji, A. and Reganold, J. (2006). Organic Agriculture: A Global Perspective. CSIRO Press, Victoria, Australia.

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3ES03A					DSE-3: ORGANIC FARMING					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	3	2	3	2	2	3	1	2	3	2.3	
CO-2	1	2	3	2	2	3	2	3	2	2	2.2	
CO-3	1	2	3	2	2	3	3	2	2	3	2.3	
CO-4	3	2	2	3	1	3	3	1	2	3	2.3	
CO-5	2	3	2	1	3	1	2	2	3	3	2.2	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3ES03B	DSE-3: BIOINFORMATICS AND BIONANOTECHNOLOGY	5	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	study the basic elements of interface, concepts between biology and nanotechnology.	K1
CO-2	outline the basics of sequence alignment and analysis.	K2
CO-3	classify different types of biological databases.	K3
CO-4	explain the synthesis approaches for nanomaterial and its characterization.	K4
CO-5	construct various types of nanomaterial for application and evaluate the impact on environment.	K5 & K6

Unit-I

(15 Hours)

Overview of Bioinformatics, Need for Bioinformatics technology, Data format and processing, secondary resources and applications. Role of structural bioinformatics, Biological data integration system. Bioinformatics and its applications. Biological Database Retrieval System - NCBI, PUBMED, EBI, EMBL, DDBJ and Gen- Bank.

Unit-II

(15 Hours)

Database searches for homology using BLAST and FASTA. Proteomic data bases - Swiss-Prot, Uni-Prot, ExPASy and PDB. RNA data bases-Rfam and GtRNA. Phylogenetic analysis- Construction of Phylogenetic tree with reference to DNA and Protein sequences. Biological importance of computerized Phylogenetic analysis.

Unit-III

(15 Hours)

Nanotechnology – definition, origin, scope and importance. Principles: quantization effects - inverse relationship between size and reactive surface area. Properties: surface effects, the effects of size, shape and surface area. Advances made with plant nanobionics-bomb detection, glowing plants, augmented photosynthesis, etc. Essentials of nanostructure generation: top-down vs. bottom-up. Physical, chemical and biogenic synthesis of nanomaterials - biomimetics, green plants and microorganisms. Role of biomolecules - reducing and/or capping agents: proteins, viruses and carbohydrates.

Unit-IV

(15 Hours)

Detection and measurement of nanoparticles - physical characterization by UV, FTIR, SEM, FESEM, DLS, X-ray diffraction and Zeta potential. Targeted nanoparticles: active & passive targeting. Application: medicine, manufacturing & materials, delivery vehicles, cancer therapy, tissue engineering, fluorescent biological labels, biological assays, imaging agents, biosensors, manipulation of cells and biomolecules.

Unit-V

(15 Hours)

Interactions between nanoparticles and living systems, interaction with cells, exposure of living systems to nanomaterials - toxicity effects. Mediators of the toxicity of particles. Factors influencing the interaction of nanomaterials over mammalian cells: uptake, transport and

biodistribution of nanoparticles in living system, toxicity on cellular processes. Overview of EU regulatory aspects.

Books for Study

1. Sharon, M. & Sharon, M 2012. Bio-Nanotechnology- Concepts and Applications, CRC Press.
2. Atkinson WI.2011. Nanotechnology. Jaico Book House, New Delhi.
3. Imtiaz Alam Khan. (2005). Elementary bioinformatics. Pharma Book Syndicate, Hyderabad.
4. Rastogi, S.C., Medirattta, N. and Rastogi. P. (2004). Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, Pvt. Ltd., New Delhi.
5. Nalwa HS. 2005. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology. American Scientific Publ.
6. Niemeyer CM & Mirkin CA. 2005. Nanobiotechnology. Wiley Interscience.
7. Introduction to Nanoscience, S.M. Lindsay, Oxford universal Press, First Edition, 2010
Nanotechnology: Understanding small system, Ben Rogers, Sumita Pennathur and Jesse Adams, CRC Press, Second edition, 2011.

Books for References

1. Barbara Panessa-Warren, 2006 Understanding cell-nanoparticle interactions making nanoparticles more biocompatible. Brookhaven National Laboratory
2. European Commission, SCENIHR, 2006. Potential risks associated with engineered and adventitious products of nanotechnologies, European Union
3. Gysell Mortimer, 2011. The interaction of synthetic nanoparticles with biological systems PhD Thesis, School of Biomedical Sciences, Univ.of Queensland.
4. Jain K.K. Nanobiotechnology molecular diagnostics: Current techniques and application (Horizon Bioscience) 2006 Taylor & Francis 1st edition.

Web Resources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419715/>
2. <https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html>
3. <http://www.particle-works.com/applications/controlled-drug-release/Applications>

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3ES03B					DSE-3: BIOINFORMATICS AND BIONANOTECHNOLOGY					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	3	2	1	2	2	3	2	1	2	2.1	
CO-2	2	3	2	2	2	2	3	2	2	3	2.3	
CO-3	2	2	3	2	1	2	2	3	2	2	2.1	
CO-4	1	2	2	3	2	2	3	2	3	2	2.2	
CO-5	1	2	2	3	2	2	3	2	1	3	2.1	
Mean Overall Score											2.2	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
III	21PBO3EG02	Generic Elective - 2 (BS): HORTICULTURE AND LANDSCAPING	4	3

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	learn the brief history, divisions, classification and structure of horticultural and production of horticultural crops.	K1
CO-2	highlight the aesthetics of horticulture and post-harvest handling of techniques and marketing.	K2
CO-3	evaluate and analyse different landscaping and planting techniques.	K3 & K4
CO-4	develop practical skills in micro propagation techniques, bonsai, topiary techniques and wet and dry flower decorations.	K5
CO-5	design propagation methods and propagation through various specialized underground structures.	K6

Unit-I: (12 Hours)

Importance and scope of horticulture; divisions of horticulture; climate, soil and nutritional needs. Plant propagation methods - Cutting, Grafting, Budding and Layering. Natural horticultural gardening in India.

Unit-II: (12 Hours)

Indoor gardening - foliage, flowering plants and hanging basket. Terrarium, Bonsai and topiary plants. Floriculture –cultivation of commercial flower crops - rose, orchids and *Anthurium*. Flower decoration-dry and wet.

Unit-III: (12 Hours)

Fruit crops - induction of flowering, flower thinning, fruit setting and development. Cultivation of important fruit crops - Mango and Guava.

Unit-IV: (12 Hours)

Landscaping principles - planning design for house gardens, institutional and industrial gardens- bioaesthetic, avenue planting, railway planting- Avenue trees, shrubs, climbers, herbs and ground covers, pruning - tree transplantation.

Unit-V: (12 Hours)

Lawns: different grasses, maintenance of lawns and rockeries; special types of gardens - vertical garden, roof /terrace garden, bog garden, water garden, planning parks and public garden.

Books for Study

1. Arora JS. 1992. Introductory Ornamental Horticulture, Kalyani Publishers, New Delhi.
2. George Acquaah. 2002. Horticulture Principles and Practices, 2nd Edn. Pearson Edn, Delhi.

Books for References

1. Manibushan Rao K. 1991. Text book of horticulture. MacMillan Publishing Co., New York.
2. Edmond JB et al., 1977. Fundamentals of horticulture. Tata McGraw Hill Ltd., New Delhi.
3. Rao KM. 2000. Text Book of Horticulture, MacMillan India Ltd., New Delhi.
4. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore.

Semester	Course Code					Title of the Course					Hours	Credits
III	21PBO3EG02					GENERIC ELECTIVE-2 (BS): HORTICULTURE AND LANDSCAPING					4	3
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	2	2	3	3	2	2	3	2	2.4	
CO-2	2	3	2	3	2	1	3	2	2	3	2.3	
CO-3	2	3	3	2	2	3	2	2	3	1	2.3	
CO-4	3	3	2	2	2	3	2	3	1	2	2.3	
CO-5	2	2	3	1	3	2	2	3	2	3	2.3	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4CC09	CORE-9: MICROBIOLOGY AND IMMUNOLOGY	5	5

CO No.	CO- Statements	Cognitive Levels (K- levels)
On successful completion of this course, students will be able to:		
CO-1	understand the various types of microbes in an environment and their importance.	K1
CO-2	demonstrate the role of microorganisms in food processing and spoilage, soil fertility and sewage disposal	K2
CO-3	assess role of microorganisms in industrial processing of microbial products	K3
CO-4	distinguish the structure and function of immune system in humans.	K4
CO-5	evaluate and justify the defence mechanism against infection in plants and humans.	K5 & K6

Unit-I: (15 Hours)

Scope, branches and history. Structure and organization of Bacteria, Actinomycetes. Brief study on Spirochetes, Rickettsias, Chlamydias and Mycoplasmas, Viruses – Structure, organization, replication. Brief account on Viroids, virusoids and prions. Culture of microorganisms: synchronous, batch and continuous culture. Chemostat and turbidostat, Methods of preservation of microbes.

Unit-II: (15 Hours)

Food, dairy and environmental microbiology. Source of Microbial contamination of food; food poisoning and food-borne infections. Methods of food preservation. Microbial contamination of milk, milk-borne diseases - preservation of milk and dairy products. Soil microbes and their role in biogeochemical cycling.

Unit-III: (15 Hours)

Industrial microbiology: selection of industrially useful microbes, fermentation processes, recovery of end products; production of alcohol, insulin, lactic acid, single cell oil and single cell protein. Common immunizations, antibiotics and other chemotherapeutic agents and their mode of action. Drug resistance in microbes.

Unit IV: (15 Hours)

Immunology: Role of genes in plant and animal immune system. Plant innate immunity: Role of Salicylic Acid, Jasmonate and Ethylene Signaling, Pre-existing-structural innate mechanisms: The wax layer and cuticle, Cytoskeleton, Hydathodes, Lenticles, Guard cells, Trichomes, Idioblasts. Pre-existing biochemical innate mechanisms: Anti-microbial compounds, Toxic inhibitors, Phytoanticipins and Phytohormones. Immune cells - haemopoiesis -detailed study of T and B cells, MHC molecules and antigen processing and presentation. General structure of antibodies. Immunological role of Monoclonal antibodies.

Unit V: (15 Hours)

Antigens - types, antigenicity and immunogenicity. Antigen-antibody interaction. Types of immunity - innate and adaptive - emphasis on cell mediated and humoral immune responses. Immune response during bacterial (Tuberculosis), parasitic (malaria) and viral (HIV) infections. Autoimmune disorders. Vaccines and their mode of action.

Books for Study

1. Sullia, S.B. and Shantharam, S. 1998. General Microbiology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi **Unit-II and Unit-III**
2. Pelczar, M.J., Reid, R.D. and Chan, E.C.S. 1983. Microbiology, Tata McGraw Hill Publishing Co., New Delhi. **Unit I**
3. Prescott et al., 2009 7e, Microbiology. Wm. C. Brown Publishers.
4. Kuby J, 2000, Immunology, 4th edition, WH Freeman.

Books for Reference

1. Reed, G. 1983. Prescott & Dunn's Industrial Microbiology. 4th ed. AVI Publishing Co., Connecticut, USA.
2. Adams MR and Moss MO, 2008, Food Microbiology. Royal Soc. Chem., Cambridge, UK.
3. Dickinson M. 2003. Molecular Plant Pathology. BIOS Scientific Publishers, London.
4. Roitt et al., 1998, Immunology 5th edition, Mosby International Ltd. London. UK.
5. GUIDO SESSA 2013. Molecular Plant Immunity. John Wiley & Sons, Inc. USA
6. František Baluška 2015. Signaling and Communication in Plants, Springer, New York.

Semester	Course Code					Title of the Course					Hours	Credits
IV	21PBO4CC09					CORE-9: MICROBIOLOGY AND IMMUNOLOGY					5	5
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	3	2	2	2	3	3	3	2	2	2.5	
CO-2	2	3	2	2	2	2	2	2	2	3	2.2	
CO-3	3	3	3	2	2	3	3	2	2	2	2.5	
CO-4	3	3	3	3	1	3	3	3	3	1	2.6	
CO-5	2	2	2	2	3	2	2	2	2	3	2.2	
Mean Overall Score											2.4	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4CC10	CORE-10: GENETIC ENGINEERING AND BIOTECHNOLOGY	5	5

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, student will be able to		
CO-1	understand the principles of genetic engineering.	K1
CO-2	learn the types and application of cloning vectors.	K2 & K3
CO-3	study and analyse different types of gene transfer methods.	K4
CO-4	design protocol for plant tissue culture.	K5
CO-5	compile the principles and application of Intellectual Property Rights.	K6

Unit-I: (15 Hours)

Agrobacterium mediated gene transfer and Crown gall; **Nucleases:** Exonucleases and Endonucleases, **Restriction Enzymes:** (Type I - V), RNases and Eukaryotic (cDNA). **Methylases:** CpG Methylase, Dam Methylase, Dcm Methylase; Polymerases: DNA Pol I, Klenow Fragments, Reverse Transcriptase, Taq & Pfu Polymerases. **Ligases:** T4 DNA Ligase, E. coli DNA Ligase, T4 RNA Ligase **Topoisomerases:** Type I (A, B) & Type II (A, B) End Modifying Enzymes: Terminal Transferase, T4 Polynucleotide Kinase, Alkaline Phosphatases. Linkers and Homopolymers.

Unit-II: (15 Hours)

Features of Cloning vectors: ideal cloning vehicles: Natural vectors (E. coli and *Agrobacterium* based), *in vitro* vectors (pBR), ssrDNA vectors (M13) and shuttle vectors. Human Artificial Chromosomes (HACs). Expression of cloned genes - problems and solution. Cloning strategies - cDNA libraries and genomic libraries.

Unit-III: (15 Hours)

Metagenomics. Engineered microbes - bioremediation of oil spills: oil-eating super bugs (*B. megatarium*, *P. putida* & *A. borkumensis*); Bt crops, golden rice technology, plantibodies and edible vaccines. Strategies for crop improvement: engineering for resistance against herbicides and diseases. Antisense RNA technology, CRISPR

Unit-IV: (15 Hours)

Technology protection systems (GURT) - terminator gene technology. Biosafety aspects of GMOs and GM foods. Principles of biosafety; potential risks; environmental impacts; safety of food and animal feed derived from GM crops; and patterns of gene flow. Issues concerning release of Bt-brinjal. Essentials of IPRs and patents.

Unit-V: (15 Hours)

Synthetic biology-scope and importance. Artificial DNA and synthetic genome. Contribution of JC Venter. Minimal genome, expanded gene pool. Creation of synthetic and commercially available products. Potentials and applications; ethical issues of synthetic organisms.

Books for Study

1. Old RN and Primrose S B. 2004, Principles of Gene Manipulation - Blackwell Sci., USA.

2. JD Watson, MGilman, JWitkowski and MZoller 1992. Recombinant DNA (12th Edition), WH Freeman Co., New York.

Books for Reference

1. Presidential Commission for the Study of Bioethical Issues, 2010. (www.bioethics.gov)
2. ETC Group, Canada, 2010. Extreme Genetic Engg - an introduction to synthetic biology.
3. Young, E and Alper, H, 2010. Synthetic Biology: A Review. Journal of Biomedicine and Biotechnology.

Semester	Course Code					Title of the Course					Hours	Credits
IV	21PBO4CC10					CORE-10: GENETIC ENGINEERING AND BIOTECHNOLOGY					5	5
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	3	2	2	3	3	2	3	2	2.5	
CO-2	2	3	2	3	2	2	3	2	2	3	2.4	
CO-3	2	2	3	2	3	3	3	2	3	1	2.4	
CO-4	3	3	3	3	1	3	3	3	3	1	2.6	
CO-5	2	2	2	2	3	2	2	2	2	3	2.2	
Mean Overall Score											2.42	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4CC11	CORE-11: CELL AND MOLECULAR BIOLOGY	4	3

CO. No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	recognize the structural, organization and function of different cell organelles.	K1
CO-2	explain the genetic code and its perpetuation.	K2
CO-3	differentiate the basic cellular and molecular events.	K3
CO-4	apply the knowledge acquired to interpret the molecular mechanisms.	K4 & K5
CO-5	critique the principles of gene regulation.	K6

Unit-I (12 Hours)

Phases and control system of cell cycle, Cell cycle checkpoints - DNA damage, centrosome duplication, spindle assembly. Cyclins and Cyclin-dependent kinases, apoptosis. Cytoskeleton structure and functions: actin filaments (microfilaments), microtubules, and intermediate filaments.

Unit-II (12 Hours)

Cell communication: general principles, Signaling molecules and their receptors. Receptors: Cell surface receptors - ion-channel linked receptors, G-protein coupled receptors, and Tyrosine-kinase linked receptors (RTK), Programmed cell death.

Unit-III (12 Hours)

Transcription: RNA polymerases and their role. Transcription signals - promoters and terminators. Detailed account of transcription in *E. coli* and eukaryotes. Differences between the prokaryotic and the eukaryotic transcription, Post transcriptional modifications of mRNA (5'CAP formation, poly adenylation, spliciosome assembly, splicing editing). Organization of mRNA, RNA editing, mRNA export.

Unit-IV (12 Hours)

Translation: Genetic code – introduction, important features of the genetic code, exceptions to the standard code. Mechanism of translation in prokaryotes and eukaryotes. Differences between prokaryotic and eukaryotic protein synthesis. Protein sorting and translocation: Post-translational modification of proteins, Protein folding-self-assembly and role of chaperones.

Unit-V (12 Hours)

Gene regulation: Operon model - Inducible and repressible systems. Attenuation, positive and negative regulation. *lac* and *trp* operons of *E. coli*. Regulation of eukaryotic gene expression. Gene families and hormonal control in eukaryotes. Gene silencing: transcriptional and post transcriptional gene silencing.

Books for Study

Malacinski GM. 2015. Essentials of Molecular Biology. Jones and Bartlett, Boston, USA.

Books for Reference

1. Cooper M 2000. The Cell-a molecular biology approach. 2nd ed. Sinauer Associates, Massachusetts.
2. Lodish et al 2004. Molecular Cell Biology, COH freeman & Co. New York.
3. Watson JD et al. 2004. Molecular biology of the gene, Pearson education, Singapore.
4. Gardner et al. 2004. Principles of genetics. John Wiley & Sons Inc. Singapore.
5. Veer Bala Rastogi, 2016. Principles of Molecular Biology, Medtech publishers, New Delhi.

Semester	Course Code					Title of the Course					Hours	Credits
IV	21PBO4CC11					CORE-11: CELL AND MOLECULAR BIOLOGY					4	3
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	3	2	2	2	2	3	2	2	2	2	2.2	
CO-2	3	1	2	2	3	3	2	2	2	2	2.2	
CO-3	2	2	2	2	2	2	2	2	1	2	1.9	
CO-4	2	1	3	2	2	2	3	2	2	3	2.1	
CO-5	2	2	2	3	2	2	2	2	1	2	2.0	
Mean Overall Score											2.08	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4CP07	LABORATORY COURSE 7: MICROBIOLOGY, IMMUNOLOGY, GENETIC ENGINEERING AND BIOTECHNOLOGY	4	3

Experiments

1. Isolation and enumeration (CFU) of microorganisms in soil by serial dilution.
2. Bacterial staining: Differential staining – Gram's Staining.
3. Isolation of bacteria from skin, mouth and urine.
4. Potability test of water - presumptive, confirmative and completed tests.
5. Quantitative estimation of bacteria in milk.
6. Testing quality of milk by methylene blue reductase (MBRT) and phosphatase test.
7. Morphological and biochemical identification of bacteria - indole test, methyl red test, Voges-Proskauer test, Citrate utilization test, TSI agar test.
8. Blood grouping
9. WIDAL- test for typhoid
10. RPR- test for syphilis
11. RF- test for rheumatoid arthritis
12. Immuno-diffusion assay – single radial Immuno-diffusion
13. ELISA-Demo
14. Identification of local crop diseases (sugar cane, paddy, banana, brinjal and citrus).
15. Callus induction and regeneration.
16. Clonal propagation.
17. Embryo culture
18. Electrophoretic separation of DNA, protein and restriction digestion.
19. Preparation of synthetic seeds.

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4ES04A	DSE-4: INTELLECTUAL PROPERTY RIGHTS	5	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
On successful completion of this course, students will be able to		
CO-1	understand the concept and procedure of IPR.	K1
CO-2	know the status of IPR in India.	K2
CO-3	evaluate the difference between patent, copy right and trademark.	K3 & K4
CO-4	analyse the benefits of patent, copy right and trademark.	K5
CO-5	prepare applications for patent, copy right and GI.	K6

Unit-I (15 Hours)

Intellectual Property Rights – Introduction, Concept and Theories, Kinds of Intellectual Property Rights, Need for intellectual property right, Advantages and Disadvantages of IPR. International Regime Relating to IPR – TRIPS, WIPO, WTO, GATTs. IPR in India genesis and development.

Unit-II (15 Hours)

Patent – introduction, Patent acts and its amendments. Patentable and Non patentable inventions. Process and product patent, double patent, patent of addition. Patent application process - Searching a patent, Drafting of a patent, filling of a patent, Types of patent applications-national, regional and international, patent document: specification and claims. Infringement.

Unit-III (15 Hours)

Copy right – concepts and principles. Historical background and development of copyright law – Copy right act, Berne Convention, Universal Copyright Convention, WIPO Phonograms and Performances treaty. Conditions for grant of copyright. Copyright in Literary, Dramatic and musical works, sound recording, cinematograph films and computer programme. Right of Broadcasting and performers. Copyright Board - Power and functioning.

Unit-IV (15 Hours)

Trademark – introduction, examples of well-known trademark. Historical development of the concept of trademark and trademark law-National and International. Kinds of trademarks. Procedure for registration of trademark. Infringement of trademark.

Unit-V (15 Hours)

Geographical Indication – introduction, types. GI laws. Indian GI act. Traditional knowledge and IPR. Public health and Intellectual Property Rights – case study. New plant varieties protection laws – need and benefits. Patenting of microorganism. IPR and Climate change. Patents and Biotechnology.

Books for Study

Venkataraman M. 2015. An introduction to Intellectual property rights. Create space Independent Pub.North Charleston, USA.

Books for Reference

1. Gopalakrishnan N.S. & T.G. Agitha, (2009), Principles of Intellectual Property, Eastern Book Company, Lucknow.
2. Ramakrishna B and Anil Kumar, HS. 2017. Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers, Notion Press, Chennai.
3. James Boyle, Jennifer Jenkins, 2018. Intellectual Property: Law & the Information Society—Cases and Materials, Create space Independent Pub. North Charleston, USA.
4. Damodar Reddy S.V. 2019. Intellectual Property Rights -- Law and Practice, Asia Law House, Hyderabad.

Semester	Course Code					Title of the Course					Hours	Credits
IV	21PBO4ES04A					DSE-4: INTELLECTUAL PROPERTY RIGHTS					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	3	2	2	1	2	2	2	2	2	2.2	
CO-2	2	3	2	2	1	2	2	2	2	3	2.1	
CO-3	2	2	3	2	2	2	2	2	2	1	2.0	
CO-4	2	2	2	3	2	2	2	2	2	3	2.2	
CO-5	2	2	2	2	3	1	2	2	2	2	2.2	
Mean Overall Score											2.1	
Result											Medium	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4ES04B	DSE-4: GENETICS	5	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
Upon completion of this course, graduates will		
CO-1	understand the principles of linkage, crossing over and the hereditary mechanisms.	K1 & K2
CO-2	examine the structure and functions of genetic materials.	K3
CO-3	explain the organization of prokaryotic and eukaryotic genomes.	K4
CO-4	justify and outline the mechanisms of DNA repair.	K5
CO-5	compose the dynamics of genetic variation and data interpretation.	K6

Unit-I (15 Hours)

Mendel and his work: Laws of inheritance. Back cross and Test cross. Gene interaction and Modified Mendelian ratios. Quantitative inheritance and multiple alleles. Problem solving in genetics.

Unit-II (15 Hours)

Linkage and crossing over, 3-point cross and gene mapping methods. DNA is the genetic material: Griffith's experiment, Avery et al., and Hershey and Chase experiment; RNA as genetic material - Experiment of Fraenkel and Singer.

Unit-III (15 Hours)

Organization of eukaryotic and bacterial genomes- transformation, transduction (generalized and specialized), conjugation (F factor mediated, Hfr and Sexduction). Fine structure of the Gene: Cistron, muton and recon, Watson and Crick model of DNA helix, Semi-conservative replication mechanism of DNA: replication of linear and circular DNA, Replication of RNA genomes.

Unit-IV (15 Hours)

Molecular mechanisms of DNA repair (mismatch and proof reading, photo reactivation, excision, recombination and SOS repair). Mobile genetic elements- IS elements and transposons in maize and bacteria. Beneficial and harmful effects of mutations.

Unit-V (15 Hours)

Population genetics: gene frequency, gene pool, Hardy–Weinberg equilibrium. Gene frequencies-conservation and changes. Decline of human gene pool and eugenics. Genomics: Arabidopsis genome and rice genome. Gene therapy with reference to Haemophilia, Stem cells- Definition, types & sources.

Books for Study

1. Malacinski GM and Freifelder D 2008. Essentials of Molecular Biology, 4th E Jones & Bartlett.
2. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand, New Delhi.

Books for References

1. Gardner E J, Simmons M J, Snustad D P (1991). Principles of Genetics (III Edn). John Wiley and Sons Inc. 8th Edn., New York.

2. Strickberger (2005). Genetics (III Edn).Prentice Hall of India Pvt. Ltd.
3. D Peter Snustad and Michael J Simmons (2010). Principles of Genetics. John Wiley & Sons

Semester	Course Code					Title of the Course					Hours	Credits
IV	21PBO4ES04B					DSE-4: GENETICS					5	4
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	Mean score of COs	
CO-1	2	2	2	2	3	2	2	3	2	2	2.2	
CO-2	3	2	2	1	2	1	3	3	2	3	2.2	
CO-3	1	2	3	2	3	2	3	2	3	2	2.3	
CO-4	2	2	1	3	2	2	3	2	3	3	2.3	
CO-5	2	2	2	2	3	1	3	2	3	3	2.3	
Mean Overall Score											2.3	
Result											High	

Semester	Course Code	Title of the Course	Hours	Credits
IV	21PBO4CE01	COMPREHENSIVE EXAMINATION	-	2

Unit I:

Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Ecology and Evolutionary trends. Levels of organization of tissues, organs & systems. Nodal anatomy, stomatal types; Shoot and root development; floral meristems and floral development, microsporogenesis, endosperm, embryo development and apomixis.

Unit II:

Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle, structure & function of cytoskeleton, signaling through G-protein coupled receptors, signal transduction pathways; DNA replication, repair and recombination, Protein synthesis and gene expression; Methods of genetic transfers – transformation, conjugation, transduction, germinal verses somatic mutants, Structural and numerical alterations of chromosomes

Unit III:

Light harvesting complexes; mechanisms of electron transport, CO₂ fixation-C₃, C₄ and CAM pathways. Nitrogen metabolism, plant hormones- physiological effects, phytochromes, photoperiodism, Plant response to biotic and abiotic stress. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins), Principles of catalysis, enzyme kinetics and enzyme regulation, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Unit IV:

Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants; Concept of habitat and niche, Ecosystem structure; ecosystem function; energy flow and mineral cycling, biogeographical zones of India. Rare, endangered species. Conservation strategies. Environmental pollution; global environmental change

Unit V:

Cells and molecules involved in innate and adaptive immunity, antigens, inflammation, hypersensitivity and autoimmunity; Microbial fermentation, Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals. Bioremediation and phytoremediation, Biosensors, RFLP, RAPD and AFLP techniques; Measures of central tendency and dispersal, Levels of significance; Regression and Correlation; t-test.

B Sc BOTANY

LOCF SYLLABUS 2023



Department of Botany
School of Biological Sciences
St. Joseph's College (Autonomous)
Tiruchirappalli - 620002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) POSTGRADUATE COURSES

St. Joseph's College (Autonomous), an esteemed institution in the realm of higher education in India, has embarked on a journey to uphold and perpetuate academic excellence. One of the pivotal initiatives in this pursuit is the establishment of five Schools of Excellence commencing from the academic year 2014-15. These schools are strategically designed to confront and surpass the challenges posed by the 21st century.

Each School amalgamates correlated disciplines under a unified umbrella, fostering synergy and coherence. This integrated approach fosters the optimal utilization of both human expertise and infrastructural assets. Moreover, it facilitates academic fluidity and augments employability by nurturing a dynamic environment conducive to learning and innovation. Importantly, while promoting collaboration and interdisciplinary study, the Schools of Excellence also uphold the individual identity, autonomy, and distinctiveness of every department within.

The overarching objectives of these five schools are as follows:

1. **Optimal Resource Utilization:** Ensuring the efficient use of both human and material resources to foster academic flexibility and attain excellence across disciplines.
2. **Horizontal Mobility for Students:** Providing students with the freedom to choose courses aligning with their interests and facilitating credit transfers, thereby enhancing their academic mobility and enriching their learning experience.
3. **Credit-Transfer Across Disciplines (CTAD):** The existing curricular structure, in accordance with regulations from entities such as TANSCHÉ and other higher educational institutions, facilitates seamless credit transfers across diverse disciplines. This underscores the adaptability and uniqueness of the choice-based credit system.
4. **Promotion of Human Excellence:** Nurturing excellence in specialized areas through focused attention and resources, thus empowering individuals to excel in their respective fields.
5. **Emphasis on Internships and Projects:** Encouraging students to engage in internships and projects, serving as stepping stones toward research endeavors, thereby fostering a culture of inquiry and innovation.
6. **Addressing Stakeholder Needs:** The multi-disciplinary nature of the School System is tailored to meet the requirements of various stakeholders, particularly employers, by equipping students with versatile skills and competencies essential for success in the contemporary professional landscape.

In essence, the Schools of Excellence at St. Joseph's College (Autonomous) epitomize a holistic approach towards education, aiming not only to impart knowledge but also to cultivate critical thinking, creativity, and adaptability – qualities indispensable for thriving in the dynamic global arena of the 21st century.

Credit system

The credit system at St. Joseph's College (Autonomous) assigns weightage to courses based on the hours allocated to each course. Typically, one credit is equivalent to one hour of instruction per week. However, credits are awarded regardless of actual teaching hours to ensure consistency and adherence to guidelines.

The credits and hours allotted to each course within a programme are detailed in the Programme Pattern table. While the table provides a framework, there may be some flexibility due to practical sessions, field visits, tutorials, and the nature of project work.

For undergraduate (UG) courses, students are required to accumulate a minimum of 133 credits, as stipulated in the programme pattern table. The total number of courses offered by the department is outlined in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

OBE is an educational approach that revolves around clearly defined goals or outcomes for every aspect of the educational system. The primary aim is for each student to successfully achieve these predetermined outcomes by the culmination of their educational journey. Unlike traditional methods, OBE does not prescribe a singular teaching style or assessment format. Instead, classes, activities, and evaluations are structured to support students in attaining the specified outcomes effectively.

In OBE, the emphasis lies on measurable outcomes, allowing educational institutions to establish their own set of objectives tailored to their unique context and priorities. The overarching objective of OBE is to establish a direct link between education and employability, ensuring that students acquire the necessary skills and competencies sought after by employers.

OBE fosters a student-centric approach to teaching and learning, where the delivery of courses and assessments are meticulously planned to align with the predetermined objectives and outcomes. It places significant emphasis on evaluating student performance at various levels to gauge their progress and proficiency in meeting the desired outcomes.

Here are some key aspects of Outcome-Based Education:

Course: A course refers to a theory, practical, or a combination of both that is done within a semester.

Course Outcomes (COs): These are statements that delineate the significant and essential learning outcomes that learners should have achieved and can reliably demonstrate by the conclusion of a course. Typically, three or more course outcomes are specified for each course, depending on its importance.

Programme: This term pertains to the specialization or discipline of a degree programme.

Programme Outcomes (POs): POs are statements that articulate what students are expected to be capable of by the time they graduate. These outcomes are closely aligned with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs outline the specific skills and abilities that students should possess upon graduation within a particular discipline or specialization.

Programme Educational Objectives (PEOs): PEOs encapsulate the expected accomplishments of graduates in their careers, particularly highlighting what they are expected to achieve and perform during the initial years postgraduation.

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The Learning Outcomes-Centric Framework (LOCF) places the learning outcomes at the forefront of curriculum design and execution. It underscores the importance of ensuring that these outcomes are clear, measurable, and relevant. LOCF orchestrates teaching methodologies, evaluations, and activities in direct correlation with these outcomes. Furthermore, LOCF adopts a backward design approach, focusing on defining precise and attainable learning objectives. The goal is to create a cohesive framework where every educational element is in harmony with these outcomes.

Assessment practices within LOCF are intricately linked to the established learning objectives. Evaluations are crafted to gauge students' achievement of these outcomes accurately. Emphasis is often placed on employing authentic assessment methods, allowing students to showcase their learning in real-life scenarios. Additionally, LOCF frameworks emphasize flexibility and adaptability, enabling

educators to tailor curriculum and instructional approaches to suit the diverse needs of students while ensuring alignment with the defined learning outcomes.

Some Important Terminologies

Core Course (CC): Core Courses represent obligatory elements within an academic programme, imparting fundamental knowledge within the primary discipline while ensuring consistency and acknowledgment.

Allied Course (AC): Allied Courses complement primary disciplines by furnishing supplementary knowledge, enriching students' understanding and skill repertoire within their academic pursuit.

Foundation Course (FC): Foundation Courses serve to bridge the gap in knowledge and skills between secondary education and college-level studies, facilitating a smoother transition for students entering higher education.

Skill Enhancement Course (SE): Skill Enhancement Courses aim to nurture students' abilities and competencies through practical training, open to students across disciplines but particularly advantageous for those in programme-related fields.

Value Education (VE): Value education encompasses the teaching of moral, ethical, and social values to students, aiming to foster their holistic development. It instills virtues such as empathy, integrity, and responsibility, guiding students towards becoming morally upright and socially responsible members of society.

Ability Enhancement Compulsory Course (AE): Ability Enhancement Compulsory Course is designed to enhance students' knowledge and skills; examples include Communicative English and Environmental Science. These courses are obligatory for all disciplines.

AE-1: Communicative English: This three-credit mandatory course, offered by the Department of English during the first semester of the degree programme, is conducted outside regular class hours.

AE-2: Environmental Science: This one-credit compulsory course, offered during the second semester by the Department of Human Excellence, emphasizes environmental awareness and stewardship.

Allied Optional (AO): Allied optional course are elective modules that complement the primary disciplines by providing additional knowledge and skills. These courses allow students to explore areas of interest outside their major field of study, broadening their understanding and enhancing their skill set.

Discipline Specific Elective (ES): These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature. Four courses are offered, two courses each in semester V and VI

Note: To offer one ES, a minimum of two courses of equal importance/weightage is a must. A department with two sections must offer two courses to the students.

Generic Elective (EG): A course chosen from a different discipline or subject area, typically to gain exposure. Students pursuing specific disciplines must select Generic Elective courses from the options available across departments as per the college's course offerings. The breadth of Generic Elective (GE) Courses is directly linked to the diversity of disciplines offered by the college. Two GE Courses are available, one in each semester V and VI, and are open to students from other departments.

Self-paced Learning (SP): It is a two-credit course designed to foster students' ability for independent and self-directed learning. With a syllabus structured to be completed within 45 hours, this course

encourages learners to take control of their own educational journey. Notably, Self-paced Learning is conducted outside of regular class hours, emphasizing autonomy and self-motivation in students.

Internship (IS): Following the fourth semester, students are required to undertake an internship during the summer break. Subsequently, they must submit a comprehensive report detailing their internship experience along with requisite documentation. Additionally, students are expected to participate in a viva-voce examination during the fifth semester. Credits for the internship will be reflected in the mark statement for the fifth semester.

Comprehensive Examination (CE): A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Extra Credit Courses: To support students in acquiring knowledge and skills through online platforms such as Massive Open Online Courses (MOOCs), additional credits are granted upon verification of course completion. These extra credits can be availed across five semesters (2 - 6). In line with UGC guidelines, students are encouraged to enhance their learning by enrolling in MOOCs offered by portals like SWAYAM, NPTEL, and others. Additionally, certificate courses provided by the college also qualify for these extra credits.

Outreach Programme (OR): It is a compulsory course to create a sense of social concern among all the students and to inspire them to dedicated service to the needy.

Course Coding

The following code system (11 alphanumeric characters) is adopted for Under Graduate courses:

23	UXX	0	0	XX	00/X
Year of Revision	UG Department Code	Semester Number	Part Specification	Course Specific Initials	Running Number/with Choice

Course Specific Initials

GL - Languages (Tamil / Hindi / French / Sanskrit)

GE - General English

CC - Core Theory; CP- Core Practical

AC - Allied Course

AP - Allied Practical

FC - Foundation Course

SE - Skill Enhancement Course

VE - Value Education

WS - Workshop

AE - Ability Enhancement Course

AO - Allied Optional

OP - Allied Optional Practical

ES - Discipline Specific Elective

IS - Internship

SP - Self-paced Learning

EG - Generic Elective

ES - Discipline Specific Elective

PW - Project and Viva Voce

CE - Comprehensive Examination

OR - Outreach Programme

EVALUATION PATTERN

Continuous Internal Assessment

Sl No	Component	Marks Alloted
1	Mid Semester Test	30
2	End Semester Test	30
3	*Three Components (15 + 10 + 10)	35
4	Library Referencing (30 hours)	5
Total		100

Passing minimum: 40 marks

* The first component is a compulsory online test (JosTEL platform) comprising 15 multiple choice questions (10 questions at K1 level and 5 questions at K2 level); The second and the third components are decided by the course in-charge.

Question Paper Blueprint for Mid and End Semester Tests

Duration: 2 Hours		Maximum Marks: 60						
Section		K levels						Marks
		K1	K2	K3	K4	K5	K6	
A (compulsory)		7						$7 \times 1 = 7$
B (compulsory)			5					$5 \times 3 = 15$
C (either ...or type)				3				$3 \times 6 = 18$
D (2 out of 3)	For courses with K5 as the highest cognitive level, one K4 and one K5 question is compulsory. (Note: two questions on K4 and one question on K5)				1	1*		$2 \times 10 = 20$
	For courses with K6 as the highest cognitive level: Mid Sem : two questions on K4 and one question on K5; End Sem : two questions on K5 and one question on K6)				Mid Sem			
						End Sem		
					1	1	1*	
Total								60

* Compulsory

Question Paper Blueprint for Semester Examination

Duration: 3 Hours				Maximum Marks: 100	
UNIT	Section A (Compulsory)	Section B (Compulsory)	Section C (Either...or type)	Section D (3 out of 5)	
	K1	K2	K3	K4	K5
UNIT I	2	2	2	3*	2*
UNIT II	2	2	2		
UNIT III	2	2	2		
UNIT IV	2	2	2		
UNIT V	2	2	2		
Marks	10 × 1 = 10	10 × 3 = 30	5 × 6 = 30	3 × 10 = 30	

* For courses with K5 as the highest cognitive level wherein two K4 and one K5 questions are compulsory.
(Note: three questions on K4 and two question on K5)

Evaluation Pattern for Part IV and One/Two-credit Courses

Title of the Course	CIA	Semester Examination	Total Marks
<ul style="list-style-type: none"> Skill Enhancement Course (Non Major Elective) Foundation Course Skill Enhancement Course (WS) 	20 + 10 + 20 = 50	50 (A member from the Department other than the course instructors)	100
<ul style="list-style-type: none"> Self-paced Learning Comprehensive Examination 	25 + 25 = 50	50 (CoE)	100
<ul style="list-style-type: none"> Value Education Environmental Studies 	50	50 (CoE)	100
Skill Enhancement Course: Soft Skills	100	-	100
Generic Elective	100	100 (CoE)	100
Project Work and Viva Voce	100	100	100

Grading System

The marks obtained in the CIA and semester for each course will be graded as per the scheme provided in Table - 1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$SGPA \text{ and } CGPA = \frac{\sum_{i=1}^n C_i Gp_i}{\sum_{i=1}^n C_i}$$

$$WAM = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$$

Where,

C_i - credit earned for the Course i

Gp_i - Grade Point obtained for the Course i

M_i - Marks obtained for the Course i

n - Number of Courses **passed** in that semester

WAM - Weighted Average Marks

Classification of Final Results

- For each of the first three parts in the UG Programme, there shall be separate classification on the basis of CGPA, as indicated in Table - 2.
- For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management as Outstanding/Excellent/Very Good/Good/Above Average/Average, the marks and the corresponding CGPA earned by the candidate in Part III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in all the five Parts of the programme.

- Grade in Part IV and Part V shall be shown separately and it shall not be taken into account for classification.
- A pass in SHEPHERD will continue to be mandatory although the marks will not be counted for the calculation of the CGPA.
- Absence from an examination shall not be considered as an attempt.

Table - 1: Grading of the Courses

Mark Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	0	RA

Table - 2: Grading of the Final Performance

CGPA	Grade	Performance
9.00 and above	O	Outstanding*
8.00 to 8.99	A+	Excellent*
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appear

**The Candidates who have passed in the first appearance and within the prescribed duration of the UG programme are eligible. If the Candidates Grade is O/A+ with more than one attempt, the performance is considered "Very Good".*

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value- driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

- Graduates will be able to accomplish professional standards in the global environment.
- Graduates will be able to uphold integrity and human values.
- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to comprehend the concepts learnt and apply in real life situations with analytical skills.
2. Graduates with acquired skills and enhanced knowledge will be employable/ become entrepreneurs or will pursue higher Education.
3. Graduates with acquired knowledge of modern tools communicative skills and will be able to contribute effectively as team members.
4. Graduates are able to read the signs of the time analyze and provide practical solutions.
5. Graduates imbued with ethical values and social concern will be able to understand and appreciate social harmony, cultural diversity ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Graduates will acquire the basic concepts to utilize them for lifelong learning, communicative skills and to imbibe ethical values to create a better world.
2. Graduates will learn about the systematics, structure and functions of plants for effective management of cultivation practices for improved plant performance.
3. Graduates will develop laboratory skills utilizing modern tools, techniques and protocols to collect and process data to design innovative scientific problems and solutions.
4. Graduates will apply the skills for the benefit of the society through teamwork and project management practices for employability and entrepreneurship.
5. Graduates will exploit the knowledge gained through various courses for sustainable environment and human welfare.

PROGRAMME STRUCTURE					
Part	Semester	Specification	No. of Courses	Hours	Credits
1	1 - 4	Languages (Tamil / Hindi/ French/ Sanskrit)	4	17	12
2	1 - 4	General English	4	20	12
3	1 - 6	Core Course	11	51	40
	1 - 6	Core Practical	7	22	14
	1 - 6	Allied Course	2	8	6
		Allied Practical	2	4	2
	3, 4	Allied Optional	2	8	6
	3, 4	Allied Optional Practical	1	4	2
	5, 6	Discipline Specific Elective	4	20	12
	5	Internship	1	-	1
	5	Self-paced Learning	1	-	2
	5	Project Work and Viva Voce	1	-	2
	5	Comprehensive Examination	1	-	2
4	1	Foundation Course	1	2	1
	1	Skill Enhancement Course (Non-Major Elective)	1	2	1
	5	Skill Enhancement Course (Soft Skills)	1	2	1
	6	Skill Enhancement Course (WS)	1	2	1
	1 - 4	Value Education	4	8	4
	1, 2	Ability Enhancement Compulsory Course	2	2(6)	4
	5, 6	Generic Elective	2	8	4
5	2 - 6	Outreach Programme (SHEPHERD)	-	-	4
	2 - 6	Extra Credit Courses (MOOC)/Certificate Courses	5	-	(15)
		Total	58	180(6)	133(15)

PROGRAMME PATTERN								
Course Details						Scheme of Exams		
Sem	Part	Course Code	Title of the Course	Hours	Credits	CIA	SE	Final
1	1	23UTA11GL01A	General Tamil - 1	5	3	100	100	100
		23UFR11GL01	French - 1					
		23UHI11GL01	Hindi - 1					
		23USA11GL01	Sanskrit - 1					
	2	23UEN12GE01	General English - 1	5	3	100	100	100
	3	23UBO13CC01	Core Course - 1: Plant Diversity - 1 (Algae)	5	4	100	100	100
		23UBO13CP01	Core Practical - 1: Algae	3	2	100	100	100
		23UBO13AC01	Allied Course - 1: Allied Zoology - 1	4	3	100	100	100
		23UBO13AP01	Allied Practical - 1: Invertebrates and Vertebrates	2	1	100	100	100
	4	23UBO14FC01	Foundation Course: Basics of Botany	2	1	100	-	100
		-	Skill Enhancement Course - 1: (Non-Major Elective): Refer ANNEXURE 1	2	1	100	-	100
		23UHE14VE01	Value Education - 1: Essentials of Humanity*	2	1	50	50	50
		23UEN14AE01	Ability Enhancement Compulsory Course - 1: Communicative English	(6)	3	100	-	100
Total				30(6)	22			
2	1	23UTA21GL02	General Tamil - 2	4	3	100	100	100
		23UFR21GL02	French - 2					
		23UHI21GL02	Hindi - 2					
		23USA21GL02	Sanskrit - 2					
	2	23UEN22GE02	General English - 2	5	3	100	100	100
	3	23UBO23CC02	Core Course - 2: Bryophytes, Fungi, Lichens and Plant Pathology	4	3	100	100	100
		23UBO23CC03	Core Course - 3: Pteridophytes, Gymnosperms, Anatomy and Embryology	4	3	100	100	100
		23UBO23CP02	Core Practical - 2: Bryophytes, Fungi, Lichens, Plant Pathology, Pteridophytes, Gymnosperms, Anatomy and Embryology	3	2	100	100	100
		23UBO23AC02	Allied Course - 2: Agricultural Entomology	4	3	100	100	100
	4	23UBO23AP02	Allied Practical - 2: Agricultural Entomology	2	1	100	100	100
		23UHE24VE02	Value Education - 2: Fundamentals of Human Rights*	2	1	50	50	50
		23UHE24AE01	Ability Enhancement Compulsory Course - 2: Environmental Studies*	2	1	50	50	50
		-	Extra Credit courses (MOOC/ Certificate course) - 1	-	(3)			
Total				30	20(3)			
3	1	23UTA31GL03	General Tamil - 3	4	3	100	100	100
		23UFR31GL03	French - 3					
		23UHI31GL03	Hindi - 3					
		23USA31GL03	Sanskrit - 3					
	2	23UEN32GE03	General English - 3	5	3	100	100	100
	3	23UBO33CC04	Core Course - 4: Taxonomy of Angiosperms	5	4	100	100	100
		23UBO33CC05	Core Course - 5: Plant Breeding and Evolution	5	4	100	100	100
		23UBO33CP03	Core Practical - 3: Taxonomy of Angiosperm, Plant Breeding and Evolution	3	2	100	100	100
		23UBO33AO01A	Allied Optional - 1: Chemistry for Biologists - 1	4	3	100	100	100
	23UBO33AO01B	Allied Optional- 1: Biometrics and Computer Applications - 1						
	4	@	Allied Optional Practical: Chemistry for Biologists	2	-	-	-	-
		@	Allied Optional Practical: Biometrics and Computer Applications					
		23UHE34VE03A	Value Education - 3: Social Ethics - 1*	2	1	50	50	50
23UHE34VE03B	Value Education - 3: Religious Doctrine - 1*							
-				Extra Credit Courses (MOOC/Certificate Courses) - 2				
Total				30	20(3)			
4	1	23UTA41GL04B	General Tamil - 4 அறிவியல் தமிழ் (Scientific Tamil)	4	3	100	100	100
		23UFR41GL04	French - 4					
		23UHI41GL04	Hindi - 4					
		23USA41GL04	Sanskrit - 4					
	2	23UEN42GE04	General English - 4	5	3	100	100	100
	3	23UBO43CC06	Core Course - 6: Cell Biology and Genetics	5	4	100	100	100
		23UBO43CC07	Core Course - 7: Ecology and Climate Change	5	4	100	100	100

		23UBO43CP04	Core Practical - 4: Cell Biology, Genetics, Ecology and Climate Change	3	2	100	100	100	
		23UBO43AO02A	Allied Optional - 2: Chemistry for Biologists - 2	4	3	100	100	100	
		23UBO43AO02B	Allied Optional - 2: Biometrics and Computer Applications - 2						
		23UBO43OP01A	Allied Optional Practical: Chemistry for Biologists	2	2	100	100	100	
		23UBO43OP01B	Allied Optional Practical: Biometrics and Computer Applications						
	4	23UHE44VE04A	Value Education - 4: Social Ethics - 2*	2	1	50	50	50	
		23UHE44VE04B	Value Education - 4: Religious Doctrine - 2*						
		-	Extra Credit courses (MOOC/Certificate Courses) - 3		(3)				
	Total				30	22(3)			
	5	3	23UBO53CC08	Core Course - 8: Biophysics and Biostatistics	5	4	100	100	100
23UBO53CC09			Core Course - 9: Microbiology and Immunology	5	4	100	100	100	
23UBO53CP05			Core Practical - 5: Biophysics, Biostatistics, Microbiology and Immunology	4	2	100	100	100	
23UBO53ES01A			Discipline Specific Elective - 1: Molecular Biology	5	3	100	100	100	
23UBO53ES01B			Discipline Specific Elective - 1: Bioinformatics and Bionanotechnology						
23UBO53ES02A			Discipline Specific Elective - 2: Research Methodology	5	3	100	100	100	
23UBO53ES02B			Discipline Specific Elective - 2: Biopesticides						
23UBO53IS01			Internship	-	1	100	-	100	
23UBO53SP01			Self-paced Learning: Economic Botany*	-	2	50	50	50	
4		-	Generic Elective - 1: Refer ANNEXURE 2	4	2	100	100	100	
		23USS54SE01	Skill Enhancement Course - 2: Soft Skills	2	1	100	-	100	
		-	Extra Credit courses (MOOC/Certificate Courses) - 4		(3)				
Total				30	22(3)				
6	3	23UBO63CC10	Core Course - 10: Plant Physiology	4	3	100	100	100	
		23UBO63CP06	Core Practical - 6: Plant Physiology	3	2	100	100	100	
		23UBO63CC11	Core Course - 11: Genetic Engineering and Biotechnology	4	3	100	100	100	
		23UBO63CP07	Core Practical - 7: Genetic Engineering and Biotechnology	3	2	100	100	100	
		23UBO63ES03A	Discipline Specific Elective - 3: Biochemistry	5	3	100	100	100	
		23UBO63ES03B	Discipline Specific Elective - 3: Agricultural Botany						
		23UBO63ES04A	Discipline Specific Elective - 4: Medicinal Botany	5	3	100	100	100	
		23UBO63ES04B	Discipline Specific Elective - 4: Biological Techniques						
		23UBO63PW01	Project Work and Viva Voce	-	2	100	100	100	
		23UBO63CE01	Comprehensive Examination*	-	2	50	50	50	
	4	-	Generic Elective - 2: Refer ANNEXURE 3	4	2	100	100	100	
		-	Skill Enhancement Course - 3 (WS): Refer ANNEXURE 4	2	1	100	-	100	
		-	Extra Credit courses (MOOC/Certificate Courses) - 5		(3)				
		Total		30	23(3)				
2 - 6	5	23UCW65OR01	Outreach Programme (SHEPHERD)	-	4				
1 - 6			Total (3 years)	180	133 (15)				

@ - year end practical

*- for grade calculation 50 marks are converted into 100 in the mark statements

Passed by	Board of Studies held on 18.12.2023							
Approved by	48th Academic Council Meeting held on 27.03.2024							

ANNEXURE 1**Skill Enhancement Course - 1: (Non-Major Elective)***

Department	Course Code	Title of the Course
Computer Science	23UCS14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Office Automation
BCA	23UBC14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Fundamentals of Information Technology
Mathematics	23UMA14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Mathematics for Competitive Examinations
Statistics	23UST14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Basics of Statistics
Vis Com	23UVC14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Digital Storytelling and Scriptwriting
English	23UEN14SE01	Skill Enhancement Course - 1: (Non-Major Elective): English for Communication
History	23UHS14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Introduction to Tourism
Tamil	23UTA14SE01	Skill Enhancement Course - 1: (Non-Major Elective): பேச்சுக்கலைத் திறன் (Oratory Skills)
BBA	23UBU14SE01A	Skill Enhancement Course - 1: (Non-Major Elective): Practical Advertising
	23UBU14SE01B	Skill Enhancement Course - 1: (Non-Major Elective): Digital Marketing
B. Com	23UCO14SE01A	Skill Enhancement Course - 1: (Non-Major Elective): Introduction to Accounting
	23UCO14SE01B	Skill Enhancement Course - 1: (Non-Major Elective): Consumer Protection and Rights
B. Com CA	23UCC14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Entrepreneurship Skills
Economics	23UEC14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Demography
Chemistry	23UCH14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Role of Chemistry in Daily Life
Electronics	23UEL14SE01	Skill Enhancement Course - 1: (Non-Major Elective): Consumer Electronics
Physics	23UPH14SE01A	Skill Enhancement Course - 1: (Non-Major Elective): Physics for Everyday Life
	23UPH14SE01B	Skill Enhancement Course - 1: (Non-Major Elective): Home Electrical Installation

*Offered to students from other Departments

ANNEXURE 2
Generic Elective - 1*

Department	Course Code	Title of the Course
Computer Science	23UCS54EG01	Generic Elective - 1: Ethical Hacking
BCA	23UBC54EG01	Generic Elective - 1: Fundamentals of Data Science
Mathematics	23UMA54EG01	Generic Elective - 1: Numerical Ability
Statistics	23UST54EG01	Generic Elective - 1: Actuarial Statistics
Vis Com	23UVC54EG01	Generic Elective - 1: Media Education
English	23UEN54EG01	Generic Elective - 1: Film Studies
History	23UHS54EG01	Generic Elective-1: Tamil Heritage and Culture
Tamil	23UTA54EG01	Generic Elective - 1: தமிழிலக்கியத்தில் மனித உரிமைகள் (Human rights in Tamil literature)
BBA	23UBU54EG01A	Generic Elective - 1: Global Supply Chain Management
	23UBU54EG01B	Generic Elective - 1: Starts-ups and small Business Management
B.Com.	23UCO54EG01A	Generic Elective - 1: Computerised Accounting
	23UCO54EG01B	Generic Elective - 1: Basics of Excel
	23UCO54EG01C	Generic Elective - 1: Personal Investment Planning
B. Com CA	23UCC54EG01	Generic Elective - 1: E-commerce and E Business Management
Economics	23UEC54EG01	Generic Elective - 1: Principles of Economics
Chemistry	23UCH54EG01	Generic Elective - 1: Health Science
Electronics	23UEL54EG01A	Generic Elective - 1: Everyday Electronics
	23UEL54EG01B	Generic Elective - 1: Wireless Communication
Physics	23UPH54EG01A	Generic Elective-1: Everyday Physics
	23UPH54EG01B	Generic Elective-1: Renewable Energy Physics

*Offered to students from other Departments

ANNEXURE 3
Generic Elective - 2*

Department	Course Code	Title of the Course
Computer Science	23UCS64EG02	Generic Elective - 2: 3D Printing and Design
BCA	23UBC64EG02	Generic Elective - 2: Industry 4.0
Mathematics	23UMA64EG02	Generic Elective - 2: Quantitative Techniques
Statistics	23UST64EG02	Generic Elective - 2: Applied Statistics
Vis Com	23UVC64EG02	Generic Elective - 2: Digital Media Production
English	23UEN64EG02	Generic Elective - 2: English for the Media
History	23UHS64EG02	Generic Elective - 2: Intellectual Revivalism in Tamil Nadu
Tamil	23UTA64EG02	Generic Elective - 2: தமிழர் மருத்துவம் (Tamil Medicine)
BBA	23UBU64EG02A	Generic Elective - 2: Personality Development
	23UBU64EG02B	Generic Elective - 2: NGO Management
B. Com	23UCO64EG02A	Generic Elective - 2: Rural Marketing
	23UCO64EG02B	Generic Elective - 2: Entrepreneurship Development
	23UCO64EG02C	Generic Elective - 2: Digital Marketing
B. Com CA	23UCC64EG02	Generic Elective - 2: Total Quality Management
Economics	23UEC64EG02	Generic Elective - 2: Economics for Competitive Exams
Chemistry	23UCH64EG02	Generic Elective - 2: Solid Waste Management
Electronics	23UEL64EG02A	Generic Elective - 2: CCTV and Smart Security Systems
	23UEL64EG02B	Generic Elective - 2: Entrepreneurial Electronics
Physics	23UPH64EG02A	Generic Elective - 2: Laser Technology and its applications
	23UPH64EG02B	Generic Elective - 2: Physics of Earth

*Offered to students from other Departments

ANNEXURE 4

Skill Enhancement Course - 3 (WS)*

School	Course Code	Title of the Course
SBS	23UBO64SE02	Skill Enhancement Course - 3 (WS): Herbal Technology

**Offered to students from other Departments within School*

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UTA11GL01A	General Tamil - 1	5	3

கற்றலின் நோக்கங்கள்				
தமிழ்ச் செவ்வியல் இலக்கியங்களையும் காப்பியங்களையும் மாணவர்கள் அறிந்துகொள்ளல்				
தமிழர் பேணி வளர்த்த அறம்சார் விழுமியங்களை மாணவர்கள் தம் வாழ்வில் பின்பற்றுதல்				
தமிழில் பக்திஇயக்கப் பங்களிப்பையும் பகுத்தறிவுச் சிந்தனை மரபையும் உணர்தல்				
மாணவர்கள் தம் எழுத்தாற்றலையும் மொழிப்புலமையையும் வளர்த்தெடுத்தல்				
போட்டித்தேர்வுகளை எதிர்கொள்ளும் வகையில் இலக்கணம், இலக்கியம் கற்றல்				

அலகு - 1 தமிழ் இலக்கிய, இலக்கண வரலாறு அறிமுகம்.

(10 மணி நேரம்)

1. இலக்கணம் :

அ.தொல்காப்பியம், இறையனார் களவியல் உரை , நம்பியகப் பொருள், புறப்பொருள் வெண்பா மாலை, நன்னூல், தண்டியலங்காரம், யாப்பருங்கலக்காரிகை- நூல்கள்

ஆ.மொழிப் பயிற்சி- ஒற்றுப்பிழை தவிர்த்தல்

- வல்லினம் மிகும் இடங்கள்
- வல்லினம் மிகா இடங்கள்
- ஈரொற்று வரும் இடங்கள்
- ஒரு, ஒர் வரும் இடங்கள்
- அது, அஃது வரும் இடங்கள்
- தான், தாம் வரும் இடங்கள்

பயிற்சி : வல்லினம் மிகும் இடங்கள், மிகா இடங்கள் தவறாக வரும்வகையில் ஒரு பத்தி கொடுத்து ஒற்றுப் பிழை திருத்தி எழுதச் செய்தல்.

2. சங்க இலக்கியம் - எட்டுத்தொகை, பத்துப்பாட்டு

3. அற இலக்கியம்-பதினெண்கீழ்க்கணக்கு நூல்கள்

4. காப்பிய இலக்கியம் - ஐம்பெருங் காப்பியங்கள், ஐஞ்சிறு காப்பியங்கள், சமயக் காப்பியங்கள்

5. பக்தி இலக்கியமும் (பன்னிரு திருமுறைகள், நாலாயிர திவ்வியப் பிரபந்தம் -- பகுத்தறிவு இலக்கியமும் (சித்தர் இலக்கியங்கள், புலவர் குழந்தையின் இராவண காவியம்)

அலகு - 2 சங்க இலக்கியம்

(15 மணி நேரம்)

எட்டுத்தொகை :

6. நற்றிணை-முதல் பாடல் -நின்ற சொல்லர்

7. குறுந்தொகை 3 ஆம் பாடல் -நிலத்தினும் பெரிதே

8. ஐங்குறுநூறு -நெல் பல பொலிக! பொன் பெரிது சிறக்க! (முதல் பாடல்)-வேட்கைப் பத்து

9. கலித்தொகை- 51 - சுடர்த்தொடிக் கேளாய் -குறிஞ்சிக் கலி

10. புறநானூறு -189 தென்கடல் வளாகம் பொதுமையின்றி, நாடா கொன்றோ -187

பத்துப்பாட்டு:

முல்லைப்பாட்டு (முழுவதும்)

அலகு - 3 அற இலக்கியம்

(10 மணி நேரம்)

12. திருக்குறள் -அறன் வலியுறுத்தல் அதிகாரம்

13. நாலடியார்-பாடல்: 131 (குஞ்சியழகும்)

14. நான்மணிக்கடிகை-நிலத்துக்கு அணியென்ப

15. பழமொழி நானூறு- தம் நடை நோக்கார்

16. இனியவை நாற்பது- 37. இளமையை மூப்பு என்று

அலகு - 4 காப்பிய இலக்கியம்

(20 மணி நேரம்)

17. சிலப்பதிகாரம் – வழக்குரைகாதை

18. மணிமேகலை- பாத்திரம் பெற்ற காதை

19. பெரியபுராணம் - பூசலார் நாயனார்புராணம்
20. கம்பராமாயணம்- குகப் படலம்
21. சீறாப்புராணம் – மானுக்குப் பிணை நின்ற படலம்
22. இயேசு காவியம் -ஊதாரிப்பிள்ளை

அலகு - 5 பக்தி இலக்கியமும், பகுத்தறிவு இலக்கியமும்

(15 மணி நேரம்)

23. பக்தி இலக்கியம்:

- திருநாவுக்கரசர் தேவாரம் - நாமார்க்கும் குடியல்லேம் எனத் தொடங்கும் பாடல் மட்டும்
- மாணிக்கவாசகர் கிருவாசகம் - நாமச்சுவாய வாழ்க நாதன்தான் வாழ்க முதல் சிரம்குவிவார் ஓங்குவிக்கும் சீரோன் கழல் வெல்க வரை
- பொய்கையாழ்வார்-வையந் தகளியா வார்கடலே
- பூதத்தாழ்வார்-அன்பே தகளியா
- பேயாழ்வார்-திருக்கண்டேன் பொன்மேனி கண்டேன்
- ஆண்டாள் – திருப்பாவை மார்கழித் திங்கள் (முதல் பாடல்)

24. பகுத்தறிவு இலக்கியம் :

- திருமூலர் – திருமந்திரம் (270,271, 274, 275 285)
- பட்டினத்தார் -திருவிடை மருதூர் (காடே திரிந்து – எனத் தொடங்கும் பாடல்
- பா.எண்.279, 280)
- கடுவெளி சித்தர் - பாபஞ்செய் யாதிரு மனமே (பாடல் முழுவதும்)
- இராவண காவியம் – தாய்மொழிப் படலம் - 18. (ஏடுகை யில்லா ரில்லை முதல் - 22. செந்தமிழ் வளர்த்தார் வரை)

கற்பித்தல் முறை	விரிவுரை (Lecture), காணொளிக் காட்சி (Videos), விளக்கக் காட்சி (PPT presentation)
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பாடநூல்

1. பொதுத்தமிழ்-1 (தமிழ் இலக்கிய வரலாறு-1), தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி – 620 002, முதற்பதிப்பு - 2023
2. பார்வை நூல்கள்
3. வரதராசன்.மு., தமிழ் இலக்கிய வரலாறு, சாகித்ய அக்காதெமி, புதுடெல்லி. 2021
4. விமலானந்தன். மது. ச., தமிழ் இலக்கிய வரலாறு, முல்லை நிலையம், சென்னை, 2019
5. தமிழண்ணல், புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, பாரி நிலையம், சென்னை, 2022
6. சிற்பி பாலசுப்பிரமணியன் & சேதுபதி.சொ., தமிழ் இலக்கிய வரலாறு, கவிதா வெளியீடு, சென்னை, 2015
7. சிற்பி பாலசுப்பிரமணியன், & பத்மநாபன். நீல., புதிய தமிழ் இலக்கிய வரலாறு (3 தொகுதிகள்), சாகித்ய அக்காதெமி, புதுடெல்லி, 2013
8. பெருமாள். அ.கா., தமிழ் இலக்கிய வரலாறு, சுதர்சன் புகல், நாகர்கோவில், 2014
9. ஏசுதாசன். ப.ச., தமிழ் இலக்கிய வரலாறு, நியூ செஞ்சரி புக் ஹவுஸ், சென்னை, 2015
10. ஸ்ரீகுமார். எஸ்., தமிழ் இலக்கிய வரலாறு, ஸ்ரீசெண்பகா பதிப்பகம், சென்னை, 2014
11. பாக்கியமேரி எஃப்., வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு, பூவேந்தன் பதிப்பகம், சென்னை, 2022
12. சுப்புரெட்டியார்.ந., தமிழ் பயிற்றும் முறை, மணிவாசகர் நூலகம், சிதம்பரம், 1980

Websites and eLearning Sources

1. <https://www.chennaiLibrary.com/>
2. <https://www.sirukathaigal.com>
3. <https://www.tamilvirtualuniversity.org>
4. <https://www.noolulagam.com>
5. <https://www.katuraitamilblogspot.com>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	இப்பாடத்தின் நிறைவில் மாணவர்கள்	
CO1	சங்க இலக்கியங்கள்வழி பண்டைத்தமிழரின் வாழ்வியலையும் பண்பாட்டையும் அறிந்து கொள்வர்	K1
CO2	அற இலக்கியங்கள், காப்பியங்கள் வெளிப்படுத்தும் அறம்சார் விழுமியங்களைத் தம் வாழ்வில் பின்பற்றுவர்	K2
CO3	இலக்கணக் கோட்பாடுகளை இக்கால வாழ்வியலோடு பொருத்திப் பார்ப்பர்	K3
CO4	மொழியறிவோடு பெறுவர் திறன் பகுத்தாராயும் இலக்கியங்களைப்	K4
CO5	பக்தி இயக்கங்களின் செல்வாக்கையும், தமிழரின் பகுத்தறிவு மரபையும் மதிப்பிடுவர்	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours	Credits		
1	23UTA11GL01A		General Tamil - 1					5	3		
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	2	2.2
CO2	2	2	3	2	2	2	3	2	3	2	2.3
CO3	1	2	2	3	2	2	2	3	3	3	2.3
CO4	2	2	3	2	2	3	2	3	3	2	2.4
CO5	3	1	2	2	2	2	3	2	3	3	2.3
Mean Overall Score										2.3 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UFR11GL01	French - 1	5	3

Course Objectives
Identify the basic French sentence structure
Define and describe the various grammatical tenses and use them to communicate in French
Examine the various documents presented and discuss and reply to the questions asked on it
Analyze and interpret expressions used to convey the cause, the effect, the purpose, and the opposition in French
Evaluate the grammatical nature present in passages

UNIT I (15 Hours)

- Salut ! Enchanté

UNIT II (15 Hours)

- J'adore

UNIT III (15 Hours)

- Tu veux bien ?

UNIT IV (15 Hours)

- On se voit quand ?

UNIT V (15 Hours)

- Bonne idée

Teaching Methodology	Videos, Audios, PPT presentation, Role-play, Quiz
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Book for Study

1. Mérieux, R. & Loiseau, Y. (2017). *Latitudes -1- (A1 /A2)*, méthode de français, Didier. (Units 1 - 6 only)

Books for Reference

1. P.Dauda, L.Giachino and C.Baracco, *Generation AI*, Didier, Paris 2020.
2. J.Girardet and J.Pecheur, *Echo AI*, CLE International, 2^e edition, 2017
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Websites and eLearning Sources

1. <https://www.wikihow.com/Pronounce-the-Letters-of-the-French-Alphabet>
2. <https://français.lingolia.com/en/grammar/tenses/le-present>
3. <https://www.lawlessfrench.com/grammar/articles/>
4. <https://www.frenchpod101.com/french-vocabulary-lists/10-lines-you-need-for-introducing-yourself>
5. <https://www.tolearnfrench.com/exercices/exercice-french-2/exercice-french-3295.php>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	recall and remember the usage of grammatical tenses in constructing sentences in a dialogue.	K1
CO2	apply the learnt grammar rules in practice exercises to improve their understanding	K2
CO3	explain the nuances in the usage of various grammatical tenses and their aspects	K3
CO4	demonstrate knowledge of various expressions used to express opinions, emotions, cause, effect, purpose, and hypothesis in French	K4
CO5	communicate in French and summarize a given text	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
1	23UFR11GL01		French - 1						5		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	3	1	3	3	2	3	2	2.4
CO2	2	3	3	2	1	3	3	3	3	2	2.5
CO3	1	3	2	1	2	2	2	2	3	2	2.0
CO4	3	3	3	3	3	3	3	2	3	2	2.8
CO5	3	3	3	3	2	3	3	3	3	2	2.8
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UHI11GL01	Hindi - 1	5	3

Course Objectives
To understand the basics of Hindi Language
To make the students to be familiar with the Hindi words
To enable the students to develop their effective communicative skills in Hindi.
To introduce the socially relevant subjects in Modern Hindu Literature
To empower the students with globally employable soft skills

UNIT I: Buniyadi Hindi (15 Hours)

- Swar
- Vyanjan
- Barah Khadi
- Shabd aur
- Vakya Rachna

UNIT II: Hindi Shabdavali (15 Hours)

- Rishto ke Naam
- Gharelu padartho ke Naam

UNIT III: Vyakaran (15 Hours)

- Sadharan Vakya aur Sangya
- Sarvanam
- Visheshan
- Kriya aadi shabdo ka prayog

UNIT IV: Chote Gadyansh ka pattan (15 Hours)

- Bacho ki Kahaniya
- Patra-Patrikao mein prakashit Gadyansho ka Pathan

UNIT V: Nibandh (15 Hours)

- Sant Tiruvalluvar
- E.V.R Thandai Periyar
- Naari Sashaktikaran
- Paryavaran Sanrakshan
- Vibhinna pratiyogi parikshao ke bare mein jaankari dena
- Pratiyogi priksa par adharit nibandho dwara bhasha ki kshamta badhane vale prashikshan kary.

Teaching Methodology	Videos, PPT, Quiz, Group Discussion, Project Work.
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Books for Study

1. Gupth, M.K. (2020). *Hindi Vyakaran*, Anand Prakashan, Kolkatta.
2. Tripaty, V. (2018). *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd, New Delhi.
3. Jain, S.K. (2019). *Anuwad: Siddhant Evam Vyavhar*, Kailash Pustak Sadan, Madhya Pradesh.

Books for Reference

1. Abdul Kalam, A. P.J. (2020). *Mere sapnom ka Bharath*, Prabath Prakashan, Noida.
2. Singh, L.P. (2017). *Kavya ke sopan*, Bharathy Bhavan Prakashan.

3. Kumar, A. (2019). *Sampoorna Hindi Vyakaran our Rachana*, Lucent publisher.
4. (2018). *Adhunik Hindi Vyakaran our Rachana*, Bharati Bhavan Publishers & distributors.
5. Shukla, A.R. (2022). *Hindi Sahitya Ka Itihas*, Prabhat Prakashan.

Websites and e-Learning Sources

1. <https://learningmole.com/hindi-alphabet-letters-pronunciation-guide/>
2. <https://www.careerpower.in/hindi-alphabet-varnamala.html>
3. <https://www.youtube.com/watch?v=b0UvXnIC8qc>
4. <https://www.importanceoflanguages.com/learn-hindi-language-guide/>
5. <https://parikshapoint.com/hindi-sahitya/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	introduction to Hindi sounds	K1
CO2	acquisition of Hindi Vocabulary	K2
CO3	sentence formation in Hindi	K3
CO4	reading of stories and other passages	K4
CO5	modules to increase language ability through general essays based on competitive exams	K5

Relationship Matrix											
Semester	Course Code			Title of the Course					Hours	Credits	
1	23UHI11GL01			Hindi - 1					5	3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	1	3	3	3	1	3	2	2.3
CO2	2	3	2	3	1	2	3	3	3	2	2.4
CO3	3	2	2	2	1	3	2	3	2	3	2.3
CO4	3	1	2	3	2	3	2	3	3	2	2.4
CO5	2	3	3	2	3	2	3	3	1	3	2.5
Mean Overall Score											2.38 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23USA11GL01	Sanskrit - 1	5	3

Course Objectives
To help the students learn the alphabets of Sanskrit.
To understand the Sanskrit grammar and sabdas.
To have an idea of the epics.
To closely understand the literary works in Sanskrit with special reference to Pancamahakavyas.
To understand the Raghuvamsha Mahakavya and Kalidasa.

UNIT I (15 Hours)

Introduction to Sanskrit (Alphabets, Two letter words and three letter words)

Grammar:

ākārāntaḥpumliṅgaḥśabda-s - 1. बाल (Bāla) and 2. देवे (Deva) *ākārāntaḥstrīliṅgaḥśabda-s* - 1. बाला (Bālā) and 2. लता (Latā) *ākārāntaḥnapuṃsakaliṅgaḥśabda-s* - 1. फल (Phala) and 2. वन (Vana)

UNIT II (15 Hours)

Introduction to *Rāmāyana*, *Kālidāsa* and his poetic works

Text: *Raghuvamśa* (Canto I) Verses 1-15

UNIT III (15 Hours)

Introduction to the works of *Bhāravi* -

Text: *Raghuvamśa* (canto I) Verses 16-30

UNIT IV (15 Hours)

Introduction to the works of *ŚrīHarṣa* -

Text: *Raghuvamśa* (Canto I) Verses 31-45

UNIT V (15 Hours)

Grammar:

Conjugations -*Laṭlakāra-s* – (Present tense)

- (i) गच्छत (Gacchati) (ii) ततष्ठत (Tiṣṭhati) (iii) पठत (Paṭhati)
 (iv) नृत्यत (Nr̥tyati) (v) कुप्यत (Kupyati) (vi) कथयत (Kathayati)
 (vii) गणयत (Gaṇayati) (viii) अतत (Asti)
 (ix) करोत (Karoti) (x) शृणोत (Śṛṇoti)

Indeclinables (Avyayaani) - अतप (api), कदा (kadā), च (ca), अद्य (adya), तवना (vinā), सह (saha), तत्र (tatra), कम् (kim), यद् (yadi) - तर्हि (tarhi), यथा (yathā) - तथा (tathā) Prefixes (Upasargas) - आङ् (āñ), तव (vi), पर (pari), अनु (anu), अति (adhi), उत् (ut), प्रत (prati), उप (upa), प्र (pra) तनर् (nir)

Teaching Methodology	Videos, PPT, demonstration.
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Book for Study

1. Murugan, C., et al. (eds.). (2022). *Kalasala Samskrta Sukha Bodhini I* (for under graduate foundation course) Published by University of Madras.

Book for Reference

1. Vadhyar, R.S. (2017). *Shabdha manjari*, R.S. Vadyar & Sons, Palakkad.

Websites and e-Learning Sources

1. <https://www.arlingtoncenter.org/Sanskrit%20Alphabet.pdf>

2. <https://courses.lumenlearning.com/suny-hccc-worldcivilization/chapter/sanskrit/>
3. https://www.newworldencyclopedia.org/entry/Sanskrit_literature
4. <https://archive.org/details/AShortHistoryOfsanskritLiterature>
5. https://archive.org/details/raghuvamsha_with_sanjivini_edited_by_mr_kale

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	remember the usage of grammatical tenses in constructing sentences in dialogue.	K1
CO2	apply the rules of usage in practice exercises and identify errors	K2
CO3	explain the nuances in the usage of various grammatical tenses and aspects	K3
CO4	demonstrate knowledge of various expressions of opinion, emotions, cause, effect, purpose, and hypothesis in French	K4
CO5	communicate in French and summarize the given text	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23USA11GL01		Sanskrit - 1							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	3	2	3	1	3	2	3	2	2	2.1
CO2	2	3	2	3	1	2	2	3	2	3	2.5
CO3	3	2	2	2	2	2	3	2	3	2	2.1
CO4	3	2	3	2	2	3	3	2	3	2	2.4
CO5	3	2	3	3	2	2	3	2	3	3	2.3
Mean Overall Score											2.34 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UEN12GE01	General English - 1	5	3

Course Objectives
To enable learners to acquire self awareness and positive thinking required in various life situations
To help them acquire the attribute of empathy
To assist them in acquiring creative and critical thinking abilities
To enable them to learn the basic grammar
To assist them in developing LSRW skills

UNIT I: Self-awareness ELF-A (WHO) & Positive Thinking (UNICEF) (15 Hours)

Life Story

1. Chapter 1 from Malala Yousafzai, I am Malala
2. An Autobiography or The Story of My Experiments with Truth (Chapters 1, 2 & 3) M.K. Gandhi

Poem

3. Where the Mind is Without Fear – Gitanjali 35 – Rabindranath Tagore
4. Love Cycle – Chinua Achebe

UNIT II: Empathy (15 Hours)

Poem

5. Nine Gold Medals – David Roth
6. Alice Fell or poverty – William Wordsworth

Short Story

7. The School for Sympathy – E.V. Lucas
8. Barn Burning – William Faulkner

UNIT III: Parts of Speech (15 Hours)

9. Articles
10. Noun
11. Pronoun
12. Verb
13. Adverb
14. Adjective
15. Preposition

UNIT IV: Critical & Creative Thinking. (15 Hours)

Poem

16. The Things That Haven't Been Done Before – Edgar Guest
17. Stopping by the Woods on a Snowy Evening – Robert Frost

Readers Theatre

18. The Magic Brocade – A Tale of China
19. Stories on Stage – Aaron Shepard (Three Sideway Stories from Wayside School" by Louis Sachar)

Unit V: Paragraph and Essay Writing (15 Hours)

20. Descriptive
21. Expository
22. Persuasive
23. Narrative
24. Reading Comprehension

Teaching Methodology	Interactive methods, and multimedia presentations
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Books for Study

1. Yousafzai, M. (2013). *I am Malala*, Little. Brown and Company.
2. Gandhi, M. K. (2011). *An Autobiography or The Story of My Experiments with Truth (Chapter - I)*. Rupa Publications.
3. Tagore, R. (1913). *"Gitanjali 35" from Gitanjali (Song Offerings): A Collection of Prose Translations Made by the Author from the Original Bengali*. MacMillan.
4. Shepard, A. (2017). *Stories on Stage*. Shepard Publications.

Books for Reference

1. Krishnasamy, N. (1975). *Modern English: A Book of Grammar, Usage and Composition*. Macmillan.
2. Nesfield, J. C. (2019). *English Grammar Composition and Usage*. Macmillan.

Websites and eLearning Sources

1. <https://archive.org/details/i-am-malala>
2. <https://www.indiastudychannel.com/resources/146521-Book-Review-An-Autobiography-or-The-story-of-my-experiments-with-Truth.aspx>
3. <https://www.poetryfoundation.org/poems/45668/gitanjali-35>
4. <https://amzn.eu/d/9rVzINv>
5. <https://archive.org/details/in.ernet.dli.2015.44179>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	discover self awareness and positive thinking required in various life situations	K1
CO2	classify the attributes of empathy	K2
CO3	apply creative and critical thinking skills	K3
CO4	focus on grammar for functional purposes	K4
CO5	integrate the LSRW skills for effective communication	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
1	23UEN12GE01		General English - 1						5		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3	3	3	2.5
CO3	3	3	3	2	3	3	3	3	3	2	2.8
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3	3	3	2.8
Mean Overall Score											2.82 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UBO13CC01	Core Course - 1: Plant Diversity - 1 (Algae)	5	4

Course Objectives
To provide a comprehensive knowledge on the biology of algae.
To provide a basis for better understanding of the evolution higher of plants.
To understand reproductive biology, ecology of plants by studying the simpler systems in algae.
To understand the role of algae in ecosystems as primary producers of nutrition.
To understand importance of algae to animals and humans.

UNIT I (15 Hours)

General characters of Algae: algal distribution; criteria for classification; classification of Algae (Fritsch-1935-1945).

UNIT II (15 Hours)

Thallus organization (unicellular-Chlorella, Diatoms, colonial-Volvox, filamentous-Anabaena, Oedogonium, siphonous-Caulerpa, parenchymatous- Sargassum, Gracilaria).

UNIT III (15 Hours)

Reproduction-Vegetative, asexual, sexual reproduction and life histories (haplontic- Oedogonium and Chara, diplontic-Diatoms and Sargassum, diplohaplontic-Ulva and diplobiontic-Gracilaria).

UNIT IV (15 Hours)

Algal cultivation methods, Algal production systems; indoor cultivation methods and large scale cultivation of algae, harvesting of algae.

UNIT V (15 Hours)

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite. Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phycoremediation. Role of algae in CO₂ sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence.

Teaching Methodology	Chart, PPT, chalk and talk
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Books for Study

1. Lee, R. E. (2018). *Phycology*, (5th Ed.). Cambridge University Press.
2. Kumar, H. D. (1999). *Introductory phycology*. Affiliated East-West Press.
3. Singh, V., Pande, P. C. & Jain, D. K. (2020). *A textbook of botany*, (5th Ed.). Rastogi Publication.
4. Morris, I. (1977). *An introduction to the algae*. Hutchinson & Co (Publishers) Ltd.

Books for Reference

1. Das, M. K. (2010). *Algal biotechnology: New vistas*. Daya Publishing House.
2. Chapman, V. J. & Chapman, D. J. (2013). *The algae*. Alpha Numera.
3. Fritsch, F. E. (1945). *The structure and reproduction of the algae*. Cambridge University press.
4. Round, F. E. (1984). *The Ecology of algae*. Cambridge University Press.
5. Lee, R. E. (2008). *Phycology*, (4th Ed.). Cambridge University Press.
6. Bold, H. C. & Wynne, M. J. (1978). *Introduction to the algae: Structure and function*. Prentice Hall of India.

Websites and eLearning Sources

1. <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
2. <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
3. <https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-SecondEdition/Barsanti-Gualtieri/p/book/9781439867327>

4. <https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-EnvironmentalAssessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678>
5. <https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-DrA-K-Sinha-Dr-V-P-Singh>
6. <https://www.wileyindia.com/a-textbook-of-algae.html>
7. <https://www.kobo.com/in/en/ebook/algae-biotechnology>
8. <https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	relate to the structural organization, reproduction and significance of algae.	K1
CO2	demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth	K2
CO3	explain the benefits of various algal technologies on the ecosystem.	K3
CO4	compare and contrast the thallus organization and modes of reproduction in algae.	K4
CO5	determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23UBO13CC01		Core Course - 1: Plant Diversity - 1 (Algae)							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UBO13CP01	Core Practical - 1: Algae	3	2

Course Objectives
To develop skills to identify algae based on habitat, thallus structure and the internal organization.
To identify microalgae in a mixture.
To develop skills to prepare the microslides of algae.
To study the economic importance of few species.
To understand importance of algae to animals and humans.

Experiments

1. Micro-preparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of algal mixture.
4. Field visit to study fresh water/marine water algal habitats.
5. Visit to nearby industry actively engaged in algal technology.

Teaching Methodology	PPT, microslide preparation, models, chalk and talk, diagrams
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Books for Study

1. Kumar, H. D. (1999). *Introductory phycology*. Affiliated East-West Press.
2. Bendre, A. & Kumar, A. (2020). *A textbook of practical botany-1*, (10th Ed.). Rastogi Publications.
3. Round, F. E. (1984). *The ecology of algae*. Cambridge University Press.
4. Singh, V., Pande, P. C & Jain, D. K. (2020). *A textbook of botany*, (5th Ed.). Rastogi Publication.

Books for Reference

1. Serediak, N. & Huynh, M. L. (2011). *Algae identification lab guide: accompanying manual to the algae identification field guide*. Agriculture and Agri-Food.
2. Chapman, V. J. & Chapaman, D. J. (1960). *The algae*. ELBS & MacMillan.
3. Lee, R. E. (2008). *Phycology*, (4th Ed.). Cambridge University Press.
4. Lee, R. E. (2018). *Phycology*, (5th Ed.). Cambridge University Press.

Websites and eLearning Sources

1. <https://www.amazon.in/Practical-Manual-Algae-Sundara-Rajan/dp/8126106492>
2. https://books.google.co.in/books/about/Practical_Manual_of_Algae.html?id=8d5DAAAACAAJ&redir_esc=
3. [https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae\(PDF-21P\).html](https://freebookcentre.net/biology-books-download/Concepts-of-Botany-Algae(PDF-21P).html)
4. <https://www.ebooks.com/en-in/book/210152662/algae/sachin-kumar-mandotra/>
5. https://books.google.co.in/books/about/Algae.html?id=s1P855ZWc0kC&redir_esc=y

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recall and identify algae using key identification characters.	K1
CO2	demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.	K2
CO3	describe the internal structure of algae prescribed in the syllabus.	K3
CO4	decipher the algal diversity in fresh/marine water and their economic significance.	K4
CO5	evaluate the various techniques used to culture algae for commercial purposes	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23UBO13CP01		Core Practical - 1: Algae							3	2
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UBO13AC01	Allied Course - 1: Allied Zoology - 1	4	3

Course Objectives
To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida.
To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata.
To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia.
To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia.
To acquire detailed knowledge of select invertebrate and chordate forms.

UNIT I: Diversity of Invertebrates - I (12 Hours)

Principles of taxonomy. Criteria for classification - Symmetry and Coelom - Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

UNIT II: Diversity of Invertebrates - II (12 Hours)

Classification of Arthropoda, Mollusca and Echinodermata up to class level with examples

UNIT III: Diversity of Chordates - I (12 Hours)

Classification of Prochordata, Pisces and Amphibia up to orders giving two examples

UNIT IV: Diversity of Chordates - II (12 Hours)

Classification of Reptilia, Aves and Mammalia up to orders giving two examples

UNIT V: Animal organisation (12 Hours)

Structure and organization of (i)Earthworm (ii)Rabbit (iii)Prawn

Teaching Methodology	PPT, videos, demonstration using specimens, models and charts.
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Book for Study

1. Ayyar, M. E. (1972). *Outlines of zoology*. Viswanathan Publication.

Books for Reference

1. Ayyar, M. E., & Ananthakrishnan, T. N. (1991). *A manual of zoology: Invertebrata* (Vol. 1). Viswanathan Publishers.
2. Ayyar, M. E., & Ananthakrishnan, T. N. (1992). *A manual of zoology: Invertebrata* (Vol. 2). Viswanathan Publishers.
3. Ayyar, M. E., & Ananthakrishnan, T. N. (1981). *A manual of zoology: Chordata*. Viswanathan Publishers.
4. Jordan, E. L. & Verma, P. S. (2015). *Invertebrate zoology*. S. Chand & Co.

Websites eLearning Sources

1. <https://www.sanctuaryasia.com>
2. <https://www.iaszoology.com>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recall the characteristic features invertebrates and chordates.	K1
CO2	classify invertebrates up to class level and chordates up to order level.	K2
CO3	explain and discuss the structural and functional organisation of some invertebrates and chordates.	K3
CO4	relate the adaptations and habits of animals to their habitat.	K4
CO5	analyse the taxonomic position, structure and organisation of animals.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23UBO13AC01		Allied Course - 1: Allied Zoology - 1							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UBO13AP01	Allied Practical - 1: Invertebrates and Vertebrates	2	1

Course Objectives
To understand the concept of taxonomy and systematic position of selected invertebrates.
To understand the feeding behaviour of different insects with reference to their mouth parts.
To prepare mounting of body and penial setae in earthworm and different appendages of prawn.
To acquire skill in dissection and displaying the different system in earthworm and cockroach.
To identify the campus fauna and apply the knowledge to classify them.

Experiments

1. **Earthworm:** External features and dissection of digestive and nervous systems; Mounting of body and Penial setae, Ovary and Spermatheca
2. **Cockroach:** External features and dissection of digestive system, nervous system and Reproductive system.
3. **Spotters:** NNRepresentative animal for each class in vertebrate and invertebrate phyla.
4. Temporary mounting of Mouth parts of Cockroach, House fly and mosquito.
5. Temporary mounting of Prawn appendages
6. Campus fauna identification.
7. Visit to a vermi- compost farm / sericulture research station and submission of report.

Teaching Methodology	Charts, slides, specimens, models and mounting dissection.
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Books for Study

1. Wallace, R. L., Taylor, W. K., & Beck, D. E. (2004). *Invertebrate zoology: a laboratory manual*, (5th Ed).
2. Verma, P. S., & Agarwal, V. K. (2003). *A manual of practical zoology*, (6th Ed.). S. Chand Publication.

Books for Reference

1. Lal, S. S. (2015). *A text book of practical zoology - Vertebrate*. Oscar Publication.
2. Jordan, E. L., & Verma, P. S. (1995). *Chordata zoology and elements of animal physiology*. S. Chand and Co.
3. Ayyar, M. E., & Ananthakrishnan, T. N. (1992). *A manual of zoology: Invertebrata* (Vol. 1, Part 1). Viswanathan Publishers.
4. Kotpal, R. L. (1992). *Animal diversity* (Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Molluscs, Echinodermata). Rastogi Publications.

Websites and eLearning Sources

1. <https://www.biodiversitylibrary.org/item/63900>
2. <https://fordham.libguides.com/Biology/Zoology>
3. <https://www.austincc.edu /sziser/ Zoology Lab>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	identify and draw the external features of selected invertebrates and vertebrates.	K1
CO2	prepare the temporary mounting of mouth parts of insects and appendages of prawn.	K2
CO3	illustrate and labelling the digestive, nervous and reproductive system of dissected animals.	K3
CO4	dissect and identify different systems in earthworm and cockroach.	K4
CO5	explore the biological role of earthworm and silkworm from the field exposure.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23UBO13AP01		Allied Practical - 1: Invertebrates and Vertebrates							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UBO14FC01	Foundation Course: Basics of Botany	2	1

Course Objectives				
To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.				
To understand the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.				
To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.				
Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles.				
Understanding of laws of inheritance, genetic basis of loci and alleles.				

UNIT I: Biodiversity (6 Hours)

Systematics: Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.

UNIT II: Cell Biology (6 Hours)

Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane Plastids, Ribosomes.

UNIT III: Plant Morphology (6 Hours)

Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Flowers, Fruits and Seeds.

UNIT IV: Genetics (6 Hours)

Concept of Heredity and Variation - Mendel's Laws of Inheritance.

UNIT V: Plant Physiology (6 Hours)

Cell as a Physiological Unit: Water relations -Absorption and movement: Diffusion, Osmosis, Plasmolysis, Imbibition -Permeability, Water Potential - Transpiration - Movement - Mineral Nutrition.

Teaching Methodology	Charts, PPT, chalk and talk.
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Books for Study

1. Singh, V., Pande, P. C. & Jain, D. K. (2021). *A textbook of botany*. Rastogi Publications.
2. Bhatnagar, S. P. & Moitra, A. (2020). *Gymnosperms*. New Age International (P) Ltd.
3. Sharma, O. P. (2017). *Bryophyta*, MacMillan India Ltd.
4. Lee, R. E. (2008). *Phycology*, (4th Ed.). Cambridge University Press.
5. Pandey, B. P. (1986). *Textbook of botany (College Botany)* (vols.: 1-2). S. Chand and Co.
6. Rao, K., Krishnamurthy, K. V. & Rao, G. S. (1979). *Ancillary botany*. S. Viswanathan Pvt. Ltd.

Books for Reference

1. Parihar, N. S. (2012). *An introduction to embryophyta -Pteridophytes*. Surjeet Publications.
2. Alexopoulos, C. J. (2013). *Introduction to mycology*. Willey Eastern Pvt. Ltd.
3. Vashishta, P. C. (2014). *Botany for degree students: Gymnosperms*. Chand & Company Ltd.
4. Coulter, M. J. (2014). *Morphology of gymnosperms*. Surjeet Publications.
5. Vashishta, P. C. (2014). *Botany for degree students: Algae*. Chand & Company Ltd.
6. Parihar, N. S. (2013). *An introduction to embryophyta -Bryophytes*. Surjeet Publications.

Websites and eLearning Sources

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>

5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-anintroduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>
8. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	increase the awareness and appreciation of human friendly algae and their economic importance.	K1
CO2	develop an understanding of microbes and fungi and appreciate their adaptive strategies	K2
CO3	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours	Credits	
1	23UBO14FC01		Foundation Course: Basics of Botany						2	1	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
Mean Overall Score											2.32 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UHE14VE01	Value Education - 1: Essentials of Humanity	2	1

Course Objectives
To identify one's own potentials, strengths and weaknesses
To identify various challenges (physical, emotional, and social) in adolescence
To consciously overcome one's challenges and move towards self-esteem
To maximize one's own potential in enabling a holistic development
To assimilate human values comprehensively

UNIT I: Principles of Value Education (6 Hours)

Introduction to values - Characteristics and Roots of Values - Value Education & Value Clarification
- Moral Characters - Kinds of Values - Objectives of Values

UNIT II: Development of Human Personality (6 Hours)

Personality: Introduction, Theories, Integration & Factors influencing the development of personality - SEL Series - Discovering self - Defence Mechanism Power of positive thinking - Why worry?

UNIT III: The Dimensions of Human Development (6 Hours)

Areas of Development: Physical, Intellectual, Emotional, Social Development, Moral & Spiritual development

UNIT IV: Responsible Parenthood (6 Hours)

Human Sexuality - Marriage and Family - Sex and Love - Characteristics of Responsible parent - Causes of Marriage disharmony - Art of wise parenting

UNIT V: Gender Equality and Empowerment (6 Hours)

Historical perspective - Women in Independence struggle - Women in Independent India - Education & Economic development - Crimes against Women - Women rights - Time-line of Women achievements in India

Teaching Methodology	Chalk and Talk, Power point
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Book for Study

1. Department of Human Excellence. (2021). *Essentials of Humanity*. St. Joseph's College.

Books for Reference

1. Xavier, A. (2012). *You Shall Overcome*, (6th Ed.). ICRDE Publication.
2. Alex, K. (2009). *Soft Skills*. S. Chand.
3. Kalam, A.A. P. J. (2012). *You Are Unique*. Punya Publishing.

Websites and eLearning Sources

1. <http://livingvalues.net>. Accessed 05 March 2021.
2. <http://www.apa.org/topics/personality#>. Accessed 05 March 2021.
3. <http://www.peacecorps.gov/educators/resources/global-issues-gender-equaligy-and-womens-empowerment/>. Accessed 05 March 2021.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	recall the prescribed values and their dimensions.	K1
CO2	examine themselves by learning the developmental changes happening in the course of their lifetime.	K2
CO3	Apply the trained values in the day-to-day life.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23UHE14VE01		Value Education - 1: Essentials of Humanity							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	2	3	3	2.8
CO2	3	2	2	3	3	2	3	3	2	2	2.5
CO3	2	3	3	3	2	3	3	3	3	3	2.8
Mean Overall Score											2.7 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UEN14AE01	Ability Enhancement Compulsory Course - 1: Communicative English	6	3

Course Objectives
To recognize and identify the components of a formal letter.
To summarize the main points of a given letter and identify the intended meaning.
To use appropriate grammatical structures in context within their own writing.
To compare and contrast the elements of successful and unsuccessful letters.
To create well-structured letters with clear purpose and effectively evaluate and revise their own writing.

Basic Level

UNIT I (18 Hours)

- 1) A letter to avail college hostel
- 2) A requisition letter to provide fee concession
- 3) A requisition letter to provide Bonafide certificate
- 4) A letter to avail resources in college library
- 5) An On Duty Permission Letter
- 6) Nouns
- 7) Pronouns
- 8) Adjectives
- 9) Verbs
- 10) Adverbs

UNIT II (18 Hours)

- 11) A letter to provide conduct certificate
- 12) A letter to provide new ID card
- 13) A Permission letter for Name Correction in Mark sheet
- 14) A permission letter for Sports Events
- 15) A letter to avail permission for the Shepherd programme
- 16) Prepositions
- 17) Conjunctions
- 18) Articles
- 19) Conjugation of present form 'Be' verbs
- 20) Conjugation of past form 'Be' verbs

UNIT III (18 Hours)

- 21) A letter to avail the College Hostel
- 22) A permission letter to join the sport team
- 23) A request letter to access college Wi-Fi
- 24) A letter to vice principal requesting to change Elective course
- 25) A permission letter for project extension
- 26) Conjugation of future form 'Be' verbs
- 27) Conjugation of present continuous 'Be' verbs
- 28) Conjugation of Past continuous 'Be' verbs
- 29) Conjugation of Future continuous 'Be' verbs
- 30) Conjugation of Present Perfect 'Be' verbs

UNIT IV (18 Hours)

- 31) An apology letter to Dean for using mobile phone

- 32) A request letter to repair fan and tube light
- 33) A letter to invite Chief guest for Bibliophile Club meeting
- 34) A requisition Letter to issue the Transfer certificate
- 35) A permission letter for group exam coaching class
- 36) Conjugation of Past Perfect 'Be' verbs
- 37) Conjugation of Future Perfect 'Be' verbs
- 38) Conjugation of Present Perfect Continuous 'Be' verbs
- 39) Conjugation of Past Perfect Continuous 'Be' verbs
- 40) Conjugation of Future Perfect Continuous 'Be' verbs

UNIT V

(18 Hours)

- 41) A letter seeking help to find the missing laptop
- 42) A letter to the editor regarding frequent power cut
- 43) A medical leave letter
- 44) A requesting OD Letter to issue invitation to other colleges
- 45) A requisition letter to change Shift
- 46) Conjugation of present form 'Action' verbs
- 47) Conjugation of past form 'Action' verbs
- 48) Conjugation of Present form 'do' verbs
- 49) Conjugation of Past form 'do' verbs
- 50) Conjugation of Future form 'have' verbs

Teaching Methodology	Chalk and Talk, discussion, Training
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Book for Study

1. Jayapaul, V.L. (2023). *Begin to Learn English*. St. Joseph's College (Autonomous), Tiruchirappalli.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	compose various types of letters (request, permission, and apology) demonstrating clarity, coherence, and correctness.	K1
CO2	exhibit a sound understanding of nouns, pronouns, adjectives, verbs, and adverbs, utilizing them accurately in written and spoken English.	K2
CO3	apply language skills in real-life college scenarios, gaining confidence in communicating effectively with peers, faculty, and administrative staff.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
1	23UEN14AE01		Ability Enhancement Compulsory Course - 1: Communicative English						6		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
Mean Overall Score											2.37 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UEN14AE01	Ability Enhancement Compulsory Course - 1: Communicative English	6	3

Course Objectives
To recognize and identify common punctuation marks and their usage in paragraphs.
To summarize the main topics introduced in a paragraph and demonstrate understanding.
To apply the learned concepts to construct paragraphs that convey ideas effectively.
To analyze paragraphs to identify the role of prefixes, suffixes, and noun types in enhancing meaning.
To synthesize information to create paragraphs, evaluate their own writing, and engage in role-playing scenarios to demonstrate understanding.

Intermediate Level

UNIT I (18 Hours)

- 1) Paragraph Punctuation
- 2) Introducing a Topic
- 3) Rhyming Words
- 4) Word Association
- 5) Going To
- 6) What Will Happen

UNIT II (18 Hours)

- 7) Every Drop Counts
- 8) Prefix
- 9) Suffix
- 10) Comprehending Characters
- 11) Complimenting & Thanking
- 12) Proper & Common Nouns

UNIT III (18 Hours)

- 13) Noun Substitution Table
- 14) A, Some
- 15) Visual Comprehension
- 16) Singular to Plural
- 17) Making & Responding
- 18) Pronoun Classification

UNIT IV (18 Hours)

- 19) Pronoun I, Me, He, Him, She, Her, We.
- 20) Singular to Plural
- 21) Responding
- 22) Pronoun Classification
- 23) Using Preposition of Movement
- 24) Preposition: Visual Talk

UNIT V (18 Hours)

- 25) Prepositional Phrases
- 26) Storytelling
- 27) Asking For Opinion
- 28) Using Things Creatively
- 29) Transition Sequencing
- 30) Role Play

Book for Study

1. Joy, J. L. (2020). *Learning to Communicate*. St. Joseph's College (Autonomous), Tiruchirappalli.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	demonstrate proficiency in paragraph construction, rhyming words, and the use of prefixes and suffixes.	K1
CO2	apply advanced grammar rules, including proper/common nouns and pronoun usage, in both written and spoken communication.	K2
CO3	express opinions, compliments, and gratitude effectively, showcasing an enhanced ability to articulate thoughts and emotions.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
1	23UEN14AE01		Ability Enhancement Compulsory Course - 1: Communicative English						6		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
Mean Overall Score											2.37 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23UEN14AE01	Ability Enhancement Compulsory Course - 1: Communicative English	6	3

Course Objectives
To recognize and demonstrate basic self-introduction strategies.
To summarize information from listening and reading exercises, demonstrating understanding.
To apply learned concepts to construct essays, actively contribute to group discussions, and create coherent narratives.
To analyze reviews to understand how different elements contribute to a comprehensive evaluation.
To synthesize information to create compelling presentations, actively participate in debates, interviews, and assess their own communication proficiency.

Advance Level

UNIT I		(18 Hours)
1) Self Introduction		
2) Listening		
3) Reading		
UNIT II		(18 Hours)
4) Essay Writing		
5) Group Discussion		
6) Story Building, Story Writing & Story Narration		
UNIT III		(18 Hours)
7) Book Review		
8) Film Review		
UNIT IV		(18 Hours)
9) News Paper Reading and Analysis		
10) Public speaking: Drafting and Speaking		
UNIT V		(18 Hours)
11) Debate		
12) Interview Skills		

Websites and eLearning Resources

1. <https://ielts-up.com/listening/ielts-listening-practice.html>
2. <https://www.bestmytest.com/ielts/speaking>
3. <https://ielts-up.com/speaking/ielts-speaking-practice.html>
4. <https://learnenglishteens.britishcouncil.org/skills/writing/a2-writing/film-review>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	exhibit high-level language skills in self-introduction, listening, reading, and diverse writing tasks such as essay writing and storytelling.	K1
CO2	critically evaluate and analyze literature through book reviews, film reviews, and newspaper reading, demonstrating an ability to articulate informed opinions.	K2
CO3	showcase proficiency in public speaking, group discussions, debates, and interviews, reflecting a comprehensive mastery of advanced communication skills.	K3

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
1	23UEN14AE01	Ability Enhancement Compulsory Course - 1: Communicative English								6	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
Mean Overall Score											2.37 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UTA21GL02	General Tamil - 2	4	3

கற்றலின் நோக்கங்கள்
தமிழ் இலக்கிய வரலாற்றை அறிதல்.
எழுத்து, சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிதல்.
அயலகக் கவிதை வடிவங்களை விளங்கிக் கொள்ளுதல்.
மொழிபெயர்ப்புக் கவிதைகளின் வாயிலாக மொழிபெயர்ப்புத் திறனை வளர்த்தெடுத்தல்.
போட்டித் தேர்வுகளை எதிர்கொள்வதற்கான இலக்கண அறிவு பெறுதல்.

அலகு - 1

(12 மணிநேரம்)

பாரதியார் கவிதைகள் - குயில்பாட்டு (குயில் தன் பூர்வ ஜென்மக் கதை உரைத்தல்)

பாரதிதாசன் கவிதைகள் - சஞ்சீவி பர்வதத்தின் சாரல்

நற்றமிழ்க்கோவை - முதல் மூன்று கட்டுரைகள்

அலகு - 2

(12 மணிநேரம்)

வெ.இராமலிங்கனார் - சொல், தமிழன் இதயம்

முடியரசனார் - உயிர் வெல்லமோ, மனத்தாய்மை

பெருஞ்சித்திரனார் - அஞ்சாதீர், மொழி, இனம், நாடு

பட்டுக்கோட்டை கலியாண சுந்தரனார் - வருங்காலம் உண்டு, உழைக்காமல் சேர்க்கும் பணம்

இலக்கணம் - எழுத்து

இலக்கிய வரலாறு - புதுக்கவிதை, தமிழில் புதிய கவிதை வடிவங்கள்

அலகு-3

(12 மணி நேரம்)

சுரதா - நல்ல தீர்ப்பு

கண்ணதாசன் - ஒரு பாணையின் கதை

அப்துல் ரகுமான்- வீடு

மேத்தா - ஒரேகுரல்

இலக்கிய வரலாறு - தமிழ்ச்சிறுகதைகள், இருபதாம் நூற்றாண்டு உரைநடை வளர்ச்சி

சிறுகதை - முதல் மூன்று சிறுகதைகள்

அலகு - 4

(12 மணிநேரம்)

அரசியல் கவிதைகள்

ஈரோடு தமிழன்பன்- அகல் விளக்காக இரு

ஆதவன் தீட்சண்யா- இன்னும் இருக்கும் சுவர்களின் பொருட்டு

சுகிர்தராணி- என் கண்மணியே இசைப்பிரியா

சக்தி ஜோதி - யுகாந்திர உறக்கம்

பழநி பாரதி- வெள்ளைக்காகிதம்

லிவிங்ஸ்மைல் வித்யா - நினைவில் பால்யம் அழுத்தம்

இலக்கணம் - சொல்

அலகு - 5

(12 மணிநேரம்)

அயலகக் கவிதைகள்

ஓசேரிசால் (தமிழில் நெய்தல்) - விடைகொடு என்தாய் மண்ணே

ஹைபுன் கவிதைகள்

சிறுகதை - நான்கு முதல் ஆறு சிறுகதைகள்

நற்றமிழ்க் கோவை - நான்கு முதல்ஆறு கட்டுரைகள்

கற்பித்தல் முறை (Teaching Methodology)	விரிவுரை (Lecture), காணொளிக் காட்சி (Videos), விளக்கக் காட்சி (PPT presentation)
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பாடநூல்கள்

1. தமிழாய்வுத்துறை (2023). பொதுத்தமிழ் -2, தூய வளனார் தன்னாட்சிக் கல்லூரி.
2. தமிழாய்வுத்துறை (2021). நற்றமிழ்க் கோவை, தூய வளனார் தன்னாட்சிக் கல்லூரி.

Websites and eLearning Sources

1. <https://www.chennaiilibrary.com/bharathiyar/kuyilpattu.html>
2. www.tamildigitallibrary.in
3. <https://eluthu.com/kavithai>
4. https://podhutamizh.blogspot.com/2017/09/blog-post_42.html
5. <https://thamizhsudar.com>
6. <https://ta.wikipedia.org/wiki>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	இப்பாடத்தின் நிறைவில் மாணவர்கள்	
CO1	தமிழ் இலக்கிய நூல்கள் பற்றிய அறிவைப் பெறுவர்.	K1
CO2	தமிழ் இலக்கண வளர்ச்சியைப் புரிந்து கொள்வர்.	K2
CO3	பிழையின்றி எழுதும் திறன் பெறுவதோடு கற்றல் திறனையும் வளர்த்துக்கொள்வர்.	K3
CO4	பிற கவிதை வடிவங்களைக் கையாளும் திறன் பெறுவர்.	K4
CO5	போட்டித் தேர்வுகளை எதிர்கொள்ளும் திறனைப் பெறுவர்.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23UTA21GL02		General Tamil - 2							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO4	PSO5	
CO1	2	1	2	2	3	3	3	2	3	2	2.3
CO2	2	1	2	2	2	3	2	2	2	2	2.0
CO3	2	1	2	2	3	3	3	2	3	2	2.3
CO4	1	2	1	2	2	3	2	2	3	2	2.0
CO5	1	1	2	2	3	3	3	2	3	2	2.2
Mean Overall Score											2.16 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UFR21GL02	French - 2	4	3

Course Objectives
To construct simple phrases with pronominal verbs
To apply the different types of articles
To understand the usage of pronouns
To analyse the French culture through French culinary art
To evaluate and compare the French fashion in current scenario

UNIT I (12 Hours)

- TITRE: Les Loisirs
- GRAMMAIRE : les adjectifs interrogatifs, les nombres ordinaux, les verbes pronominaux
- LEXIQUE : les différentes activités quotidiennes, les loisirs, les activités quotidiennes, les matières
- PRODUCTION ORALE : parler sur votre passe-temps
- PRODUCTION ECRITE : décrire sa journée

UNIT II (12 Hours)

- TITRE: La routine
- GRAMMAIRE : les pronoms personnels COD, les verbes du premier groupe en e/er/eler/eter, le verbe prendre
- LEXIQUE : exprimer ses goûts et ses préférences, le temps, l'heure, la fréquence
- PRODUCTION ORALE : savoir comment dire l'heure
- PRODUCTION ECRITE : écrire vos préférences en quelques lignes

UNIT III (12 Hours)

- TITRE: Où Faire Ses Courses?
- GRAMMAIRE : les articles partitifs, le pronom en (la quantité), très ou beaucoup
- LEXIQUE : inviter et répondre à une invitation, les commerces et les commerçants, demander et dire le prix, les quantités
- PRODUCTION ORALE : faire des courses pour une soirée
- PRODUCTION ECRITE : écrire un message en acceptant l'invitation

UNIT IV (12 Hours)

- TITRE: Découvrez et Dégustez
- GRAMMAIRE : l'impératif, il faut, les verbes devoir, pouvoir, savoir, vouloir
- LEXIQUE : Commander et commenter sur un plat de la carte, les aliments, les services, les moyens de paiement
- PRODUCTION ORALE : Jeu de rôle – au restaurant (entre vous et le garçon)
- PRODUCTION ECRITE : faire une comparaison avec la carte française et indienne

UNIT V (12 Hours)

- TITRE: Tout le monde s'amuse/ les ados au quotidien
- GRAMMAIRE : les adjectifs démonstratifs, le pronom indéfini on, le futur proche, le passé composé, les verbes en –yer, voir et sortir
- LEXIQUE : connaître les marques connues sur les vêtements, les sorties, situer dans le temps, les vêtements et les accessoires
- PRODUCTION ORALE : décrire une tenue

- PRODUCTION ECRITE : écrire une lettre amicale, une carte postale

Teaching Methodology	Chalk and talk, visual cues like flashcards, one to one conversation
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Book for Study

1. Dauda, P., Giachino, L. & Baracco, C. (2016). *Generation A1*. Didier.

Books for Reference

1. Girardet, J. & Pecheur, J. (2017). *Echo A1*. CLE International, (2nd Ed.).
2. Mérieux, R. & Loiseau, Y. (2012). *Latitudes A1*. Didier.
3. Fournier, I. (2011). *Talk French*. Goyal Publishers.

Websites and eLearning Sources

1. <https://www.frenchtoday.com/blog/french-verb-conjugation/french-reflexive-verbs-list-exercises/>
2. <https://www.fluentu.com/blog/french/french-subject-pronouns/>
3. <https://grammarist.com/french/french-partitive-article/>
4. <https://www.talkinfrench.com/guide-french-food-habits/>
5. <https://www.fluentu.com/blog/french/talking-about-clothes-in-french/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	relate pronominal verbs in expressing one's day today activity	K1
CO2	compare the different types of articles – article partitif and contracte	K2
CO3	construct texts using pronouns – passages and dialogues	K3
CO4	discover the food habits of the French culture	K4
CO5	appraise the French fashion	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23UFR21GL02		French - 2							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	1	3	1	2	2	2	2.2
CO2	2	1	2	3	2	3	1	2	2	2	2.0
CO3	3	2	3	2	2	3	3	1	3	2	2.4
CO4	3	2	2	1	3	3	3	1	1	3	2.2
CO5	2	1	2	2	3	3	3	2	2	2	2.2
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UHI21GL02	Hindi - 2	4	3

Course Objectives
To understand the basics of Hindi Language
To make the students to be familiar with the Hindi words
To enable the students to develop their effective communicative skills in Hindi
To introduce the socially relevant subjects in Modern Hindi Literature
To empower the students with globally employable soft skills

UNIT I (12 Hours)

- Kafan
- Letter Writing - Chutti Patra
- Bakthikal - Namakarn
- Sarkari Kariyalayom Ka Naam

UNIT II (12 Hours)

- Baathcheeth - Dookan Mein
- Kriya
- Letter Writing - Rishthedarom Ko Patra
- Bakthikal - Samajik Paristhithiyam

UNIT III (12 Hours)

- Vah Thodthi Patthar
- Adverb
- Letter Writing - Naukari Keliye Avedan Patra
- Bakthikal - Sahithiyik Paristhithiyam

UNIT IV (12 Hours)

- Mukthi
- Samas
- Letter Writing - Kitab Maangne Keliye Patra
- Bakthikal - Salient Features, Main Divisions

UNIT V (12 Hours)

- Anuvad
- Sandhi
- Letter Writing - Nagarpalika Ko Patra
- Bakthikal - Visheshathayem

Teaching Methodology	Peer Instruction Exercise, Videos, PPT, Quiz, Group Discussion
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Books for Study

1. Viswanath Tripaty. (2018). *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd.
2. Kamathaprasad Gupth, M. (2020). *Hindi Vyakaran*. Anand Prakashan.
3. Sadananth Bosalae. (2020). *kavya sarang*, Rajkamal Prakashan.

Books for Reference

1. Acharya Ramchandra Shukla. (2021). *Hindi Sahitya Ka Itihas*. Prabhat Prakashan.
2. Krishnakumar, G. (2016). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.
3. Aravind Kumar. (2019). *Sampoorna Hindi Vyakaran our Rachana*, Lucent publisher.
4. Lakshman Prasad Singh. (2017). *Kavya ke sopan*. Bharathy Bhavan Prakashan.

Websites and e-Learning Sources

1. <https://hindigrammar.in/sandhi.html>
2. <https://www.successcds.net/class10/hindi/samas-in-hindi>
3. <https://mycoaching.in/kriya-ke-bhed-verb-in-hindi>
4. <https://namastesensei.in/adverb-in-hindi-examples/>
5. <https://viahindi.in/hindi-vyakaran/sandhi-paribhasha-prakar-or-udaharan>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	Find out the Terms & Expressions related to letter writing.	K1
CO2	Explain the works of Hindi writers.	K2
CO3	Complete the sentences in Hindi using basic grammar.	K3
CO4	Analyze the social & political conditions of Devotional period in Hindi Literature.	K4
CO5	Justify the human values stressed on the works of the following authors "Premchand, Nirala, etc."	K5

Relationship Matrix											
Semester	Course Code			Title of the Course					Hours	Credits	
2	23UHI21GL02			HINDI - 2					4	3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	1	3	1	2	2	3	3	3	2	3	2.3
CO3	3	2	3	2	2	3	2	3	2	2	2.4
CO4	2	3	3	1	3	2	3	2	1	2	2.2
CO5	3	2	2	2	3	2	3	2	3	2	2.4
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23USA21GL02	Sanskrit - 2	4	3

Course Objectives				
To bring out the salient aspects of classical Sanskrit poetry				
To introduce court epics in Sanskrit				
To train students in declensions of pronouns in Sanskrit				
To coach the students in the conjugation patterns of verbs in Sanskrit				
To offer coaching in morpho-phonemic rules and their applications in Sanskrit				

UNIT I (12 Hours)

Asmathi usmath tat kim (MFN) sarvanaam asabdaha

UNIT II (12 Hours)

Sandhi Niyamaah Abhyaash (Guna , Visarga , Dirgha , Vrddhi)

UNIT III (12 Hours)

Lang lakaarah Kriyapadaani Prayoga Vivaranam

UNIT IV (12 Hours)

Raguvamsaha Pratama sargaha (1 -15 slokas)

UNIT V (12 Hours)

Suvacanani Vakya Prayoga Vivaranam

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
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Books for Study

1. Saralasamkritham Skisha. (2021).
2. Dhaatu Manjari. (2021).

Books for Reference

1. Paindrapuram Ashram, Srirangam. (2019).
2. Vadhyar, R. S., & Sons, Book - Seller and Publishers. (2021).
3. Kulapthy, K. M. (2018). *Saral Sanskrit Balabodh*. Bharathiys Vidya Bhavan.

Websites and eLearning Sources

1. <https://www.meritnation.com>
2. <https://www.aplustopper.com>
3. <https://mycoaching.in/lang-lakar>
4. https://sanskritdocuments.org/sites/giirvaani/giirvaani/rv/sargas/01_rv.htm
5. <https://resanskrit.com/blogs/blog-post/sanskrit-shlok-popular-quotes-meaning-hindi-english>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Remembering names of different objects, remembering different verbal forms and sandhi	K1
CO2	Contrast different verbal forms Explain good sayings, Relate good saying to life.	K2
CO3	Apply and build small sentences	K3
CO4	Analyze different forms of Verbs and nouns	K4
CO5	Appreciate subhashitas and Sanskrit poetry	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23USA21GL02		Sanskrit - 2							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	1	3	2	2	2	3	3	2	1	2.1
CO2	3	2	3	2	2	3	2	3	3	2	2.5
CO3	2	2	3	2	2	2	2	3	3	1	2.1
CO4	3	2	3	3	1	2	3	3	3	1	2.4
CO5	3	2	2	2	3	2	2	3	3	1	2.3
Mean Overall Score											2.28 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UEN22GE02	General English - 2	5	3

Course Objectives
To develop an expanded and specialised vocabulary related to diverse themes such as education, entertainment, career, and society through activities like word grids, reading, and discussions.
To enhance problem-solving abilities through activities like debates, role-playing, and scenario analysis.
To enable students to express ideas with precision and clarity by practising different forms of expressing quality, comparison, and actions in various contexts.
To equip students with language skills relevant to professional settings.
To encourage students to explore language as a tool for creative expression and communication.

UNIT I (15 Hours)

01. Education Word Grid
02. Reading Problems and Solutions
03. Syllabification
04. Forms for Expressing Quality
05. Expressing Comparison
06. Monosyllabic Comparison
07. Di/polysyllabic Comparison
08. The Best Monosyllabic Comparison
09. The Best Di/Polysyllabic Comparison
10. Practising Quality Words

UNIT II (15 Hours)

11. Wh Words
12. Yes/No Recollection
13. Unscramble Wh Questions
14. Wh Practice
15. Education and the Poor
16. Controlled Role Play
17. Debate on Education
18. Education in the Future
19. Entertainment Word Grid
20. Classify Entertainment Wordlist
21. Guess the Missing Letter
22. Proverb-Visual Description
23. Supply Wh Words
24. Rearrange Questions
25. Information Gap Questions

UNIT III (15 Hours)

26. Asking Questions
27. More about Actions
28. More about Actions and Uses
29. Crime Puzzle
30. Possessive Quiz
31. Humorous News Report
32. Debate on Media and Politics
33. Best Entertainment Source

UNIT IV

(15 Hours)

34. Career Word Grid
35. Job-Related Wordlist
36. Who's Who?
37. People at Work
38. Humour at Workplace
39. Profession in Context
40. Functions and Expressions
41. Transition Fill-in
42. Transition Word Selection
43. Professional Qualities
44. Job Procedures
45. Preparing a Resume
46. Interview Questions
47. Job Cover Letter Format
49. Emailing an Application
50. Mock Interview

UNIT V

(15 Hours)

51. Society Word Grid
52. Classify Society Wordlist
53. Rearrange the Story
54. Storytelling
55. Story Cluster
56. Words Denoting Time
57. Expressing Time
58. What Can You Buy?
59. Noise Pollution
60. Positive News Headlines
61. Negative News Headlines
62. Matching Conditions
63. What Would You Do?
64. If I were the Prime Minister
65. My Dream Country

Teaching Methodology	Lecture Method, Use of ICT Tools and Interactive method
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Book for Study

1. Joy, J.L. & Peter, F.M. (2014). *Let's Communicate 2*, Trinity Press.

Books for Reference

1. Ahrens, Sönke. (2017). *How to Take Smart Notes: One Simple Technique to Boost Writing, Learning and Thinking*. Create Space.
2. Aspinall, Tricia. (2002). *Test Your Listening*. Pearson.
3. Bailey, Stephen. (2004). *Academic Writing: A Practical Guide for Students*. Routledge.
4. Fitikides, T.J. (2002). *Common Mistakes in English*, (6th Ed.). Longman
5. Wainwright., Gordon. (2007). *How to Read Faster and Recall More: Learn the Art of Speed Reading with Maximum Recall*, (3rd Ed.). How to Books.

Websites and eLearning Sources

1. <https://learnenglish.britishcouncil.org/>
2. <https://oneminuteenglish.org/en/best-websites-learn-english/>
3. <https://www.dailywritings.com/best-websites-to-learn-english/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	write paragraphs with apt punctuation marks	K1
CO2	discuss basic issues with friends, relatives and members of the family	K2
CO3	use polite expressions in appropriate ways	K3
CO4	evaluate the language and communication aspects of the topics	K4
CO5	create and produce various forms of communication, including professional documents like resumes and cover letters, debates	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23UEN22GE02		General English - 2							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
CO4	2	2	3	2	3	3	2	3	2	3	2.5
CO5	2	2	2	3	2	2	2	3	2	2	2.2
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UBO23CC02	Core Course - 2: Bryophytes, Fungi, Lichens and Plant Pathology	4	3

Course Objectives				
To provide a comprehensive knowledge of the Bryophytes.				
To impart the knowledge on the cell wall, nutrition pattern and classification of fungi.				
To understand the concept about the reproduction of fungi.				
To understand the role of lichens with the special reference to its ecosystems and Economic importances				
To enable them to understand the defense mechanism of plants.				

UNIT I (12 Hours)

Bryophytes: General characteristics of Bryophytes, Various natural habitats of Bryophytes, Classification (Rothmaler, 1951), vegetative reproduction and economic importance. Evolution of gametophytes and sporophytes among Bryophytes.

UNIT II (12 Hours)

Fungi: General characteristics - mode of nutrition and reproduction. Outline on the Classification of fungi (G. C Ainsworth, 1973; C. J Alexopoulos and C. W. Mims, 1983). Economic importance.

UNIT III (12 Hours)

Fungi: detailed study of morphology and reproduction of the following: (a) Mastigimycotina - *Albugo*; (b) Zygomycotina - *Rhizopus*; (c) Ascomycotina - *Penicillium*; (d) Basidiomycotina - *Puccinia*; (e) Deuteromycotina - *Cercospora*.

UNIT IV (12 Hours)

Lichens: occurrence, distribution, classification, structure, vegetative and sexual reproduction (with reference to fruticose lichen - *Usnea*). Ecological and Economic importance of Lichens.

UNIT V (12 Hours)

Plant Pathology: Definition of terms used in plant pathology; plant diseases: concept and classification of plant diseases-methods of control of plant diseases: mechanical, chemical and biological. Defence mechanism in plants: structural, morphological and biochemical.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Singh, V., Pande, P.C., & Jain, D. K. (2020). *A Text Book of Botany* (5th Ed.). Rastogi Publication.
2. Pandey, B. P. (2018). *College Botany* Volume I, 20/e, S. Chand and Company.
3. Pandey, B. P. (2005). *Simplified Course in Botany*. S. Chand and Company.

Books for Reference

1. Sharma, O. P. (1989). *Text Book of fungi*. Tata McGraw Hill.
2. Vasishta, B. R., & Sinha, A. K. (2003). *Botany for degree students Fungi*. S Chand.
3. Mehrotra, R.S. (1991). *Plant Pathology*. Tata McGraw-Hill Publishing.
4. Hale, M.E. (1983). *The Biology of Lichens*. New Age International publishers.
5. Prem Puri. (1981). *Bryophytes-Morphology growth and differentiation*. Atma Ram & Sons.
6. Smith, G.M. (1955). *Cryptogamic Botany* Vol-1 & II. McGraw Hill.

Websites and eLearning Sources

1. <https://www.geeksforgeeks.org/bryophyta/>
2. [https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_\(Boundless\)/24%3A_Fungi/24.01%3A_Characteristics_of_Fungi/24.1A%3A_Characteristics_of_Fungi](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/24%3A_Fungi/24.01%3A_Characteristics_of_Fungi/24.1A%3A_Characteristics_of_Fungi)
3. <https://www.pharmaguideline.com/2007/02/morphology-classification-reproduction-cultivation-of-fungi.html>
4. [https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_\(OpenStax\)/05%3A_The_Eukaryotes_of_Microbiology/5.05%3A_Lichens](https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(OpenStax)/05%3A_The_Eukaryotes_of_Microbiology/5.05%3A_Lichens)
5. <https://sites.google.com/a/uasd.in/ecourse/plant-pathology>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	acquire thorough knowledge on the salient features of Fungi and Bryophytes	K1
CO2	learn the major classes, types, structure and reproduction of various forms of lichens.	K2
CO3	acquire the basic knowledge of the evolutionary relationship between fungi and cichans bryophytes.	K3
CO4	identify the economic importance of Bryophytes, fungi and lichens	K4
CO5	attain basic Knowledge about plant defense mechanism	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23UBO23CC02		Core Course - 2: Bryophytes, Fungi, Lichens and Plant Pathology							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	2	2	3	2	2	2	2	2.1
CO2	3	2	1	2	2	3	2	2	2	2	2.1
CO3	3	2	1	2	2	2	3	2	1	2	2.0
CO4	2	3	2	2	1	2	2	2	1	2	1.9
CO5	2	3	1	3	2	2	3	2	2	1	2.1
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UBO23CC03	Core Course - 3: Pteridophytes, Gymnosperms, Anatomy and Embryology	4	3

Course Objectives
To learn the economic importance of Pteridophytes and gymnosperms.
To acquire knowledge on fossils and fossilization process.
To understand the salient features of Pteridophytes and gymnosperms.
To understand the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.
To attain basic knowledge of the types of embryo sac and endosperm.

UNIT I (12 Hours)

Pteridophytes: general characteristics, classification (Reimer's System, 1954). Telome theory. Stelar evolution and economic importance. Morphology, anatomy and reproduction of *Selaginella*. Fossils, types (compression, impression, petrification, coal balls). Geological time scale. Morphology, anatomy and reproduction in *Rhynia*.

UNIT II (12 Hours)

Gymnosperms: general characteristics, distribution and classification (Sporne, 1965). Morphology, anatomy and reproduction of *Cycas*. Economic importance. Fossil Gymnosperms: Morphology, anatomy and reproduction of *Calamites*.

UNIT III (12 Hours)

Tissues - definition, types - simple tissues: parenchyma, collenchyma, sclerenchyma, fibres and sclerieds - structure and functions. Complex tissues: xylem and phloem. Meristems - classifications. Vegetative shoot apex and the theories: apical cell and tunica-corpus. Root apex: Korper - Kappe theory.

UNIT IV (12 Hours)

The stem - primary and secondary structure of dicotyledonous and monocotyledonous stem. Leaf anatomy: monocot and dicot. The root: primary and secondary structure of dicotyledonous and monocotyledonous roots. Nodal anatomy: Unilacunar, Trilacunar and Multilacunar. Anomalous secondary growth.

UNIT V (12 Hours)

Fertilization. Double fertilization. Structure and types of ovules; Types of embryo sacs. Development of dicot embryo (Capsella) & development of monocot embryo (Sagittaria). Endosperm: structure, function and types. Apomixis and polyembryony - types and significance. Parthenogenesis and its significance.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

- Sharma, O. P. (2017). *Pteridophyta*. McGraw Hill Education.
- Bhatnagar, S.P., & Moitra, A. (2020). *Gymnosperms*. New Age International (P) Ltd, Publishers.

Books for Reference

- Rashid, A. (2007). *An Introduction to Pteridophyta*. Vikas publications.
- Johri, R.M., Lata, S., & Tyagi, K. (2005). *A text book of Gymnosperms*. Dominate pub and Distributer.
- Vasista, P. C., Sinha, A.K., & Anil kumar. (2005). *Botany for degree students, Gymnosperms*, S Chand.
- Bard, J. (1990). *Morphogenesis*. Cambridge University Press.

5. Agarwal, S.B. (1990). *Embryology of Angiosperms - a fundamental approach*. Sahitya Bhawan.
6. Pandey, B.P. (1989). *Plant Anatomy*. S. Chand and Co. Ltd.

Websites and eLearning Sources

1. <https://www.youtube.com/watch?v=VA2LNWkZNW0>
2. <https://www.youtube.com/watch?v=DH65cGLvLws>
3. <https://www.youtube.com/watch?v=gdGbTk-4dLs>
4. <https://www.youtube.com/watch?v=fRgl-zhtMYU>
5. <https://www.youtube.com/watch?v=PKaabF8u8RM>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	familiar with the knowledge on tissues of plant stem, root and leaves.	K1
CO2	differentiate of the structure of dicots and monocots with reference to root, stem and leaves.	K2
CO3	value the properties and economic importance of Pteridophytes and Gymnosperms.	K3
CO4	differentiate the types of embryo sac and endosperm.	K4
CO5	value the importance of polyembryony.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours		Credits	
2	23UBO23CC03		Core Course - 3: Pteridophytes, Gymnosperms, Anatomy and Embryology					4		3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	2	2	2.3
CO2	2	3	2	3	3	2	3	2	2	2	2.4
CO3	2	2	3	2	3	3	3	2	3	3	2.7
CO4	3	3	2	1	2	3	2	3	1	2	2.3
CO5	2	3	2	2	3	2	3	2	2	3	2.6
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UBO23CP02	Core Practical - 2: Bryophytes, Fungi, Lichens, Plant Pathology, Pteridophytes, Gymnosperms, Anatomy and Embryology	3	2

Bryophytes:

Marchantia, *Anthoceros* and *Funaria*.

Fungi:

Plasmodiophora, *Albugo*, *Puccinia* and *Cercospora*.

Lichen:

Usnea

Plant Pathology:

Tobacco Mosaic Virus, Citrus Canker, Late Blight of Potato, Red Rot of Sugarcane, Bunchy Top of Banana, Little Leaf of Brinjal, Paddy Blast

Pteridophytes:

Selaginella.

Paleobotany (Fossils):

Rhynia and *Calamites*.

Gymnosperms:

Cycas.

Anatomy

Study of simple and complex tissue.

Internal structure of dicot and monocot stem. Internal structure of dicot and monocot root.

Anomalous secondary thickening in *Boerhaavia* and *Dracaena*.

Nodal anatomy: Uni, tri and multi lacunar.

Embryology

T.S of mature anther. Types of ovule, dissection and isolation of developmental stages of dicot embryos.

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UBO23AC02	Allied Course - 2: Agricultural Entomology	4	3

Course Objectives
To acquire the knowledge about the classification and morphology of insects.
To understand the functions of internal anatomy of insects.
To aware about the economical importance of selected orders.
To know about the skills involved in entrepreneur development.
To acquire the knowledge about stored and field pest and their control measures.

UNIT I (12 Hours)

General classification of insects. Morphology of insects: head, external structure. Mouth parts, tentorium, compound eye, types of antennae- thorax-tergum, sternum, pleuron. Wing structure, wing venation and coupling mechanism, Legs and their modification, Abdomen - abdominal appendages, male and female external genitalia.

UNIT II (12 Hours)

Physiology of digestive, respiratory, circulatory, nervous and reproductive systems, Immature stages of insects - metamorphosis, types and hormonal regulation.

UNIT III (12 Hours)

Economically important insect (orders): Coleoptera, Dictyoptera, Diptera, Hemiptera, Hymenoptera, Isoptera, Orthoptera and Lepidoptera. General characters and classification (up to Orders). Social behaviour/life of insects.

UNIT IV (12 Hours)

Economic classification of insects: beneficial insects (predators, parasites, pollinators, weed killers and scavengers). Destructive insects, a general knowledge of apiculture, sericulture and lac culture. Insects' role in forensic science. Recent trends in Integrated Pest Management. Plant protection - physical, chemical and biological methods of pest control.

UNIT V (12 Hours)

Pests of stored food materials (*Sitophilus oryzae*, *Rhizopertha dominica*, *Tribolium castaneum*) and their control, Study of Bionomics and control of pests of Paddy (*Tryporyza incertulas*, *Chilopolys charysa*, *Spodoptera amauritia*), Sugarcane (*Chilo infus catellus*, *C. sacchariphagas*, *Tryporyza nivella*), Cotton (*Aphis gossypii*, *Amaras cabiguttula*, *Thrips tabaci*), Coconut (*Oryctes rhinoceros*, *Rhynchophorus ferrugineus*) and Spices pests. Locust and their role in agriculture.

Teaching Methodology	Chart, PPT, Chalk and talk, Models and Field Visit
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Book for Study

1. Ambrose, P. D. (2004). *The Insect: Structure, function and biodiversity*, (1st Ed.). Kalyani Publishers.

Books for Reference

1. Rajan, K. (2024). *Manual of agricultural entomology - theory and practical*, Department of Botany, St. Joseph's College.
2. Nagarajan, K., Rajan, K., & Palavesam, A. (2017). *A Farmers Hand Book on Pest and Diseases Management in Cardamom (Elettaria cardamomum Maton)*, (1st Ed.). Wise Pub International (P) Ltd., Publishers.

3. Nagarajan, K., & Rajan, K. (2019). *Sericulture Theory and Practice*, (1st Ed.). Wise Pub International (P) Ltd., Publishers.
4. Vasantharaj, D.B., & Kumaraswami, T. (1978). *Elements of Economic Entomology*. Popular Book Department.
5. Nayar, K.K., Ananthakrishnan, T.N., & David, B.V. (1976). *General and Applied Entomology*, Tata McGraw Hill.
6. Imms, A.D. (1963). *General Text Book of Entomology*, Asia Publ House.

Websites and eLearning Sources

1. <https://agriculture.nmims.edu/agricultural-entomology/>
2. <https://www.nal.usda.gov/animal-health-and-welfare/beekeeping>
3. <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20sericultureapiculture%20lac%20culture%20and%20sericulture%20upload.pdf>
4. <https://www.gov.nl.ca/ecc/files/env-protection-pesticides-business-manuals-applic-chapter7.pdf>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	identify insects based on morphology	K1
CO2	identify beneficial and harmful insects.	K2
CO3	understand the physiology of insects.	K3
CO4	apply integrated pest management in field.	K4
CO5	categorize the insects based on its economic importance.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours		Credits	
2	23UBO23AC02		Allied Course - 2: Agricultural Entomology					4		3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	2	2	2	2	2	3	2	2.2
CO2	2	3	2	1	2	2	3	2	2	3	2.2
CO3	2	2	3	2	1	2	3	2	2	2	2.1
CO4	1	2	2	2	2	2	3	2	3	2	2.1
CO5	1	2	2	3	2	2	3	2	2	3	2.2
Mean Overall Score											2.16 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UBO23AP02	Allied Practical - 2: Agricultural Entomology	2	1

Detailed Study:

- * Study of distinguishing features of insects studied in theory and making sketches.
- * Field collection, identification and preservation of insects of agricultural importance, predators, pollinators, and weed killers - plant galls.
- * Study of different categories of insect pests and types of damage done by them in the field, godown and warehouses.
- * Dissection of Cockroach to study the mouthparts, digestive, nervous and reproductive systems, Salivary gland and Haemocytes. Modification of Antenna, legs & mouth parts.
- * Light trap collection and identification.
- * Visit to a local sericulture centre and submission of report.

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UHE24VE02	Value Education - 2: Fundamentals of Human Rights	2	1

Course Objectives
To sensitize students about various human rights and their importance
To empower them with the right understanding of human rights
To enable them to understand the Fundamental rights and the duties in the constitution of India
To help them comprehend the background, principles and the articles of UDHR
To make them involved in activities to defend human rights

UNIT I: Human Rights - An Introduction (6 Hours)

Introduction- Classification of Human Rights- Scope of Human Rights-Characteristics of Human Rights - Challenges for Human Rights in the 21st Century.

UNIT II: Historical Development of Human Rights (6 Hours)

Human Rights in Pre-World War Era- Human Rights in Post-World War Era- Evolution of International Human Rights Law - the General Assembly Proclamation- Institution Building, Implementation and the Post- Cold War Period. The ICC.

UNIT III: India and Human Rights (6 Hours)

Introduction- Preamble to Indian Constitution - Classification of Fundamental Rights-Salient Features of Fundamental Rights-and Fundamental Duties.

UNIT IV: Human Rights of Women and Children (6 Hours)

Women's Human Rights- Issues related to women's rights - and Rights of Women's and Children

UNIT V: Human Rights Violations and Organizations (6 Hours)

Human Rights Violations - Human Rights Violations in India - the Human Rights Watch Report, January 2012- Human Rights Organizations - NHRC - SHRC.

Teaching Methodology	Chalk and Talk, Power point, Handouts and Group discussion
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Book for Study

1. Department of Human Excellence, (2021). *Techniques of Social Analysis: Fundamentals of Human Rights*.

Books for Reference

1. Venkatachalem. (2005). *The Constitution of India*, Giri Law House.
2. Naik, V. & Shany, M. (2011). *Human rights education and training*, Crescent Publishing Corporation.
3. Neera, B. (2011). *Human Rights Content and Extent*. Swastika Publications.

Websites and eLearning Sources

1. <https://www.un.org/en/universal-declaration-human-rights/>
2. <https://www.ilo.org/global/lang--en/>
3. <https://www.amnesty.org/en/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Identify the importance and the values of human rights	K1
CO2	Understand the historical background and the development of Human Rights and the related organizations	K2
CO3	Apply the provisions of National and International human rights to themselves and the society	K3

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours	Credits		
2	23UHE24VE02		Value Education - 2: Fundamentals of Human Rights					2	1		
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO 2	PSO3	PSO 4	PSO5	
CO1	3	2	1	2	2	3	2	2	2	2	2.1
CO2	3	2	1	2	2	3	2	2	2	2	2.1
CO3	3	2	2	2	2	2	3	2	1	2	2.1
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23UHE24AE01	Ability Enhancement Compulsory Course - 2: Environmental Studies	2	1

Course Objectives
To enable students connect themselves with nature
To Impart knowledge of the concept of Biodiversity
To create awareness of the causes and consequences of various pollution
To help them recognize the available natural resources and the need to sustain them
To enable them to Identify the environmental problems and offer alternatives by making interventions both individually and collectively

UNIT I: Introduction to Environmental Studies (6 Hours)

Introduction - Scope and Importance - Subsystems of Earth - Various recycling Methods - Environmental Movements in India - Eco- Feminism - Public awareness - Suggestions to conserve environment

UNIT II: Natural Resources (6 Hours)

Food Resources - Land Resources - Forest resources - Mineral Resources - Water Resources - Energy Resources

UNIT III: Ecosystems, Biodiversity and Conservation (6 Hours)

General structure of ecosystem - Functions of Ecosystem - Energy flow and Ecological pyramids - Levels of Biodiversity - Hot spots of Biodiversity - Endangered and Endemic Species - Value of Biodiversity - Threats to Biodiversity - Conservation of Biodiversity

UNIT IV: Environmental Pollution (6 Hours)

Air Pollution - Water Pollution - Oil Pollution - Soil Pollution - Marine Pollution - Noise Pollution - Thermal Pollution - Radiation Pollution

UNIT V: Environmental Organizations and Treatise (6 Hours)

United Nations Environment Program (UNEP) - International treaties on Environmental protection - Ministry of Environment, Forest and Climate Change - Important National Environmental Acts and rules- Environmental Impact assessment - Issues deals with Population growth.

Teaching Methodology	Chalk and Talk, Power point and Field visit
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Book for Study

1. Department of Human Excellence, (2021). *Environmental Studies*.

Books for Reference

1. Rathor, V.S. & Rathor B. S. (2013). *Management of Natural Resources for Sustainable Development*. Daya Publishing House.
2. Sharma P.D. (2010). *Ecology and Environment*, (8th Ed.). Rastogi Publications.
3. Agrawal, A & Gibson, C.C. (2001). *Introduction: The Role of Community in Natural Resource Conservation*. Rutgers University Press.

Websites and eLearning Sources

1. <https://www.unep.org/>
2. <http://moef.gov.in/en/>
3. <https://www.ipcc.ch/reports/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Identify the concepts related to global ecology and the environment	K1
CO2	Comprehend the natural resources and environmental organizations	K2
CO3	Apply the acquired knowledge to sensitize individuals and public about the environmental crisis	K3

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23UHE24AE01		Ability Enhancement Compulsory Course - 2: Environmental Studies							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO 4	PSO 5	
CO1	3	2	1	2	2	3	2	2	2	2	2.1
CO2	3	2	1	2	2	3	2	2	2	2	2.1
CO3	3	2	2	2	2	2	3	2	1	2	2.1
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UTA31GL03	General Tamil - 3	4	3

கற்றலின் நோக்கங்கள்
தனிப்பாடல்களின் பாடற்பொருளை அறிதல்
சுற்றிலக்கியங்களின் வகைகளையும் வகைமைகளையும் அறிதல்
இடைக்காலப் புலவர்களின் பங்களிப்பை உணர்தல்
சுற்றிலக்கியங்களின் பாடுபொருள், தனித்தன்மை, மரபு ஆகியவற்றை அறிதல்
சுற்றிலக்கியங்கள்வழி தமிழின் வளர்ச்சி நிலையை அறிதல்

அலகு - 1

(12 மணி நேரம்)

ஒளவையார்

காவிரியே தார்வேந்தன் (16) கற்றது கைமண்ணளவு (39) மதியாதார் முற்றம் (42)

இனியது கேட்கின் (55) தாயொடு அறுகவை (64)

காளமேகப் புலவர் -

நஞ்சிருக்குத் தோலுரிக்கு நாதர்முடி(4) ஓடுஞ் சுழிசுத்த முண்டமாகும் (16)

அடிநந்தி சேர்தலால் ஆகம் (22) செருப்புக்கு வீரரைச் சென்றுழக்கும் (52)

துதிவாணி வீரம் (80)

இராமச்சந்திர கவிராயர் - வஞ்சகர்பா னடந்தலைந்த - 19

பொற்களந்தைப் படிக்காகத் தம்பிரான் - குட்டுதற்கோபிள்ளைப் பாண்டிய - 21

தமிழ்விடுதாது, - கண்ணிகள் 19 முதல் 62 வரை

கலிங்கத்துப்பரணி - தேவியைப் பரவியது, பாடல் 121 முதல் 134 வரை

அலகு - 2

(12 மணி நேரம்)

முக்கூடற்பள்ளு - நாட்டுப்படலம் பாடல்கள் 19 - முதல் 27 வரை

முத்துகுமாரசாமி பிள்ளைத்தமிழ் - அம்புலிப்பருவம் முதல் 5 பாடல்கள்

அறிஞர் அண்ணா - வேலைக்காரி நாடகம்

அலகு - 3

(12 மணி நேரம்)

திருக்குற்றாலக்குறவஞ்சி - மலைவளம் (6 பாடல்கள்)

இலக்கியவரலாறு - சுற்றிலக்கியங்கள்

நற்றமிழ்க்கோவை கட்டுரைகள் 7, 8, 9

அலகு - 4

(12 மணி நேரம்)

தாயுமானவர் திருப்பாடல்கள் - பராபரக்கண்ணி 7 முதல் 30 வரை உள்ள கண்ணிகள்

இலக்கணம் - அணிகள்

குணங்குடி மஸ்தான் சாகிபு - குறை இரங்கி உரைத்தல் - 7 பாடல்கள்

அலகு - 5

(12 மணி நேரம்)

திருவருட்பா - திருக்கதவம் திறத்தல்

இலக்கிய வரலாறு - இடைக்காலப் புலவர்கள், நாடகத்தமிழ்

நற்றமிழ்க்கோவை - கட்டுரைகள் - 10, 11, 12

கற்பித்தல் முறை	விரிவுரை (Lecture), காணொளிக் காட்சி (Videos), விளக்கக் காட்சி (PPT presentation)
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பாட நூல்கள்

1. தமிழாய்வுத்துறை (2023), பொதுத்தமிழ்-3, தூய வளனார் கல்லூரி

2. தமிழாய்வுத்துறை (2021), நற்றமிழ்க்கோவை, தூய வளனார் கல்லூரி

பார்வை நூல்கள்

1. செயராமன் ந. வீ. (1967), சுற்றிலக்கியச் செல்வம், மணிவாசகர் பதிப்பகம்

2. பொன்னுசாமி (2023), சுற்றிலக்கிய வரலாறு, இரண்டு தொகுதிகள், பாரிநிலையம்

3. சண்முகம் பிள்ளை மு. (2022), சுற்றிலக்கிய வகைகள், மணிவாசகர் பதிப்பகம்

Websites and eLearning Sources

1. <https://ta.wikipedia.org/wiki/>

2. <https://www.britannica.com/science/Siddha-medicine>

3. <https://nischennai.org/main/siddha-medicine/>

4. <https://tamil.hindustantimes.com/>
5. <https://www.tamiluniversity.ac.in/english/library2-/digital-library/>
6. <https://www.tamilelibrary.org/>
7. www.projectmadurai.or
8. <http://www.tamilvu.org/ta/library-libcontnt-273141>
9. <https://www.tamildigitallibrary.in/>
10. <https://noolaham.org/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	இப்பாடத்தின் நிறைவில் மாணவர்கள்	
CO1	இடைக்காலப் புலவர்களின் பாட்டுத்திறனை அறிந்து கொள்வர்	K1
CO2	சிறந்தலக்கிய வகைகளையும் வகைமைகளையும் அறிந்து கொள்வர்	K2
CO3	பள்ளு, பரணி, பிள்ளைத்தமிழ், குறவஞ்சி போன்ற இலக்கியங்கள் வழி வீரம், பக்தி, காதல் உணர்வை அறிந்து கொள்வர்	K3
CO4	சிறந்தலக்கியங்களின் அமைப்பு பாட்டு வடிவங்களை அறிந்து கொள்வர்	K4
CO5	இடைக்காலத் தமிழ் வளர்ச்சி நிலையை அறிந்து கொள்வர்	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UTA31GL03		General Tamil - 3							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	2	3	2	3	3	2	2.5
CO2	2	2	2	3	3	2	2	3	3	2	2.4
CO3	3	3	2	3	3	2	2	3	3	3	2.7
CO4	3	2	2	3	2	3	2	3	2	3	2.5
CO5	2	3	2	3	2	3	2	3	2	3	2.5
Mean Overall Score											2.52 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UFR31GL03	French - 3	4	3
Course Objectives				
To analyse the French clothing with respect to its culture				
To apply prepositions and understand its usages				
To analyse a contemporary text in present tense				
To evaluate the French festivals and compare with their own cultural context				
To apply the past tense using simple conversation				

UNIT I (12 Hours)

- TITRE: Vivre la ville
- GRAMMAIRE : la comparaison, les prépositions avec les noms géographiques, les pronoms personnels COI, le pronom y (le lieu)
- LEXIQUE : se repérer sur un plan de ville, la ville, les lieux de la ville
- PRODUCTION ORALE : demander et indiquer une direction dans un dialogue
- PRODUCTION ECRITE : décrire votre ville natale, créez les affiches en appréciant votre ville

UNIT II (12 Hours)

- TITRE: Visiter une ville
- GRAMMAIRE : la position des pronoms compléments, les verbes du premier groupe en – ger et – cer, les verbes ouvrir et accueillir
- LEXIQUE : dire les informations sur une ville de votre choix, les transports, les points cardinaux, les prépositions de lieu
- PRODUCTION ORALE : Indiquer le chemin
- PRODUCTION ECRITE : Demander des renseignements touristiques

UNIT III (12 Hours)

- TITRE: On vend ou on garde
- GRAMMAIRE : la formation du pluriel, les adjectifs de couleurs, l'adjectif beau, nouveau, vieux
- LEXIQUE : savoir comment s'habiller des grandes occasions, les couleurs, les formes, les matériaux
- PRODUCTION ORALE : comprendre une présentation de catalogues vestimentaires en France
- PRODUCTION ECRITE : adresser des souhaits à quelqu'un

UNIT IV (12 Hours)

- TITRE: Ventes d'autrefois, ventes d'aujourd'hui
- GRAMMAIRE : les pronoms relatifs qui et que, l'imparfait, les verbes connaître, écrire, mettre et vendre, la question avec inversion
- LEXIQUE : comprendre la description de personnes dans un extrait de roman, les mesures, l'informatique
- PRODUCTION ORALE : imaginez un dialogue avec un personnage célèbre. Utilisez l'inversion.
- PRODUCTION ECRITE : écrire une biographie en utilisant les pronoms relatifs

UNIT V (12 Hours)

- TITRE: Félicitations! / On voyage!

- GRAMMAIRE : les pronoms démonstratifs, les articles : particularités, les pronoms interrogatifs variables : lequel, les adverbes de manières, les verbes recevoir et conduire
- LEXIQUE : les moyens de transports, les voyages, les fêtes, l'aéroport et l'avion, la gare et le train, l'hôtel
- PRODUCTION ORALE : Présenter ses vœux–
- PRODUCTION ECRITE : Faire une réservation

Teaching Methodology	PPT Presentation, Seminar, Video Assignments
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Book for Study

1. Dauda, P., Giachino, L., & Baracco, C. (2016). *Generation AI*. Didier.

Books for Reference

1. Girardet, J., & Pecheur, J. (2017). *Echo AI*. (2nd Ed.). CLE International.
2. Mérieux, R., & Loiseau, Y. (2012). *Latitudes AI*. Didier.
3. Fournier, I. (2011). *Talk French*. Goyal Publishers.

Websites and eLearning Sources

1. <https://français.lingolia.com/en/grammar/prepositions>
2. <https://www.lawlessfrench.com/grammar/present-tense/>
3. <https://www.thoughtco.com/textures-french-adjectives-and-expressions-1368980>
4. <https://study.com/academy/lesson/past-tense-in-french.html>
5. <https://absolutely-french.eu/french-celebrations/?lang=en>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Relate colours, materials and shapes to the french clothing.	K1
CO2	Select appropriate prepositions in giving directions.	K2
CO3	construct a text in present tense using different verbs.	K3
CO4	examine the travel manners and celebrations of the French.	K4
CO5	justify the usage of past tense in a biography.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
3	23UFR31GL03		French - 3						4		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	1	2	2	3	2	3	1	2	3	2.1
CO2	3	2	3	3	1	2	1	2	2	3	2.2
CO3	2	1	3	2	2	3	1	3	2	2	2.1
CO4	3	1	3	2	3	3	3	1	2	3	2.4
CO5	3	2	3	2	2	3	3	2	2	1	2.3
Mean Overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UHI31GL03	Hindi - 3	4	3

Course Objectives
To appreciate the features of Modern Hindi Prose
To understand the Hindi literature in association with the contemporary requirements
To enable the students to develop their effective communicative skills in Hindi
To strengthen the language competence among the students
To empower the students with globally employable soft skills

UNIT I (12 Hours)

- Tera Sneh Na Khoon
- Samband Bodak
- Reethikal - Namakarn
- Tense

UNIT II (12 Hours)

- Himadri Thung Sring Se
- Paribakshik Shabdavali
- Smuchaya Bodak
- Reethikal - Samajik Paristhithiyam

UNIT III (12 Hours)

- Insan Our Kuthae
- Vismayadi Bodak
- Reethikal - Sahithyik Paristhithiyam
- Reethikal - Salient Features

UNIT IV (12 Hours)

- Shokgeeth
- Avikary Shabdh
- Reethikal - Main Divisions
- Social Media and Modern World

UNIT V (12 Hours)

- Reethikal - Visheshathayem
- Anuvad
- Bahoo Ki Vidha (One Act Play)

Teaching Methodology	Videos, PPT, Quiz, Group Discussion, Case Based Problem Solving
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Books for Study

1. Jain, S.K. (2019). *Anuwad: Siddhant Evam Vyavhar*. Kailash Pustak Sadan.
2. Gupth, K. M. (2020). *Hindi Vyakaran*, Anand Prakashan.
3. Bosalae, S. (2020). *kavya sarang*. Rajkamal Prakashan.

Books for Reference

1. Ramdev. (2016). *Vyakaran Pradeep*. Hindi Bhavan.

2. Singh, L.P. (2017). *Kavya Ke Sopan*. Bharathy Bhavan Prakashan.
3. Shukla, A.R. (2021). *Hindi Sahitya Ka Itihas*, Prabhat Prakashan.
4. Gosamy, K. (2016). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.

Websites and eLearning Sources

1. <https://www.hindwi.org/poets/jaishankar-prasad/all>
2. <https://youtu.be/e9wK-pYfVPc>
3. <https://www.amarujala.com/kavya/sahitya/sumitranandan-pant-best-hindi-poems>
4. <https://mycoaching.in/samuchchay-bodhak-kya-hai>
5. <https://www.subhshiv.in/2021/06/avikari-shabd.html>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will able to	
CO1	find out the dialects of Hindi language.	K1
CO2	compare the poems of Sumithra Nandanpanth, Prasad & Bachan in Context with their experience of life.	K2
CO3	illustrate the importance given to family ethics by the youth in the modern period according to “Bahoo Ki vidha” One Act play.	K3
CO4	categorize the poetics in some selective poems.	K4
CO5	justify the social & political conditions of Devotional period in Hindi Literature.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours		Credits
3	23UHI31GL03		Hindi - 3						4		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	2	3	2	1	3	2	2.4
CO2	3	2	3	2	2	3	2	3	2	3	2.5
CO3	3	2	2	3	1	3	2	3	2	3	2.4
CO4	2	3	3	2	3	2	3	3	2	1	2.4
CO5	3	2	2	3	3	2	1	3	2	3	2.4
Mean Overall Score											2.42 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23USA31GL03	Sanskrit - 3	4	3

Course Objectives
To introduce simple poetry in Sanskrit
To give an exposure to the Vedas and Vedangas
To acquaint students with epics and puranas
To train students in conjugation of verbs in future tense
To introduce Upasarga-s and their role in verb formations

UNIT I (12 Hours)

Ramodantam , Balakandam (1-15 verses)

UNIT II (12 Hours)

Ramodantam, Balakandam (15-30 verses)

UNIT III (12 Hours)

Vedas - Vedangas vivaranam

UNIT IV (12 Hours)

Asta dasha Purana and Dashopanishads

UNIT V (12 Hours)

Upasargas and Bhavishyat Kaalah Vakya Prayoga

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
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Books for Study

1. Vedic literature
2. Ramodantam

Books for Reference

1. Parameshwara. (2018). *Ramodantam*. LIFCO Chennai.
2. Vadhyar, R. S., & Sons. (2019). *History of Sanskrit Literature*, Book - sellers and publishers , Kalpathu ,Palghat, Kerala , south India.
3. Kulapathy, K.M Saral *Sanskrit Balabodh, Bharathita vidya bhavan*, Munshimarg.

Websites and eLearning Sources

1. <https://www.scribd.com/doc/210917188/Sri-Ramodantam-Sanskrit-Text-With-English-Translation>
2. <http://www.sushmajee.com/ms-ppp/text/ved-notes.pdf>
3. <https://occr.org.in/publication/Vedanga.pdf>
4. https://www.forgottenbooks.com/en/download/TheThirteenPrincipalUpanishadsTranslatedFromtheSanskrit_10017247.pdf
5. <https://www.learn Sanskrit.org/guide/uninflected-words/the-upasarga/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	remember Characters and events of Ramayana	K1
CO2	understand social ethics and moral duties.	K2
CO3	apply the values learnt, in day to day life	K3
CO4	appreciate the Vedic Philosophy	K4
CO5	evaluate and create new words with upasargas	K5

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
3	23USA31GL03	Sanskrit - 3								4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	2	3	3	3	3	3	2	1	2.3
CO2	3	3	2	3	3	2	2	3	3	3	2.7
CO3	3	3	1	3	3	1	1	3	3	3	2.4
CO4	2	2	1	2	3	2	2	3	2	1	2.0
CO5	3	3	2	3	2	2	3	3	3	2	2.6
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UEN32GE03	General English - 3	5	3

Course Objectives
To develop strategies to enhance reading skills through teacher-led practices, promoting comprehension, critical analysis, and creative engagement with various genres.
To strengthen informal and formal letter writing skills.
To analyze and appreciate different literary forms, including anecdotes, biographies, poems, and prose, fostering critical thinking and creative expression.
To practice applying grammatical structures, including the simple future and future continuous tenses, in writing tasks.
To engage in critical discussions through reading and writing about societal issues.

UNIT I: Suggestions to Develop Your Reading Habit

(13 Hours)

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Listening and Reading Skills through Teacher-led Reading Practice
- 1.3 Glossary
 - 1.3.1 Words
 - 1.3.2 Phrases
- 1.4 Reading Comprehension
- 1.5 Critical Analysis
- 1.6 Creative Task
- 1.7 General Writing Skill: Letter Writing: Informal
- 1.8 Grammar: Simple Present Tense

UNIT II: The Secret of Success: An Anecdote

(13 Hours)

- 1.9 Introduction
- 2.0 Objectives
- 2.1 Listening and Reading Skills through Teacher-led Reading Practice
- 2.2 Glossary
 - 2.3.1 Words
 - 2.3.2 Phrases
- 2.4 Reading Comprehension
- 2.5 Critical Analysis
- 2.6 Creative Task
- 2.7 General Writing Skills: Letter Writing: Formal
- 2.8 Grammar: Present Continuous Tense

UNIT III: The Impact of Liquor Consumption on the Society

(13 Hours)

- 2.9 Introduction
- 3.0 Objectives
- 3.1 Listening and Reading Skills through Teacher-led Reading Practice
- 3.2 Glossary
 - 3.3.1 Words
 - 3.3.2 Phrases
- 3.4 Reading Comprehension
- 3.5 Critical Analysis
- 3.6 Creative Task
- 3.7 General Writing Skills: Letter to Newspaper
- 3.8 Grammar: Simple Past Tense

UNIT IV: Dr. A.P.J. Abdul Kalam: A Short Biography**(12 Hours)**

3.9 Introduction

4.0 Objectives

4.1 Listening and Reading Skills through Teacher-led Reading Practice

4.2 Glossary

4.3.1 Words

4.3.2 Phrases

4.4 Reading Comprehension

4.5 Critical Analysis

4.6 Creative Task

4.7 General Writing Skill: Write a letter applying for a job

4.8 Grammar: Past Continuous Tense

UNIT V: Golden Rule: A Poem**(12 Hours)**

4.9 Introduction

5.0 Objectives

5.1 Listening and Reading Skills through Teacher-led Reading Practice

5.2 Glossary

5.3.1 Words

5.3.2 Phrases

5.4 Reading Comprehension

5.5 Critical Analysis

5.6 Creative Task

5.7 Grammar: Simple Future Tense

5.8 General Writing Skill: Circular-Writing

UNIT VI: Hygiene**(12 Hours)**

5.9 Introduction

6.0 Objectives

6.1 Listening and Reading Skills through Teacher-led Reading Practice

6.2 Glossary

6.3.1 Words

6.3.2 Phrases

6.4 Reading Comprehension

6.5 Critical Analysis

6.6 Creative Task

6.7 General Writing Skill: Writing an Agenda for a Meeting

6.8 Grammar: Future Continuous Tense

Teaching Methodology	Lecture Method, Use of ICT Tools and Interactive method
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Book for Study

1. Jayraj., & Arul, S.J. et al. (2016). *Trend-Setter: An Interactive General English Textbook for Undergraduate Students*. Trinity.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	recall and explain the fundamental components of English language and grammar.	K1
CO2	demonstrate their understanding of various texts by summarizing, paraphrasing, and interpreting the contents.	K2
CO3	apply their language and comprehension skills to create written communication.	K3
CO4	critically analyze the texts presented in the course.	K4
CO5	synthesize the language and grammar knowledge to compose creative tasks	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UEN32GE03		General English - 3							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
CO4	2	2	3	2	3	3	2	3	2	3	2.5
CO5	2	2	2	3	2	2	2	3	2	2	2.2
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UBO33CC04	Core Course - 4: Taxonomy of Angiosperms	5	4

Course Objectives
To understand the variations in angiosperms
To understand the basic principles and guiding the plant classifications
To gain knowledge on morphology and nomenclature
To describe and identify plants in technical terms and describing the salient features of different families
To understand the economic and medicinal importance of the various families

UNIT I (15 Hours)

History of plant taxonomy. Plant collection, Identification (herbaria and botanical gardens), documentation (keys and flora). Taxonomic hierarchy; Botanical nomenclature: ICN principles, scientific names, ranks, authorship, nomenclatural types, valid publication, rejection of names, priority of publication.

UNIT II (15 Hours)

Classification: artificial (Carolus Linnaeus), natural (Bentham & Hooker) and phylogenetic (Engler & Prantle's) and Angiosperm Phylogeny Group (APG). Brief account of cytotaxonomy, chemotaxonomy, molecular taxonomy and numerical taxonomy.

UNIT III (15 Hours)

Detailed study and economic importance of the following families (classification based on APG IV, 2016): Basal angiosperms: Nymphaeales - Nymphaeaceae; Magnoliids: Piperales - Magnoliales - Annonaceae; Monocots: Alismatales - Araceae - Asparagales - Orchidaceae, Commelinales - Pontederiaceae, Poales - Poaceae.

UNIT IV (15 Hours)

Eudicots: Rosids: Fabales - Fabaceae, Rosales - Rosaceae, Cucurbitales - Cucurbitaceae; Malpighiales - Euphorbiaceae, Myrtales - Lythraceae, Myrtaceae, Sapindales - Anacardiaceae, Rutaceae, Meliaceae.

UNIT V (15 Hours)

Eudicots cont.: Superasterids: Santalales - Loranthaceae, Caryophyllales - Amaranthaceae, Asterids: Ericales - Gentianales - Rubiaceae, Apocynaceae, Solanales - Solanaceae, Lamiales - Lamiaceae, Asterales - Asteraceae.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Michael, G. S. (2019). *Plant Systematics*, (3rd Ed.). Academic Press.
2. Sharma, OP. (2009). *Plant Taxonomy*. Tata McGraw-Hill Education Pvt. Ltd.

Books for Reference

1. Sampamurthy, AVSS. (2015). *Taxonomy of Angiosperms*, (2nd Ed.). I.K. International Pvt. Ltd.
2. Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*, (2nd Ed.). Cambridge University Press.

Website and eLearning Sources

1. https://www.bionity.com/en/encyclopedia/History_of_plant_systematics.html
2. <https://thegma.org.uk/learning/resources/plant-classification?dt=2019-05-02&sig=wx3hiQ2qkPhBWa1o4boUHbHvbTDaGxQcxAcgzXMfU%3D>
3. <https://www.gbif.org/dataset/fa8ab13c-52ed-4754-b838-aeff74c79718>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recognize fundamental plant taxonomy principles and key terms.	K1
CO2	explain plant taxa evolutionary relationships with depth in taxonomy principles and methods.	K2
CO3	apply plant taxonomy knowledge to analyze literature critically and draw conclusions effectively.	K3
CO4	demonstrate proficiency in practical plant taxonomy skills, including fieldwork and specimen curation.	K4
CO5	execute independent plant taxonomy research, showcasing advanced problem-solving abilities	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UBO33CC04		Core Course - 4: Taxonomy of Angiosperms							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	2	3	2	2	2.3
CO2	3	3	3	2	2	3	2	2	2	3	2.5
CO3	3	3	3	2	2	3	3	3	2	2	2.6
CO4	2	3	3	2	3	2	3	3	3	3	2.7
CO5	3	3	3	2	3	3	3	3	3	3	2.9
Mean Overall Score											2.6 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UBO33CC05	Core Course - 5: Plant Breeding and Evolution	5	4

Course Objectives				
To acquire knowledge on objectives and various methods of plant breeding.				
To outline the process of evolution and various theories pertaining to biological evolution.				
To judge which plant breeding methods are appropriate for specific objectives.				
To analyse, evaluate and synthesize information relevant to plant breeding.				
To formulate a plan for the application of plant breeding methods to achieve a specific objective.				

UNIT I (15 Hours)

Plant Breeding: History and objectives; genetic basis and important achievements in plant breeding; modes of reproduction in crop plants (asexual, sexual, apomictic)- advantages and limitations, Floral biology in relation to selfing and crossing techniques; Plant Introduction - types and procedures; Centres of origin and domestication of crop plants.

UNIT II (15 Hours)

Selection methods: Mass selection, pure line and clonal selection- merits and demerits; Hybridization: objectives, choice of parents and causes of failure; Incompatibility and male sterility - methods to overcome; Methods of handling segregation material for isolation of superior strains - bulk method and pedigree method of selection; Role of distant hybridization- in crop improvement.

UNIT III (15 Hours)

Inbreeding depression and heterosis: genetic basis and its applications; Steps in the production of single cross, double cross, three-way cross; Polyploidy: induced polyploidy, role of auto and allopolyploids; Mutation and crop improvement.

UNIT IV (15 Hours)

Back crossing: theory and procedure for transferring various types of character; Breeding for disease resistance and drought tolerance; Preservation and utilization of germplasm; Breeding techniques for rice, sugarcane, groundnut and maize; Limitations of conventional breeding; Aspects of molecular breeding.

UNIT V (15 Hours)

Evolution: origin of life, theories of evolution of life forms: Lamarckism and Darwinism. Variations - definition causes and types, mutation (principles of Hugo De Vries). Role of mutation in speciation. Evolution through ages: human evolution. Evidences for evolution.

Teaching Methodology	Chart, PPT, Videos, Chalk and talk.
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Books for Study

1. Chaudhari, H. K. (1995). *Elementary Principles of Plant Breeding*, (Revised Ed.). Oxford & IBH.
2. Chittaranjan, K. (2006-07). *Genome Mapping and Molecular Breeding in Plants*. Vols. I-VII. Springer.

Books for Reference

1. Chopra, V. L. (1994). *Plant breeding- Theory and Practice*. Oxford & IBH.
2. Acquaah, G. (2020). *Principles of Plant Genetics and Breeding*, (3rd Ed.).
3. Singh, B. D. (2022). *Plant Breeding Principles and Methods*, (12th Ed.).

Website and eLearning Sources

1. https://link.springer.com/chapter/10.1007/978-981-19-5434-4_1
2. <https://www.seedworld.com/the-evolution-of-plant-breeding/>
3. <https://evolution.berkeley.edu/evolution-101/an-introduction-to-evolution/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	acquire knowledge on floral biology and select proper breeding method	K1
CO2	critically analyze information about life and its origins	K2
CO3	cultivate skills in emasculation and pollination of various crop plants	K3
CO4	gain expertise on hybrid seed production techniques	K4
CO5	use the descriptors in various crops for selection of superior genotypes	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UBO33CC05		Core Course - 5: Plant Breeding and Evolution							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	3	2	2	2.2
CO2	3	2	2	1	2	1	3	3	2	3	2.2
CO3	1	2	3	2	3	2	3	2	3	2	2.3
CO4	2	2	1	3	1	2	3	2	3	3	2.2
CO5	1	2	2	2	3	1	3	2	2	3	2.1
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/week	Credits
3	23UBO33CP03	Core Practical - 3: Taxonomy of Angiosperms, Plant Breeding and Evolution	3	2

Detailed Study:

- Description of plant in technical terms.
- A detailed study of the range of vegetative and floral characters of plants belonging to the families mentioned in the theory part except Orchidaceae.
- Field trip to any place within or outside the state to study the plants in their natural habitats.
- Spot identification (Binomial, Family) of plants included in the theory.
- Field note-book and 5 herbarium sheets of common angiosperms are to be prepared and submitted at the time of Practical Examination.
- Breeding techniques: Emasculation, Layering and Grafting.

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UBO33AO01A	Allied Optional - 1: Chemistry for Biologists - 1	4	3

Course Objectives
To learn the various molecule and compounds involved in Biological processes.
To learn the various concepts of chemistry in Applied Biology
To understand chemical principles involved in Biological processes.
To apply the various concepts of chemistry in Applied Biology

UNIT I: Periodicity and Chemical Bonding (12 Hours)

Periodicity: classification of elements, division of periodic table in to blocks(*s*, *p*, *d*, *f*) atomic radius, ionic radius, ionization energy, electro negativity, electron affinity-trends with in a group and periods. General electronic configurations and oxidation states of *s*, *p* and *d*-block element, inert pair effect.

Ionic Bond - definition, examples, condition for the formation of ionic bond, properties of ionic molecules.

Covalent bond - definition, examples, properties of covalent molecules, hybridization, types of hybridization, VSEPR theory: structures of BeCl_2 , BF_3 , NH_3 and H_2O .

UNIT II: Organic Chemistry (12 Hours)

Classification of organic compounds: (i) Hydrocarbons: aliphatic saturated / unsaturated, cyclic acyclic and aromatic compounds (ii) alkyl and aryl halides (iii) alcohols and ethers (iv) aldehydes, ketones and carboxylic acid and their derivative (v) amines and nitro compounds; nomenclature and examples upto five carbon atoms.

UNIT III: Quantitative Analysis (12 Hours)

Error Analysis: accuracy, precision, errors, determinate and indeterminate errors, eliminating and minimizing error, relative error, absolute error.

Concentration units: mole, molarity, molality, formality, normality, ppm, mole fraction, Primary standard and secondary standard solutions, principle of volumetric analysis, acid base titration, redox titration, complexometric titration, precipitation titration and indicators.

UNIT IV: Agricultural Chemistry (12 Hours)

Soil types-red soil, black soil, alluvial soil, desert soil, red soil; role of humus: Manures and their importance, Chemical fertilizers: Natural and synthetic fertilizers: NPK fertilizers-manufacture of NPK fertilizers, mixed fertilizers; role of macronutrients and micronutrients: Pesticides: classification insecticides, herbicides and fungicides; Structure of important pesticides: DDT, BHC, 2, 4-D, 2, 4, 5-T; biomass and its utilization; triple revolution India (Green, Blue and White).

UNIT V: Coordination and Bioinorganic Chemistry (12 Hours)

Coordinate bond-ligands, classification of ligands, nomenclature of complexes DMG, EDTA ligands. Structure of $[\text{Ag}(\text{NH}_3)_2]^+$ linear; $[\text{Cu}(\text{NH}_3)_4]^{2+}$ square planar; $[\text{Ni}(\text{Cl})_4]^{2-}$ Tetrahedral; $[\text{Pt}(\text{CN})_4]^{2-}$ square planar. Chemistry of haemoproteins, nature of hemoglobin and myoglobin, chemistry of chlorophyll, porphyrin unit and photosynthesis.

Teaching Methodology	Chalk and Talk, PPT, Videos
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Books for Study

- Puri, B.R., Sharma, L.R., & Kalia, K.K. (2020). *Principles of Inorganic Chemistry*, (33rd Ed.). Vishal Publishing Co.
Unit-I: Chapter 2 and 5
Unit-V: Chapter 26 and 37
Unit-III: Chapter 40
- Bahl, A., & Bahl, B.S. (2014). *Advanced Organic Chemistry*, (22nd Ed.). S.Chand.

Unit-II: Chapter 4

3. Sharma, B.K. (2011). *Industrial Chemistry*. Goel Publishing Company.

Unit-IV: Chapter 5**Books for Reference**

1. Puri, B.R., Sharma, L.R., & Pathania, M.S. (1993). *Principles of Physical Chemistry*, (23rd Ed.). Shoban Lal Nagin S, Chand.
2. Tewari, K.S., & Vishnoi, N.K. (2000). *A Text Book of Organic Chemistry*, (3rd Ed.). S.Chand and Company Pvt. Ltd.
3. Gopalan, R. (1999). *Elements of Analytical Chemistry*. S.Chand.

Websites and eLearning Sources

1. https://bansal.ac.in/acc_sample_ioc.pdf
2. https://www.niser.ac.in/sps/sites/default/files/basic_page/Error%20Analysis_2015.pdf



Basics of Inorganic Chemistry



Error Analysis

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - level)
	On successful completion of this course, students will be able to	
CO1	observe the chemistry of different types of soils and the irutility.	K1
CO2	understand the principles involved in periodicity and chemical bonding.	K2
CO3	develop the knowledge about various reactions of organic chemistry	K3
CO4	relate bioinorganic complex molecules with human life	K4
CO5	apply the various analytical concepts in quantitative analysis.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours		Credits	
3	23UBO33AO01A		Allied Optional - 1: Chemistry for Biologists - 1					4		3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	1	2	3	2	3	1	2	3	2	2.1
CO2	3	1	2	2	3	3	2	1	3	2	2.2
CO3	2	2	1	3	2	2	1	2	3	2	2.0
CO4	3	3	2	1	2	2	2	3	2	1	2.1
CO5	3	2	2	3	3	2	3	2	2	3	2.5
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UBO33AO1B	Allied Optional - 1: Biometrics and Computer Applications - 1	4	3

Course Objectives
Learn the basic concepts of Statistics in biological sciences.
Learn to solve systems of linear equations and application problems requiring them.
Impart the knowledge of mathematical modeling.
Explains the important concepts of statistical data.
Know the various statistical measures

UNIT I (12 Hours)

Types of measurements - Interval, ratio, rank order and categorical - Logarithm, Permutation and Combination

UNIT II (12 Hours)

Solving Equations: Solving a simple linear equation involving one variable and two variables. Matrices - Operation on matrices - Determinants - Inverse - Solving a system of equations of order 3x3 using Cramer's rule and inverse method.

UNIT III (12 Hours)

Mathematical modeling: Principle of least squares (concepts only) -Curvilinear regression, $y = ax^2 + bx + c$, $y = ab^x$ and $y = ae^{bx}$.

UNIT IV (12 Hours)

Statistics - Introduction - Uses and limitations of Statistics - Collection and classification of data - Frequency table - Frequency graphs - Diagrammatic representation of data -Sampling-Census and sample method - Methods of sampling.

UNIT V (12 Hours)

Measures of location: Mean, Median and Mode. **Measures of Dispersion:** Range, Mean deviation, Standard deviation and Coefficient of variation. Skewness and Kurtosis.

Teaching Methods	YouTube videos, PPT, Black Board teaching and Handouts.
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Books for Study

1. Gupta S.P, (2014). *Statistical Methods*, (43rd Ed.). Sultan Chand & Sons.
2. Navanitham, P.A. (2015). *Business Mathematics and Statistics*, Jai publishers.
3. Gupta S.P., & Kapoor V.K., (2020). *Fundamentals of Mathematical Statistics*, (12th Ed.). Sultan Chand & Sons.

Books for Reference

1. Rao, N. G. (2018). *Statistics for Agricultural Science*, (3rd Ed.). BS Publications.
2. Olive Jean Dunn & Virginia A Clark (2009). *Basic Statistics: A primer for the Biomedical Sciences*, (4th Ed.). A John Wiley & Sons, Inc., Publication.

Website and eLearning Resources

1. <https://youtu.be/W7sMRIOL7LM>
2. <https://youtu.be/CcFXaFB11kA>
3. <https://youtu.be/AAuuh-72HxY>
4. <https://youtu.be/NOUs-JTDnH8>

Course Outcomes		
CO No.	CO-statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	acquire the knowledge of Statistics in biological context.	K1
CO2	describe the concept of measurement, solving equations, mathematical modeling, Statistics measures.	K2
CO3	compute the statistical constants.	K3
CO4	apply the statistical concepts in real life problems.	K4
CO5	analyse the univariate and bivariate data.	K5

Relationship Matrix											
Semester	Course Code		Title of the Paper						Hours/Week	Credits	
3	23UBO33AO1B		Allied Optional - 1: Biometrics and Computer Applications - 1						4	3	
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	3	2	2	3	1	3	2.4
CO2	1	2	3	2	3	2	1	2	3	3	2.2
CO3	3	2	2	3	2	1	3	3	2	2	2.3
CO4	2	3	2	2	1	3	1	2	3	3	2.2
CO5	3	3	3	2	3	2	2	1	3	3	2.5
Mean Overall Score											2.32 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	@	Allied Optional Practical: Biometrics and Computer Applications	2	-

Course Objectives
Impart the knowledge of matrix.
Learn the basic concepts of straight line, regression and second degree.
Understand univariate and bivariate data.
Understand the basic concepts of graphical representation.
Learn the concepts of diagrammatic representation.
Impart the knowledge of matrix.

Using the Excel packages the students are asked to solve the following exercises

1. Solving a system of equations - Inverse Matrix, Cramer's rule.
2. Curve fitting - Straight line, Regression line and second degree.
3. Construction of frequency table - Univariate, Bivariate and Cross tabs.
4. Drawing frequency graphs.
5. Pictorial presentation - Bar diagrams, Pie diagrams etc.

Course Outcomes		
CO No.	CO-statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	know the solutions of the system of equations.	K1
CO2	predict the future value by fitting the appropriate curve.	K2
CO3	display the frequency table, frequency curve for the given data.	K3
CO4	draw and explain the diagrams for the data under study.	K4
CO5	give the interpretation about various statistical measures using Excel functions.	K5

Relationship Matrix											
Semester	Course Code		Title of the Paper							Hours	Credits
3	@		Allied Optional Practical: Biometrics and Computer Applications							2	-
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	2	2	2	3	2	3	2.4
CO2	1	2	3	2	3	2	1	2	3	3	2.2
CO3	3	2	2	3	2	1	3	3	2	2	2.3
CO4	2	3	2	2	1	3	1	2	3	3	2.2
CO5	3	2	3	2	3	2	2	1	3	3	2.4
Mean Overall Score											2.24(High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UHE34VE03A	Value Education - 3: Social Ethics - 1	2	1

Course Objectives
To gain a comprehensive understanding of the principles advocated in social ethics.
To examine the different types of political systems in a thorough manner.
To comprehend the role and obligations of the educated youth.
To evaluate the conduct of the elected representatives in a detailed manner.
To thoughtfully analyze the various forms of cyber crime.

UNIT I: Introduction to Social Ethics (6 Hours)

Social ethics, social ethics and social responsibility, social ethics play an important role on the areas, religion influences social changes and vice versa, secularism. Social ethics and corporate dynamics, forms of social ethics.

UNIT II: The Economic and Political System of Today (6 Hours)

Planned economy and communism - market economy and capitalism- socialism - mixed economy -the emerging market economy - political system- totalitarian system- oligarchic system.

UNIT III: Integrity in Public Life National Integration (6 Hours)

What is Integrity, Public Life, Integrity and Public Life, Integrity in a Democratic State, India as Democratic State, Behavior of a elected representative of India, Noticeable degradation acts of elected Representatives, Suggestions to stem this rot, Types of integrity, Transparency can be a guarantee for integrity.

UNIT IV: Cyber Crime (6 Hours)

Business Ethics, Business ethics permeates the whole organization, Measuring business ethics , The Vital factors highlighting the importance of business ethics , Cyber crime, Strategies in committing Cyber Crimes, Factors aiding Cyber Crime, computer Hacking, Cyber Bullying, Telecommunications piracy, Counter Measures to Cyber Crime, Ethical Hacking.

UNIT V: Social Integration (6 Hours)

Global challenges, The future is with the Educational Youth, Cost of the Sacrifice, Crusaders against corruption, Responsibility of the Educated Youth, Positive Global Scenario, Right to Education, Eradicating gender inequality, Sustainable Human Development , Social Integration, Elimination Crime, Integration with Global Market

Book for Study

1. Department of Human Excellence. (2021). *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference

1. Arora, R.K. (2014). *Ethics, Integrity and Values*. Public Service Paperback.
2. Cunningham, D. (2004). *There's something happening here: The new left, the Klan, and FBI counterintelligence*. Berkeley: University of California Press.
3. Mali, P. (2017). *Cyber law & Cyber Crimes simplified*. Cyber Info media Paperback.
4. Richardson, M. (2019). *Cyber Crime: Law and Practice Hardcover - Import*.

Websites and eLearning Sources

1. <https://cybercrime.gov.in/>

2. <https://open.lib.umn.edu/sociology/chapter/14-2-types-of-political-systems/>
3. <https://www.esv.org/resources/esv-global-study-bible/social-ethics/>
4. https://en.wikipedia.org/wiki/Political_system

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	know the responsibility of the educated youth.	K1
CO2	understand the values prescribed under social ethics.	K2
CO3	apply their minds critically to the various types of cyber crime.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UHE34VE03A		Value Education - 3: Social Ethics - 1							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	2	3	3	2.7
CO2	3	2	2	2	3	2	2	3	2	2	2.3
CO3	2	3	3	3	2	3	3	3	3	3	2.8
Mean Overall Score											2.6 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23UHE34VE03B	Value Education - 3: Religious Doctrine - 1	2	1

Course Objectives
To impart knowledge to students about Salvation History
To familiarize students with the life and mission of Jesus Christ
To help Students understand the Holy Spirit
To empower students on Gospel Values
To equip the students about Mother Mary

UNIT I: God of salvation (6 Hours)

UNIT II: Life & Mission of Jesus Christ (6 Hours)

UNIT III: The Holy Spirit (6 Hours)

UNIT IV: Gospel Values (6 Hours)

UNIT V: Mary, the Mother of God (6 Hours)

Teaching Methodology	Chalk and Talk, Power point, Assignment and Group discussion
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Books for Study

1. Department of Human Excellence. (2022). *Fullness of Life*. St. Joseph's College, Tiruchirappalli.

Books for Reference

1. (1994). *Compendium: Catechism of the Catholic Church*. Bengaluru: Theological Publications in India.
2. Holy Bible (NRSV).

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	understand the Salvation History	K1
CO2	grasp to the life and purpose of Jesus Christ	K2
CO3	live out the teachings of the Gospel	K3

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23UHE34VE03B		Value Education - 3: Religious Doctrine - 1							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	2	3	3	2.7
CO2	3	2	2	2	3	3	3	3	2	2	2.5
CO3	2	2	3	3	2	2	3	3	3	3	2.6
Mean Overall Score											2.6 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UTA41GL04B	General Tamil - 4: அறிவியல் தமிழ் (Scientific Tamil)	4	3

கற்றலின் நோக்கங்கள்				
அன்றாட வாழ்வில் அறிவியலின் செல்வாக்கை அறிந்துகொள்ளுதல்				
பண்டைத்தமிழர் வாழ்வில் இடம்பெற்ற அறிவியல்கூறுகளைக் கண்டறிதல்				
அறிவியலின் வளர்நிலைகளையும் வகைப்பாடுகளையும் கண்டுணர்தல்				
பண்டைத்தமிழரின் பல்துறைச் சிந்தனைகள்வழி தமிழர் தம் பண்பாட்டு மேன்மையை உணர்தல்				
படைப்பாற்றல் திறனைக் கண்டறிந்து வளர்த்தெடுத்தல்				

அலகு 1

(12 மணி நேரம்)

தொல்காப்பியம்: நிலம் தீ நீர் வளி விசும்போடு (தொல். பொருள் 635)

ஒன்றறிவதுவே (தொல். பொருள் 571)

புறநானூறு

மண் திணித்த நிலனும் (புறம் 2 1- 6) செஞ்ஞா யிற்றுச் செலவும் (புறம் 30 1- 7)

அகநானூறு

அம்ம வாழி, தோழி (அகம் 141: 1-11) செஞ்ஞா யிற்றுச் செலவும் (புறம் 30 1-7)

பதிற்றுப்பத்து

நிலம் நீர் வளி விசும்பு என்ற நான்கின் (பதிற்று 14:1-4)

நெடுவயின் ஒளிறு மின்னுப் பரந்தாங்கு (பதிற்று 24:1-26)

உரைநடைக்கட்டுரை: வியக்க வைக்கும் தமிழரின் அறிவியல்

அலகு 2

(12 மணி நேரம்)

சித்தர் பாடல்கள்

பதார்த்த சிந்தாமணி

குளத்து சலந்தானே கொடிதான (27) ஏரிசலம் வாதமிகு மதுவே (31)

அருவிநீர் மேக மகற்றுங் (39) மேவிய சீவன் வடிவது சொல்லிடில் (திருமூலர்)

அணுவில் அணுவினை ஆதிபிரானை (திருமூலர்)

நட்டகல்லைத் தெய்வமென்று (சிவவாக்கியர்)

உரைநடைக்கட்டுரை: தமிழர்களின் மருத்துவ அறிவியல்

அலகு 3

(12 மணி நேரம்)

திருக்குறள் (2 அதிகாரங்கள்)

வான் சிறப்பு, மருந்து வலைப்பூக்கள் உருவாக்கல், பராமரித்தல் புதிய

அறிவியல் கலைச்சொல்லாக்கங்களை உருவாக்குதல்

உரைநடைக்கட்டுரை: தமிழ் இலக்கியங்களில் வெளிப்படும் நீர்

மேலாண்மையியல்

அலகு 4

(12 மணி நேரம்)

புதினம்: சொர்க்கத்தீவு - சுஜாதா நூல் - திறனாய்வு அறிவியல் புனைவு

ஆவணப்படம், திரைப்படம் - திறனாய்வு

உரைநடைக்கட்டுரை: தமிழில் அறிவியல் புனைவுகள்

அலகு 5

(12 மணி நேரம்)

அறிவியல்; கலைச்சொற்கள் அன்றாட வாழ்வில் அறிவியல் பழமொழிகளைத் தொகுத்தல் மூலிகைகள்,

கீரைகள் ஆகியவற்றின் முக்கியத்துவத்தைக் காட்சிப்படுத்துதல். தமிழர் அறிவியல் கண்காட்சி நடத்துதல்

உரைநடைக்கட்டுரை: அறிவியல் தமிழின் வளர்ச்சி நிலைகள்;

கற்பித்தல் முறை	விரிவுரை (Lecture), காணொளிக் காட்சி (Videos), விளக்கக் காட்சி (PPT presentation)
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பாட நூல்கள்

1. தமிழாய்வுத்துறை (2021), அறிவியல் தமிழ் , தூய வளனார் தன்னாட்சிக் கல்லூரி

2. சுஜாதா (2009), சொர்க்கத்தீவு, லிசா பப்ளிகேஷன்ஸ்,
3. மூர்த்தி அ.கி.(2001) , அறிவியல் கலைச்சொல் அகராதி, மணிவாசகர் பதிப்பகம்.

பார்வை நூல்கள்

1. நெடுஞ்செழியன்(2017), இன்னும் மீதமிருக்கிறது நம்பிக்கை, பூவுலகின் நண்பர்கள் வெளியீடு
2. குழந்தைசாமி.வா.செ., (2001), அறிவியல்தமிழ், பாரதி பதிப்பகம்

Websites and eLearning Sources

1. www.tamilvu.org
2. www.tamildigitallibrary.in
3. https://www.tamiluniversity.ac.in/english/library2-/digital-library/
4. https://www.tamilelibrary.org/

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	இப்பாடத்தின் நிறைவில் மாணவர்கள்	
CO1	பண்டைய தமிழர்களின், அறிவியல் அறிவை அறிந்து கொள்வர்.	K1
CO2	பண்டைய தமிழ் இலக்கியங்களுள் காணாலும் அறிவியல் சிந்தனைகளைப் புரிந்துகொள்வர்.	K2
CO3	தமிழரின் அறிவியல் மருத்துவத்தையும், நீர் மேலாண்மை அறிவையும் அறிந்து கொள்வர்.	K3
CO4	இக்கால இலக்கியங்களுள் அறிவியல்துறை பெற்றுள்ள இடத்தை அறிந்து கொள்வர்.	K4
CO5	அறிவியல் கலைச்சொற்களைத் தமிழில் கற்றுக் கொண்டு அறிவியல்தமிழ் வளரத் துணைபுரிவர்.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23UTA41GL04B		General Tamil - 4 அறிவியல் தமிழ் (Scientific Tamil)							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	2	2.2
CO2	2	2	3	2	2	2	3	2	3	2	2.3
CO3	1	2	2	3	2	2	2	3	3	3	2.3
CO4	2	2	3	2	2	3	2	3	3	2	2.4
CO5	3	1	2	2	2	2	3	2	3	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UFR41GL04	French - 4	4	3

Course Objectives
To analyse the French clothing with respect to its culture
To apply prepositions and understand its usages
To analyse a contemporary text in present tense
To evaluate the French festivals and compare with their own cultural context
To apply the past tense using simple conversation

UNIT I (12 Hours)

- TITRE: On fait le mélange!
- GRAMMAIRE : le présent progressif, les pronoms possessifs, la phrase négative
- LEXIQUE : décrire les étapes d'une action, la maison, les tâches ménagères
- PRODUCTION ORALE : comprendre le récit d'un voyage
- PRODUCTION ECRITE : raconter ses actions quotidiennes

UNIT II (12 Hours)

- TITRE: à propos de logement
- GRAMMAIRE : quelques adjectifs et pronoms indéfinis, les verbes lire, rompre et se plaindre
- LEXIQUE : la localisation et le logement, les pièces, meubles et équipement
- PRODUCTION ORALE : jeu de rôle –votre ami et vous s'installe dans un nouveau meuble
- PRODUCTION ECRITE : décrire votre maison/appartement

UNIT III (12 Hours)

- TITRE: Tous en forme!
- GRAMMAIRE : le passé composé et l'imparfait, le passé récent, l'expression de la durée
- LEXIQUE : un souvenir et les événements du passés, le corps humain : extérieur, le corps humain : intérieur
- PRODUCTION ORALE : échanger sur ses projets de vacances
- PRODUCTION ECRITE : raconter un souvenir

UNIT IV (12 Hours)

- TITRE: Accidents et catastrophes
- GRAMMAIRE : les adjectifs et les pronoms indéfinis : rien/ personne/aucun, les verbes dire, courir et mourir
- LEXIQUE : savoir les mots et les expressions des catastrophes naturelles, les maladies et les remédies, les accidents, les catastrophes naturelles
- PRODUCTION ORALE : comprendre des personnes qui expriment leur accord ou leur désaccord selon un thème donné
- PRODUCTION ECRITE : écrivez sur une catastrophe naturelle en articulant la cause et la conséquence

UNIT V (12 Hours)

- TITRE: Faire ses études a l'étranger/ bon voyage/ la météo
- GRAMMAIRE : les pronoms démonstratifs neutres, le futur simple, situer dans le temps, moi

- aussi/non-plus – moi non/si, les verbes impersonnels, les verbes croire, suivre et pleuvoir
- LEXIQUE : savoir vivre en France, le système scolaire, les formalités pour partir à l'étranger, la météo
 - PRODUCTION ORALE : exprimer son opinion sur la météo/parler de l'avenir
 - PRODUCTION ECRITE: comparer le système scolaire français et indien

Teaching Methodology	Workshop, group activity, Sharing contemporary french cultural videos
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Book for Study

1. Dauda, P., Giachino, L., & Baracco, C. (2016). *Generation AI*. Didier.

Books for Reference

1. Girardet, J., & Pecheur, J. (2017). *Echo AI*. (2nd Ed.). CLE International.
2. Mérieux, R., & Loiseau, Y. (2012). *Latitudes AI*. Didier.
3. Fournier, I. (2011). *Talk French*. Goyal Publishers.

Websites and eLearning Sources

1. <https://www.frenchcourses-paris.com/french-travel-journal/>
2. <http://www.saberfrances.com.ar/vocabulary/house.html>
3. <https://www.thoughtco.com/different-past-tenses-in-french-1368902>
4. <https://www.youtube.com/watch?v=JZdwJM7sEY8>
5. <https://www.scholaro.com/pro/Countries/France/Education-System>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	recall the vocabulary pertaining to dwelling place.	K1
CO2	outline crisis management in France.	K2
CO3	develop a travel diary of your own.	K3
CO4	simplify the French education system.	K4
CO5	interpret past tenses in a text.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23UFR41GL04	French - 4							4	3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	3	2	2	3	2	1	2	2	2.1
CO2	3	1	2	3	3	3	2	1	3	1	2.2
CO3	3	2	3	2	2	3	2	1	3	2	2.3
CO4	3	1	2	2	3	3	3	1	3	3	2.4
CO5	2	2	3	3	1	3	1	2	3	2	2.2
Mean Overall Score											2.24 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UHI41GL04	Hindi - 4	4	3

Course Objectives
To strengthen the language competence among the students
To equip students with cinematic perspective by comparative studies of Hindi literature
To enable the students to develop their effective communicative skills in Hindi
To strengthen the language competence among the students
To incept research-oriented aspirations among students

UNIT I (12 Hours)

- Computer Ka Yug
- Prathyay
- Adhunik Kal – Namakarn
- Namakaran

UNIT II (12 Hours)

- Vigyan Hani/Labh
- Paryayvachy Shabdh
- Adhunik Kal - Samajik Paristhithiyam
- Samanarthy Shabdh

UNIT III (12 Hours)

- Nari Shiksha
- Upasarg
- Adhunik Kal – Sahithyik Paristhithiyam
- Adhunik Kal – Salient Features

UNIT IV (12 Hours)

- Review- Book/Film
- Paryavaran Pradookshan
- Adhunik Kal - Main Divisions
- Adhunik Kal - Visheshathayem

UNIT V (12 Hours)

- Sapnom Kee Home Delivery (Novel)
- Anuvad

Teaching Methodology	Debate Participation, Videos, PPT, Quiz, Project Work
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Books for Study

1. Bosalae, S. (2020). *kavya sarang*. Rajkamal Prakashan.
2. Gupt, M. K. (2020). *Hindi Vyakaran*. Anand Prakashan.
3. Jain, S.K. (2019). *Anuwad: Siddhant Evam Vyavhar*. Kailash Pustak Sadan.

Books for Reference

1. Chaturvedi, R.P. (2015). *Hindi vyakarana*. Upakar Prakashan.
2. Ramdev. (2016). *Vyakaran Pradeep*. Hindi Bhavan.
3. Gosamy, K. (2016). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.

4. Shukla, A. R (2021). *Hindi Sahitya Ka Itihas*, Prabhat Prakashan.

Websites and eLearning Sources

1. <https://youtu.be/xmr-DaQ3LhA>
2. <https://mycoaching.in/adhunik-kaal>
3. <https://m.sahityakunj.net/entries/view/bhartiya-sahitya-mein-anuvad-kee-bhoomika>
4. <https://mycoaching.in/upsarg-in-hindi>
5. <https://kalingaliteraryfestival.com/speakers/mamta-kalia/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will able to	
CO1	list out the social conditions prevailed in Modern Period which are depicted in Hindi Literature.	K1
CO2	discuss the dialects of Hindi language.	K2
CO3	illustrate the works of some eminent Hindi Writers related to society.	K3
CO4	analyze the human values expressed in life and literature of Hindi Novelist “Mamatha Kaliyah”.	K4
CO5	evaluate the film & Literary works in Hindi.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours		Credits	
4	23UHI41GL04		Hindi - 4					4		3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	3	3	2	3	2	3	1	2.4
CO2	3	2	3	3	2	3	2	3	1	2	2.4
CO3	3	2	2	3	2	2	1	3	2	3	2.3
CO4	3	2	3	1	3	3	2	3	3	2	2.5
CO5	3	2	2	3	3	2	3	2	3	3	2.6
Mean Overall Score											2.44 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23USA41GL04	Sanskrit - 4	4	3

Course Objectives
To give an exposure to Sanskrit drama in general
To showcase the structure of pre-kalidasa plays in Sanskrit
To coach students in Sanskrit morphology
To acquaint students with the structures of Sanskrit syntax
To impart communicative skills in Sanskrit by training in the functional aspects of the language

UNIT I (12 Hours)

Sanskrita Vyavahara sahasri vakiya Prayogaha

UNIT II (12 Hours)

Lot Lakaarah, Prayaogh Kartari Vaakyaani

UNIT III (12 Hours)

Naatakasya Itihaasah Vivaranam, Thuva and Tum Suffixs

UNIT IV (12 Hours)

Karnabhaaram , Naatakasya Visistyam

UNIT V (12 Hours)

Sanskrita Racanani Vubhavoga

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
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Books for Study

1. *Karnabhavam & Literature Language*
2. *Dhaatu Manjari*
3. *Sanskrita Vyavahara Sahasri (A Collection of One Thousand Sentences)*, Sanskrita Bharati, Delhi.

Books for Reference

1. Vadhyar, R.S. & Sons. (2019). *History of Sanskrit Literature*. Book - sellers and publishers , Kalpathu ,Palghat, Kerala, south India,
2. Kulapathy, Saral, K.M. (2018). *Sanskrit Balabodh , Bharathita vidya bhavan* , Munshimarg.
3. Bharathi. (2019). *Vadatu sanskritam - Samaskara Binduhu*. S. Aksharam 8th cross, 2nd phase Giri nagar Bangalore.

Websites and eLearning Sources

1. https://sanskritdocuments.org/doc_z_misc_major_works/daily.pdf
2. <https://www.learn Sanskrit.org/guide/verbs-1/karmani-and-bhave-prayoga/>
3. <https://ia902903.us.archive.org/7/items/in.ernet.dli.2015.102820/2015.102820.The-Sanskrit-Drama-In-Its-Origin-Development-Theory-And-Practice.pdf>
4. https://archive.org/details/oafI_karna-bharam-karnas-burden-of-bhasa-with-dr.-sudhakar-malaviya-gokuldas-sanskrit
5. <https://sanskritwisdom.com/composition/essays/sanskrit-language/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	understand human behaviors by studying dramas	K1
CO2	remember and identifying Mahabharata characters and events	K2
CO3	apply the morals learnt in day to day life	K3
CO4	appreciate ancient Sanskrit dramas	K4
CO5	create new conversational sentences and to Improve self-character (Personality Development)	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23USA41GL04		Sanskrit - 4							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	3	3	3	3	2	2.4
CO2	2	2	3	3	2	3	2	3	3	2	2.5
CO3	3	3	2	3	2	1	1	3	3	3	2.4
CO4	2	2	3	2	3	3	3	3	2	3	2.6
CO5	2	3	3	3	2	1	3	3	3	2	2.5
Mean Overall Score											2.48 (High)

Semester	Course Code	Title of the Course	Hours/week	Credits
4	23UEN42GE04	General English - 4	5	3

Course Objectives
To develop and enhance language proficiency in listening, reading, and writing skills through teacher-led reading practice, and comprehension exercises.
To encourage creative thinking through creative tasks and essay writing.
To foster effective communication skills by engaging in tasks that require note-taking, note-making, précis writing, paragraph writing, and the synthesis of information from different sources.
To strengthen grammatical skills by focusing on the application of different tenses and to emphasise grammatical accuracy in various writing tasks.
To encourage students to critically engage with media content and evaluate information.

UNIT I: Women Through the Eyes of Media

(13 Hours)

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Listening and Reading Skills through Teacher-led Reading Practice
- 1.3 Glossary
 - 1.3.1 Words
 - 1.3.2 Phrases
- 1.4 Reading Comprehension
- 1.5 Critical Analysis
- 1.6 Creative Task
- 1.7 General Writing Skill: Writing Minutes of a Meeting
- 1.8 Grammar: Present Perfect Tense

UNIT II: Effects of Tobacco Smoking

(13 Hours)

- 1.9 Introduction
- 2.0 Objectives
- 2.1 Listening and Reading Skills through Teacher-led Reading Practice
- 2.2 Glossary
 - 2.3.1 Words
 - 2.3.2 Phrases
- 2.4 Reading Comprehension
- 2.5 Critical Analysis
- 2.6 Creative Task
- 2.7 General Writing Skill: Note-Taking
- 2.8 Grammar: Present Perfect Continuous Tense

UNIT III: Short Message Service (SMS)

(13 Hours)

- 2.9 Introduction
- 3.0 Objectives
- 3.1 Listening and Reading Skills through Teacher-led Reading Practice
- 3.2 Glossary
 - 3.3.1 Words
 - 3.3.2 Phrases
- 3.4 Reading Comprehension
- 3.5 Critical Analysis
- 3.6 Creative Task
- 3.7 General Writing Skill: Note-Making
- 3.8 Grammar: Past Perfect Tense

UNIT IV: An Engineer Kills Self as Crow Sat on his Head: A Newspaper Report (12 Hours)

- 3.9 Introduction
- 4.0 Objectives
- 4.1 Listening and Reading Skills through Teacher-led Reading Practice
- 4.2 Glossary
- 4.3.1 Words
- 4.3.2 Phrases
- 4.4 Reading Comprehension
- 4.5. Critical Analysis
- 4.6. Creative Task
- 4.7 General Writing Skill: Précis Writing
- 4.8 Grammar: Past Perfect Continuous Tense

UNIT V: Traffic Rules (12 Hours)

- 4.9 Introduction
- 5.0 Objectives
- 5.1 Listening and Reading Skills through Teacher-led Reading Practice
- 5.2 Glossary
- 5.3.1 Words
- 5.3.2 Phrases
- 5.4 Reading Comprehension
- 5.5 Critical Analysis
- 5.6 Creative Task
- 5.7 General Writing Skill: Paragraph Writing
- 5.8 Grammar: Future Perfect Tense

UNIT VI: A Handful of Answers: A Zen Tale (12 Hours)

- 5.9 Introduction
- 6.0 Objectives
- 6.1 Listening and Reading Skills through Teacher-led Reading Practice
- 6.2 Glossary
- 6.3.1 Words
- 6.3.2 Phrases
- 6.4 Reading Comprehension
- 6.5 Critical Analysis
- 6.6 Creative Task
- 6.7 General Writing Skill: Writing Short Essays on Current Issues/General Topics
- 6.8 Grammar: Future Perfect Continuous Tense

Teaching Methodology	Lecture Method, Use of ICT Tools and Interactive method
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Book for Study

1. Jayraj., & Arul, S.J. et al. (2016). *Trend-Setter: An Interactive General English Textbook for Under Graduate Students*. Trinity.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	identify and explain key concepts and topics discussed in the course.	K1
CO2	understand the content by summarising, paraphrasing, and interpreting the materials presented.	K2
CO3	apply their knowledge to create various forms of written communication, such as meeting minutes, notes, précis, paragraphs, and essays.	K3
CO4	analyse the application of different tenses in various texts.	K4
CO5	synthesise their knowledge by creating creative tasks, including short essays on current issues and general topics	K5

Relationship Matrix											
Semester	Course Code		Title of the Course					Hours	Credits		
4	23UEN42GE04		General English - 4					5	3		
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
CO4	2	2	3	2	3	3	2	3	2	3	2.5
CO5	2	2	2	3	2	2	2	3	2	2	2.2
Mean Overall Score										2.36 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43CC06	Core Course - 6: Cell Biology and Genetics	5	4

Course Objectives
To understand the organization of cells.
To acquire knowledge on the structure and organization of various cell organelles
To learn cell cycle and methods of cell division
To solve problems with relevance to the principles and applications of genetics.
To acquire basic knowledge on genomics and proteomics.

UNIT I (15 Hours)

Cell as a unit of structure and function; prokaryotic and eukaryotic; Endosymbiotic theory. Structure, organization and functions of nucleus, mitochondria, chloroplasts, ER, ribosomes, Golgi complex, lysosome and vacuole. Organisation of cytoskeleton.

UNIT II (15 Hours)

Cytoplasmic membrane structure and functions. Cellular mechanisms in development and differentiation. Cell division (mitosis and meiosis), Cell cycle. Mutation - types, causes and detection. Mutant types - lethal, conditional, biochemical; germinal vs somatic mutants, insertional mutagenesis. Special types of chromosome - polytene and lampbrush.

UNIT III (15 Hours)

Mendel's laws of heredity, Modified Mendelian ratios. Multiple alleles. Linkage and crossing over. Sex linked inheritance. Sex determination mechanism. Extra chromosomal inheritance.

UNIT IV (15 Hours)

DNA is the genetic material: Griffith's, Avery et al., and Hershey and Chase. RNA as genetic material. Basic knowledge and applications of genomics and proteomics. Genomics: structural and functional genomics. Plant genome (*Arabidopsis* and *Oryza*), animal (*Homo sapiens*). Human Genome Project - objectives and controversies.

UNIT V (15 Hours)

Population genetics: gene frequency, genepool, Hardy-Weinberg equilibrium. Genetic drift, Gene frequencies - conservation and changes. Selection - natural, artificial, ecological.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Verma, P. S., & Agarwal, V.K. (2003). *Genetics*. S. Chand & Co. Ltd.
2. Gupta, P. K. (2018). *Genetics*, (5th Ed.). Rastogi Publications.

Books for Reference

1. Sinnott, E.W., Dunn, L.L., & Dobzhansky, T. (1997). *Principles of Genetics*. Tata McGraw Hill.
2. Freifelder, D. (1993). *Essentials of Molecular Biology*. Jones & Bartlett, Boston.
3. Gardner, E.J., Simmons, M.J. & Snustad, D. (1991). *Principles of Genetics*, (8th Ed.). John Wiley & Sons.

Websites and eLearning Sources

1. <https://www.sciencelearn.org.nz/resources/1989-cell-biology-and-genetics>
2. <https://www.wiley.com/en-us/textbooks-and-courseware/biology/cell-biology-and-genetics>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	Recall the evolution, diversity and replication of cells.	K1
CO2	Understand the role of compartmentalization and signaling in cellular biology	K2
CO3	Interpret and explain key experiments in the history of cell biology.	K3
CO4	Apply knowledge of modern techniques in cellular biology.	K4
CO5	Describe genes structure, chromosomes and proteins.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23UBO43CC06		Core Course - 6: Cell Biology and Genetics							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	2	2	2.3
CO2	2	3	2	3	3	2	3	2	2	2	2.4
CO3	2	2	3	2	3	3	3	2	3	3	2.7
CO4	3	3	2	1	2	3	2	3	1	2	2.3
CO5	2	3	2	2	3	2	3	2	2	3	2.6
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43CC07	Core Course - 7: Ecology and Climate Change	5	4

Course Objectives
To understand the fundamentals of ecology
To acquire know on various ecosystems and their components
To understand techniques of community studies
To apply their skill to manage climate change
To analyse the biogeochemical cycles and their significance

UNIT I (15 Hours)

Introduction to ecology and ecosystem. Ecological factors - physical, edaphic, topographic. Biogeochemical cycles - C, N & P. Plant succession: definition, primary and secondary succession, autogenic and allogenic succession, pioneers and climax communities. Mechanism of plant succession - xerosere.

UNIT II (15 Hours)

Autecology and Synecology - definition. Population ecology -definition, size, density, age structure, dispersal and growth. Population interactions - negative and positive. Basic idea of biodiversity - species, genetic, ecosystem and habitat diversity.

UNIT III (15 Hours)

Sampling techniques in plant community studies - quadrat and transect methods; species area curve - density, frequency, abundance, dominance of populations; importance value index - construction of phytographs. Phytogeographical zones of India.

UNIT IV (15 Hours)

Centres of origin and distribution of species. Patterns of plant distribution - continuous and discontinuous. Continental drift - evidences and impact. Endemic distribution, theories on endemism, age and area hypothesis. Ecotone and edge effect.

UNIT V (15 Hours)

Carbon emissions, global warming, climate change, carbon credit, carbon sequestration, blue carbon, alternative energy sources and green energy. Climate change conferences and the role of IPCC and UNFCCC. Anthropause effects on Environment during Covid - 19.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Book for Study

1. Kormondy, E. J. (2017). *Concepts of Ecology*, (4th Ed.). Prentice Hall.

Books for Reference

2. Sharma, P. D. (2010). *Ecology and Environment*, (8th Ed.). Rastogi Publications.
3. Odum, E. (2017). *Fundamentals of Ecology*, (5th Ed.). Cengage.
4. Letcher, T. (2015). *Climate Change*, (2nd Ed.). Elsevier Publishing.
5. Smerdon, J. (2018). *Climate Change: The Science of Global Warming and Our Energy Future*. Columbia University Press.

Websites and eLearning Sources

1. [https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Science_\(Ha_and_Schleiger\)/02%3A_Ecology/2.04%3A_Ecosystems/2.4.03%3A_Biogeochemical_Cycles](https://bio.libretexts.org/Bookshelves/Ecology/Environmental_Science_(Ha_and_Schleiger)/02%3A_Ecology/2.04%3A_Ecosystems/2.4.03%3A_Biogeochemical_Cycles)
2. https://www.agritech.tnau.ac.in/agriculture/agri_min_nutri_plantsampling.html
3. <https://www.ipcc.ch/>
4. <https://unfccc.int/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	develop an appreciation of the natural world through direct experience with local ecosystems	K1
CO2	become familiar with the variety of ways that organisms interact with both the physical and the biological environment.	K2
CO3	develop an understanding of the differences in the structure and function of different types of ecosystems.	K3
CO4	learn techniques of data analysis as well as methods of presenting scientific information in figures and tables.	K4
CO5	understand climate and climate change processes at local to global scales.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23UBO43CC07		Core Course - 7: Ecology and Climate Change							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	1	2	3	2	3	2	3	2	2.2
CO2	2	3	2	2	1	3	2	2	2	2	2.1
CO3	2	3	1	3	3	3	2	3	2	2	2.4
CO4	2	2	2	2	3	3	2	3	2	2	2.3
CO5	2	2	2	2	3	3	2	2	2	2	2.2
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43CP04	Core Practical - 4: Cell Biology, Genetics, Ecology and Climate Change	3	2

Cell Biology and Genetics:

1. Ultra structure of cell organelles.
2. Study of mitosis in root tips
3. Study of meiosis in anthers
4. Inheritance Patterns - Mendelian and modified Mendelian ratios
5. Linkage Mapping.
6. Estimation of allele frequency in natural (random matting) populations.
7. Isolation and display of polytene chromosomes.
8. Extraction of human genomic DNA from saliva.
9. Estimation of DNA (Colorimetric).

Ecology and Climate Change

1. Chemical analysis of water and Soil -Total hardness, Carbonates and Bicarbonates and Dissolved oxygen.
2. Vegetation Analysis: Quadrat, Line transects, Species Density, abundance and richness. Basal area and relative dominance
3. Green auditing
4. Field trip

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43AO02A	Allied Optional - 2: Chemistry for Biologists - 2	4	3

Course Objectives
To learn the safety in the lab
To understand the principles of titrimetric analysis
To understand the principles of organic qualitative analysis

UNIT I: Physical Chemistry (12 Hours)

Chemical Kinetics: rate, order, molecularity of reactions. Zero order and first order reaction, rate constant derivation, examples, Importance of kinetic study, activation energy, activated complex, Arrhenius equation, factors affecting rate of the reactions.

Thermodynamics: terms ΔE , ΔH , ΔS , ΔG , endothermic, exothermic reactions, conditions for spontaneity of reactions. Laws of thermodynamics (I, II, III definition only).

UNIT II: Pharmaceutical Chemistry (12 Hours)

Classification of drugs: Definitions of: drug, pharmacophore, pharmacognony, pharmacy, pharmacokinetics, pharmacodynamics, pharmacopoeia (IP, BP, USP). Antibiotics: Penicillin, chloramphenicol, (only the structural properties and SAR): Anaesthetics-general and local anaesthetics: Inhalation anaesthetics (N_2O , $CHCl_3$, haloethane, ethylchloride). Intravenous anaesthetics (thiopental sodium); Cardiovascular Drugs: classification and examples: cardiac glycosides, antihypertensive and antihypotensive drugs and sulphonamides-isolation of bioactive molecules from plants by Soxhlet method.

UNIT III: Chemistry of Natural Products (12 Hours)

Vitamins-type, sources and deficiency disorders of Vitamins A-retinol, Vitamin B complex (thiamine-B1, riboflavin-B2, cyanocobalamin-B12), Vitamin C, Vitamin D and Vitamin E Alkaloids: occurrence, classification, physical properties and biological functions, Uses of coniine, piperine, nicotine, morphine and quinine alkaloids -Terpenoids: classification, isolation, structure, properties and uses of camphor, Citral and α -pinene.

UNIT IV: Catalysis (12 Hours)

Types of catalyst positive catalyst, negative catalyst and catalyst poison. Types of catalysis-homogeneous catalysis, heterogeneous catalysis and autocatalysis - general characteristics of catalytic reactions, autocatalysis. Biocatalysis- enzyme catalyst, kinetics of enzyme catalysis, Michaelis-Menten constant, active sites, turn over number, factors affecting enzyme catalysis; concentration of substrate, temperature, pH and inhibitors.

UNIT V: Separation and Purification Techniques (12 Hours)

Types of Chromatographic Techniques- TLC - Column - HPLC: Principles, instrumentation, sampling and applications of paper, thin layer, column chromatography and electrophoresis-distillation- steam and vacuum distillation- recrystallization.

Books for Study

- Puri, B.R., Sharma, L.R., & Pathania, M.S. (1993). *Principles of Physical Chemistry*, (23rd Ed.). Shoban Lal Nagin Chand and Co.
Unit- I Chapter 23 and 27
Unit-IV Chapter 31
- Ghosh, J. (2012). *A Text Book of Pharmaceutical Chemistry*, (3rd Ed.). S. Chand and Company Pvt. Ltd.
Unit- II Chapter 11
- Subramanian, P. S., Gopalan, R., & Rangarajan, K. (2003). *Elements of Analytical Chemistry*. S. Chand.
Unit - V Chapter 9

Books for Reference

1. Tewari, K. S., & Vishnoi, N. K. (2000). *A Text Book of Organic Chemistry*, (3rd Ed.). S. Chand and Company Pvt. Ltd.
2. Bahl, A., & Bahl, B. S. (2014). *Advanced Organic Chemistry*, (22nd Ed.). S. Chand.

Websites and eLearning Sources

1. <https://www.youtube.com/watch?v=bYwq5oNZmq4>
2. <https://www.slideshare.net/Kamyaparashar/chemical-kinetics-presentation>



Electrophoresis



Chemical Kinetics

Relationship Matrix											
Semester	Course Code			Title of the Course					Hours		Credits
4	23UBO43AO02A			Allied Optional - 2: Chemistry for Biologists - 2					4		3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	3	2	3	2	2	3	2.5
CO2	2	2	1	3	2	2	1	2	3	2	2.0
CO3	3	1	2	2	3	3	2	1	3	2	2.2
CO4	3	3	2	1	2	2	2	3	2	1	2.1
CO5	2	1	2	3	2	3	1	2	3	2	2.1
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43AO02B	Allied Optional - 2: Biometrics and Computer Applications- 2	4	3

Course Objectives	
Impart the knowledge of normal distributions.	
Understand the statistical hypothesis.	
Learn the basic concepts of correlation and regression.	
Learn the concepts of theory of attributes.	
Understand the non-parametric test.	
Impart the knowledge of normal distributions.	

UNIT I (12 Hours)

Probability: Normal distribution - Definition - Properties - Areas under normal curve - Interpreting areas as probabilities - Importance of normal distributions. Confidence interval: Confidence interval for means - between two means, variance and proportion.

UNIT II (12 Hours)

Testing of hypothesis: Null hypothesis - Two kinds of errors - Testing of hypothesis based on simple mean - difference between mean - Population proportion - Difference between the population proportion - Chi-square test - Goodness of fit - Test for independence - F- test: Equality of variances.

UNIT III (12 Hours)

Correlation and regression: Correlation: Types of correlation - Scatter diagram - Pearson's coefficient of correlation - Rank correlation. Simple regression: Meaning of regression lines - Regression equations y on x and x on y only - Regression coefficient - Simple problems.

UNIT IV (12 Hours)

Theory of attributes: Introduction - Notations - Dichotomy - Classes and class frequencies - Consistency of data - Criteria of independence - Yule's coefficient of association - Coefficient of colligation.

UNIT V (12 Hours)

Non -Parametric tests: Introduction -Advantages - Sign test- Mann Whitney U test - One sample runs test -Kruskal - Wallis test and Run test for randomness.

Teaching Methods	YouTube videos, PPT, Black Board teaching and Handouts.
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Books for Study

1. Gupta S.P, (2014). *Statistical Methods*, (43rd Ed.).Sultan Chand & Sons.

Books for Reference

1. Rao, N. G (2018). *Statistics for Agricultural Science*, BS Publications, Third Edition.
2. Dunn, O.J., & Clark, V.A. (2009). *Basic Statistics: A primer for the Biomedical Sciences*, (4th Ed.). A John Wiley & Sons, Inc., Publications.

Website and eLearning Resources

1. <https://youtu.be/TvkdX6Dw994>
2. <https://youtu.be/MHrDKdk9hw0>
3. <https://youtu.be/NOUs-JTDnH8>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K -Levels)
	On successful completion of this course, students will be able to	
CO1	knowledge about formulating and testing a hypothesis and determining probability of making errors in hypothesis tests.	K1
CO2	understand the concept of test of significance.	K2
CO3	explain the concept of normal distribution, statistical hypothesis, correlation, regression, association of attributes and non-parametric test.	K3
CO4	apply hypothesis testing techniques to real-world scenarios.	K4
CO5	give the statistical interpretation about parametric and non-parametric test.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours	Credits	
4	23UBO43AO02B		Allied optional - 2: Biometrics and Computer Applications- 2						4	3	
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	3	1	2	3	2	2.3
CO2	3	2	2	3	3	3	2	1	2	3	2.4
CO3	2	3	2	2	2	3	2	2	2	3	2.3
CO4	3	3	2	2	3	2	1	3	3	2	2.4
CO5	3	2	3	1	2	3	3	2	2	3	2.4
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43OP01A	Allied Optional Practical: Chemistry for Biologists	2	2

UNIT I: Safety Rules in the Laboratory (6 Hours)

Introduction- personal protection- nature of chemicals- toxic-corrosive- explosive- inflammable, carcinogenic-other hazardous chemicals- philosophy of lab safety - first-aid techniques - general work culture inside the chemistry lab - handling of chemicals and apparatus in the laboratory: storage and handling of chemicals-disposal of chemical wastes- glassware - handling of glassware - handling of different types of laboratory equipment's like bunsen burner-centrifuge- Kipp's apparatus.

UNIT II: Volumetric Analysis (6 Hours)

Volumetric analysis - principle - standard solutions - normality and molarity - principles of titrations- primary standard and secondary standard solutions- acid-base titration- red oxtitration-complexometric titration- precipitation titration and example of each with indicators used.

UNIT III: Theory of Organic Qualitative Analysis (6 Hours)

Qualitative analysis of organic substances: solubility test in NaHCO_3 - NaOH and HCl -test for saturation and unsaturation- aliphatic and aromatic- acidic- basic and neutral nature-elements test for N, S and halogens.

UNIT IV: Volumetric Analysis (6 Hours)

1. Estimation of HCl (Std.oxalicacid $\times\text{NaOH}\times\text{HCl}$).
2. Estimation of NaOH (Std. $\text{Na}_2\text{CO}_3\times\text{HCl}\times\text{NaOH}$).
3. Estimation of oxalicacid (Std. $\text{FAS}\times\text{KMnO}_4\times\text{oxalicacid}$).
4. Estimation of FAS (Std. oxalic acid $\times\text{KMnO}_4\times\text{FAS}$).
5. Estimation of KMnO_4 (Std. $\text{K}_2\text{Cr}_2\text{O}_7\times\text{FAS}\times\text{KMnO}_4$).
6. Estimation of $\text{K}_2\text{Cr}_2\text{O}_7$ by Thio solution.
7. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution.
8. Estimation of zinc (EDTA titration).
9. Estimation of magnesium (EDTA titration).
10. Estimation of hardness of water (EDTA titration).

UNIT V: Organic Analysis (6 Hours)

1. Identification of acidic, basic, phenolic and neutral organic substances.
2. Test for aliphatic and aromatic nature.
3. Test for saturation and unsaturation.
4. Preparation of sodium fusion extract.
5. Detection of N, S, and Cl.

Books for Study

1. Puri, B.R., Sharma, L. R., & Kalia, K. K. (1993). *Principles of Inorganic Chemistry*, (23rd Ed.). Shoban Lal, Nagin Chand and Co.
Unit-II Chapter 41
2. Gnanapragasam, N.S., & Ramamurthy, G. (2007). *Organic Chemistry Lab Manual*, (2nd Ed.). S. Viswanathan Printers and Publishers (P) Ltd.
Unit-III Part A
3. (2021). *Allied Practical Manual*. Department of Chemistry. St. Joseph's College. (Private circulation).

Books for Reference

1. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A.R. (1997). *Basic Principles of Practical Chemistry*, (2nd Ed.). Sultan Chand and Sons.
2. Furniss, B.S. (1984). *Vogel's Textbook of Practical Organic Chemistry*, (7th Ed.). ELBS Longman.

Websites and eLearning Sources

1. <https://www.youtube.com/watch?v=FUo428guKt0>
2. https://www.youtube.com/watch?v=_G6_OEa1BjA



Detection of Elements

Acid-Base Titration

Note:

1. Mono-functional compounds are given for organic analysis.
2. Each student is expected to practice the analysis of at least 10 different organic substances.
3. Apart from the TWOCIA tests, one MODELTEST comprising both volume tric and organic analysis is to be conducted to enable the students ready for semester examination.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	know about the handling of chemicals and safety measures in the laboratory.	K1
CO2	estimate the principle of volume tricanalysis and various types of titration.	K2
CO3	illustrate the theoretical aspects of organic analysis.	K3
CO4	detect various element present in the organic compounds.	K4
CO5	demonstrate various techniques of volume tricanalysis.	K5

Relationship Matrix											
Semester	Course Code			Title of the Course					Hours	Credits	
4	23UBO43OP01A			Allied Optional Practical: Chemistry for Biologists					2	2	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	3	2	3	2	2	3	2.5
CO2	2	2	1	3	2	2	1	2	3	2	2.0
CO3	3	1	2	2	3	3	2	1	3	2	2.2
CO4	3	3	2	1	2	2	2	3	2	1	2.1
CO5	2	1	2	3	2	3	1	2	3	2	2.1
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UBO43OP01B	Allied Optional Practical: Biometrics and Computer Applications	2	2

Course Objectives
Learn the basic concepts of statistical test.
Impart the knowledge small sample and large sample test.
Know the concept of correlation and regression.
Learn the various statistical hypothesis tests.
Know the difference about parametric and non - parametric test.

Using the SPSS software the students are asked to solve the following exercises:

1. Finding Descriptive statistics.
2. Finding correlation coefficient, Rank Correlation.
3. T- tests
4. F-test
5. Chi-square test
6. Non-parametric tests.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	acquire the knowledge of basic statistical test.	K1
CO2	understand the concept of small and large sample test.	K2
CO3	compute various statistical measures in the real life problems.	K3
CO4	apply the hypothesis testing to parametric and non - parametric test.	K4
CO5	give the interpretations about statistical result.	K5

Relationship Matrix:												
Semester	Course Code		Title of the Paper								Hours	Credits
4	23UBO43OP01B		Allied Optional Practical: Biometrics and Computer Applications								2	2
Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	2	3	2	3	2	3	2	2	3	2	2.4	
CO2	3	2	3	2	3	2	2	3	1	2	2.3	
CO3	2	2	3	2	2	3	3	2	2	3	2.4	
CO4	3	2	2	3	3	1	2	3	1	3	2.3	
CO5	2	3	3	2	1	3	2	2	3	2	2.3	
Mean Overall Score											2.34 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UHE44VE04A	Value Education - 4: Social Ethics - 2	2	1

Course Objectives
To understand the significance of natural resources and strive to coexist harmoniously with nature.
To implement strategies for disaster management within the community.
To evaluate the significance and distinctions between science and religion.
To recognize the importance of maintaining a healthy lifestyle.
To utilize counseling techniques to address and resolve individuals' issues.

UNIT I: Harmony with Nature (6 Hours)

What is environment, Why should we think of harmony, Longing for human well-being, Principles to conserve environmental resources, Causes of disharmony, The fruits of harmony with nature, Forest resources, Water resources, Mineral resources, Food resources, Fruits of disharmony, Economic values and growth, Environmental Ethics, Guidelines to live in harmony with nature, Towards life-centered system for better quality of life. Harmony with animal kingdom.

UNIT II: Issues Dealing with Science and Religion (6 Hours)

What is Science, Science and Religion, Social Relevance of Science and Technology, Science and technology for social justice, Difference caused by Science and Technology, Need for indigenous technology, Science, Technology and Innovation Policy of India.

UNIT III: Public Health (6 Hours)

Health related issues, Health Care in India vs Developed Countries, Health and Heredity, Public Health - The Indian Scenario, Objectives of public health in India, Public Health System in India, Failure on the public health front, Role of the central government, Hospitals Services in India, Health and Abortion, Health and Drug Addiction, Drug abuse.

UNIT IV: Disaster Management (6 Hours)

Disaster Management, Types of disaster, Plans of disaster management, Technology to manage natural disasters and catastrophes, Disaster Management, Rehabilitation and Reconstruction, Human-induced disaster, First Aid, The importance of First-aid, Disaster Declaration and Response.

UNIT V: Counselling for Adolescents (6 Hours)

High Risk Behaviours, Developmental Changes in Adolescents, Key Issues of the Adolescents, Need for Counselling, Nature of Counselling, Counselling Goals, Does helping help? The Good and the Bad news. Importance of Career Guidance Counselling.

Books for Study

1. Department of Human Excellence. (2021). *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference

1. Albert, D., & Steinberg, L. *Judgment and decision making in adolescence: Journal of Research on Adolescence*, page no: 211-224 (2011).
2. Larry, R. C. (2000). *Disaster Management and Preparedness*, Lewis Publications.
3. Hurlock, E.B. (2001). *Developmental Psychology: A: Life-Span Approach*. (5th Ed.). Tata McGraw-Hill.
4. Sangha., & Kamaljit. (2015). *Ways to Live in Harmony with Nature: Living Sustainably and Working with Passion*. Australia, Woodslane Pty Limited.

Websites and eLearning Sources

1. https://en.wikipedia.org/wiki/Disaster_management_in_India
2. <https://ndma.gov.in/>
3. <https://talkitover.in/services/child-adolescent-counselling/>
4. <https://www.nipccd.nic.in/schemes/adolescent-guidance-centre-19#gsc.tab=0>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Know the value of natural recourses and to live in a harmony with nature.	K1
CO2	Apply the plans of disaster management in the society.	K2
CO3	Analyse the importance and differences of science and religion.	K3

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23UHE44VE04A		Value Education - 4: Social Ethics - 2							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	3	2	3	3	2.8
CO2	3	2	2	3	3	2	3	3	2	2	2.5
CO3	2	3	3	3	2	3	3	3	3	3	2.8
Mean Overall Score											2.7 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23UHE44VE04B	Value Education - 4: Religious Doctrine - 2	2	1

Course Objectives
To explore the rich historical background of the Catholic Church
To explore and comprehend the Sacraments practiced by the Catholic Church
To incorporate Christian Prayer into daily routines
To reflect on personal growth through the lens of Sacraments and Christian Prayer
To promote unity by embracing universal values from various religions

UNIT I	The Catholic Church	(6 Hours)
UNIT II	Sacraments of Initiation	(6 Hours)
UNIT III	Sacraments of Healing & at the Service of Community	(6 Hours)
UNIT IV	The Christian Prayer	(6 Hours)
UNIT V	Harmony of Religions	(6 Hours)

Teaching Methodology	Chalk and Talk, Power point, assignment and Group discussion
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Book for Study

1. Department of Human Excellence (2022). Fullness of Life, St Joseph's College (Autonomous), Tiruchirappalli.

Book for Reference

1. (1994). *Compendium: Catechism of the Catholic Church*. Bengaluru: Theological Publications in India.
2. Holy Bible (NRSV).

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	understand the history of the Catholic Church	K1
CO2	examine and grasp the Sacraments of the Catholic Church	K2
CO3	apply the Christian Prayer to their everyday life	K3

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
4	23UHE44VE04B	Value Education - 4: Religious Doctrine - 2								2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	2	3	3	2.7
CO2	3	2	2	2	3	3	3	3	2	2	2.5
CO3	2	2	3	3	2	2	3	3	3	3	2.6
Mean Overall Score											2.6 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53CC08	Core Course - 8: Biophysics and Biostatistics	5	4

Course Objectives
To understand the field of biophysics with reference to bioenergetics
To understand the principles of statistics and know the method of calculation
To learn to apply physical principles to biological systems
To apply the statistical principles to solve the biological problems
To analyse the measures of central value and standard deviation

UNIT I (15 Hours)

Biophysics: Photobiology - electromagnetic spectrum, visible range of spectrum, solar energy and photosynthesis. Influence of light on Phytochrome and its effect on root growth. Phototropin, its significance in plant growth. Fluorescence. Bioluminescence. Phosphorescence.

UNIT II (15 Hours)

Bioenergetics - energy and work. Laws of thermodynamics - concept of entropy and enthalpy. Gibbs's free energy - energy transduction in biological systems. High-energy compounds - ATP bioenergetics and energy coupled reactions. Radioactivity - structure of an atom, isotopes, types of radiations, application of radioactive isotopes in biological studies, detection of radiation, autoradiography.

UNIT III (15 Hours)

Biostatistics: Data - primary & secondary; variable - discrete & continuous. Population and sample, sampling techniques, classification of data, frequency distribution - discrete, continuous and cumulative; parts of a statistical table - advantages of classification of data. Presentation of data - histogram, frequency polygon, frequency curve, Ogive curve, bar charts
- simple, multiple, subdivided, pie diagram.

UNIT IV (15 Hours)

Measures of central values: mean, median, mode. Measures of dispersion: range, mean deviation, standard deviation, coefficient of variation - Skewness. Correlation - definition - types - methods of studying correlation: scatter diagram method and Karl Pearson's coefficient of correlation for simple and linear data. Regression: definition - regression lines.

UNIT V (15 Hours)

Probability - definition, binomial, poisson and normal distributions. Tests of significance. General procedure - large sample testing & small sample testing: t-Test, Chi-square test and F test.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Book for Study

1. Fabrizio, C. (2016). *The physics of living systems*. Springer International Publishing.

Books for Reference

1. Mishra, S. R. (2010). *Textbook of Photobiology*. Discovery Publishing Pvt. Ltd.
2. Gupta, S. P. (2008). *Elementary Statistical Methods*. Sultan Chand & Sons.

Websites and eLearning Sources

1. <https://opentextbc.ca/biology/chapter/5-1-overview-of-photosynthesis/>
2. <http://www.biosciencenotes.com/bioenergetics/>
3. https://www.osmosis.org/notes/Introductory_Biostatistics

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recognize the structure and dynamics of macromolecules, cells and tissues	K1
CO2	realize energy transformation and transfer; thermodynamics	K2
CO3	understand and use statistical theory underlying the application of biostatistical methods	K3
CO4	analyze the different type of data using appropriate statistical software.	K4
CO5	demonstrate a good understanding of descriptive statistics and graphical tools.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours	Credits	
5	23UBO53CC08		Core Course - 8: Biophysics and Biostatistics						5	4	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	2	2	1	2	2.2
CO2	2	3	1	2	3	3	2	2	2	2	2.2
CO3	2	3	1	2	2	2	2	2	1	2	1.9
CO4	2	2	2	2	1	2	2	2	1	2	1.8
CO5	2	2	1	3	3	2	3	2	2	2	2.3
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53CC09	Core Course - 9: Microbiology and Immunology	5	4

Course Objectives
To provide students with basic understanding of Structure and organization of bacteria
To understand the application of microbes in food and dairy microbiology
To provide comparative analysis of major groups of microbes.
To be aware about the immune systems of human being
To know about the antibody production and their immunological role

UNIT I (15 Hours)

Microbiology: History, Development and Classification (Outline). Whittaker's five kingdom concept, Bergey's Manual of Systematic Bacteriology (outline). Morphology, cell structure, cell wall chemistry, growth, nutrition and reproduction of bacteria. Viruses: structure, classification and reproduction - lytic and lysogenic cycle. A brief account on Rickettsias, Chlamydia, Mycoplasmas, Viroids and Prions.

UNIT II (15 Hours)

Culture of microorganisms: Pure cultures, batch and continuous cultures. Methods of Preservation of microorganisms. Microorganisms and Human diseases: Food borne (Botulism), water borne (Cholera), air borne (Tuberculosis), vector borne (malaria) and contact diseases (AIDS) and SARS. Control of microorganisms - physical, chemical and biological methods.

UNIT III (15 Hours)

Soil Microbes and Their Roles, Improvements in Soil Fertility, Nitrogen Fixing Bacteria and Their Role in Nitrogen Cycle, Phosphate Solubilization. Mycorrhizae. Plant-Microbes Interactions: Ectomycorrhizae and Endomycorrhizae. Food microbiology: Types of food spoilage and methods of food preservation. Dairy microbiology: Fermented dairy products. Industrial microbiology: Fermentation and Industrial production of alcohol and antibiotics.

UNIT IV (15 Hours)

Immunology: Immune system - adaptive, innate, humoral and cellular immunity. Origin, structure and immunological role of primary lymphoid organs (bone marrow and thymus) and Secondary lymphoid organs (Spleen, lymph nodes, Payer's patches, tonsils and appendix).

UNIT V (15 Hours)

Origin and role of immune cells (Leucocytes and lymphocytes). Lymph: composition and functions. Antibody types, study of IgG, its structure and immunological role. Virus encounter human system and vaccination.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Pelczar, J. C., ECS & Krieg, R. (1999). *Microbiology*. Tata McGraw Hill.
2. Sullia, S.B., & Shantharam, S. (2005). *General microbiology*. Oxford & IBH

Books for Reference

1. Dubey, R.C., & Maheshwari, D.K. (2004). *A text book of microbiology*. S.Chand.
2. Casida, L.E., (2005). *Industrial Microbiology*. New Age International.

Websites and eLearning Sources

1. <https://www.wileyindia.com/a-textbook-of-plant-pathology.html>
2. <https://www.britannica.com/science/plant-disease>.
3. <https://www.planetatural.com/pest-problem-solver/plant-disease/>
4. https://www.imgt.org/IMGTeducation/Tutorials/ImmuneSystem/UK/the_immune_system.pdf2
5. https://www.roswellpark.org/sites/default/files/repasky_9-1-16_cells_and_tissues_lecture_part_1.pdf

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the various types of microbes in an environment and their importance.	K1
CO2	comprehend the structure and function of immune system in humans.	K2
CO3	demonstrate the role of microorganisms in food processing and spoilage, soil fertility and sewage disposal	K3
CO4	identify the defense mechanism against infection in humans.	K4
CO5	assess role of microorganisms in industrial processing of microbial products	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53CC09		Core Course - 9: Microbiology and Immunology							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	2	2	2.3
CO2	2	3	2	2	1	2	3	2	2	2	2.1
CO3	2	2	3	2	2	3	3	2	3	1	2.3
CO4	3	3	2	1	1	3	2	2	1	2	2.1
CO5	2	3	2	2	3	1	3	2	1	3	2.4
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53CP05	Core Practical - 5: Biophysics, Biostatistics, Microbiology & Immunology	4	2

Biophysics

1. Separation of cell and tissue components by centrifugation
2. Separation of pigments by Paper chromatography
3. Absorption spectrum of macromolecules and pigments - UV, FTIR

Biostatistics

1. Sampling by Random Number Table
2. Data Collection
3. Classification of Data: Discrete, continuous and cumulative.
4. Statistical diagrams: Histogram, Frequency curve, Bar chart and Ogive curve
5. Measures of Central Values: Mean, Median and Mode
6. Measures of Dispersion: Range, Mean Deviation and Standard Deviation.

Microbiology

1. Preparation of common media (Nutrient agar & Potato dextrose agar).
2. Staining of Bacteria (Simple & Grams staining).
3. Isolation and enumeration of microbes in soil and water (serial dilution).
4. Study of motility by Hanging Drop.
5. Pure cultures of bacteria - Streak plate, Pour plate and Spread plate.
6. Microbiology of milk (Phosphatase and MBRT)
7. Antibiosis - Kirby Baur method

Immunology

1. Blood grouping
2. WIDAL- test for typhoid
3. RPR- test for syphilis
4. RF- test for rheumatoid arthritis
5. Immunoelectrophoresis - Demo
6. ELISA - Demo

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53ES01A	Discipline Specific Elective - 1: Molecular Biology	5	3

Course Objectives				
To understand the structure, organization and function of prokaryotic and eukaryotic genome.				
To acquire knowledge on mechanism and influences on genetic code and its perpetuation.				
To comprehend the basic cellular and molecular events.				
To apply the knowledge acquired to study the molecular mechanisms.				
To analyse the principles of gene regulation.				

UNIT I (15 Hours)

Organisation of genome - prokaryotic and eukaryotic. Linear and circular DNA molecules. Mutations - types, causes and detection. Mutant types - lethal, conditional, biochemical, germinal vs somatic mutants, insertional mutagenesis. Basic idea about mobile genetic elements - IS elements and transposons.

UNIT II (15 Hours)

DNA replication: General features, enzymology, detailed mechanism (initiation, elongation and termination). DNA damage: damages caused by alkylation, UV, gamma and X-rays. DNA repair: excision, double-strand break, mismatch and SOS mechanisms.

UNIT III (15 Hours)

Transcription: The Central Dogma, Genetic code, RNA polymerase, promoters, enhancers, silencers, general transcription factors and the mechanism of transcription (initiation, elongation and termination) in prokaryotes and eukaryotes. Post-transcriptional events (splicing, capping and polyadenylation).

UNIT IV (15 Hours)

Translation: Organization of mRNA, genetic code and its characterization, ribosome and rRNA, amino acyl synthetase, tRNA and amino acid activation. Mechanism of initiation elongation and termination. Translation factors, post-translation processing.

UNIT V (15 Hours)

Gene regulation: Basic principles of transcriptional regulation- positive and negative; inducible and repressible; activators and repressors. The lac operon (positive and negative control), the trp operon (repression-derepression and attenuation), riboswitches, mRNA stability, RNA interference, microRNAs.

Teaching Methodology	Chart, PPT, Videos, Chalk and talk.
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Books for Study

1. Freifelder, D. (1993). *Essentials of Molecular Biology*. Jones & Bartlett.
2. Gupta, P.K. (2005). *Molecular Biology and Genetic Engineering*. Rastogi Publications.
3. Wilson, K., & Walker, J. (2010). *Principles and Techniques of Biochemistry and Molecular Biology*.

Books for Reference

1. De Robertis & De Robertis. (1990). *Cell and Molecular Biology*. Saunders College, Philadelphia.
2. Elliott, W.H., & Elliott, D.C. (2005). *Biochemistry and Molecular Biology*, (3rd Ed.). Oxford University.

Websites and eLearning Sources

1. <https://www.nature.com/scitable/definition/transcription-dna-transcription-87/>
2. <https://www.ncbi.nlm.nih.gov/books/NBK26887/>
3. <https://courses.lumenlearning.com/wm-biology1/chapter/reading-steps-of-genetic-transcription/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	demonstrate the impact of structure modification on a biological system and relationship between systems	K1
CO2	demonstrate the principal molecular events of transcription and translation in prokaryotes and eukaryotes	K1
CO3	have knowledge on molecular events of DNA replication	K2
CO4	emphasize the concepts of split genes, splicing mechanisms	K3
CO5	develop comprehensive understanding about Ribo-switches and RNA interference	K4

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53ES01A		Discipline Specific Elective - 1: Molecular Biology							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	1	2	3	1	2	3	3	2.2
CO3	2	2	2	3	1	2	2	3	2	2	2.1
CO4	3	2	2	1	3	3	1	3	2	3	2.4
CO5	2	3	2	3	1	3	2	3	2	1	2.2
Mean Overall Score											2.3 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53ES01B	Discipline Specific Elective - 1: Bioinformatics and Bionanotechnology	5	3

Course Objectives				
To study the basic elements of interface, concepts between biology and nanotechnology.				
To outline the basics of sequence alignment and analysis.				
To classify different types of biological databases.				
To explain the synthesis approaches for nanomaterial and its characterization.				
To construct various types of nanomaterial for application and evaluate the impact on environment.				

UNIT I (15 Hours)

Bioinformatics: Introduction, Aim, Scope and Research areas of Bioinformatics. Branches of Bioinformatics. Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System - NCBI, PUBMED, EBI, EMBL, gene bank etc.

UNIT II (15 Hours)

Database searches for homology using BLAST and FASTA and interpretation of the results to derive biological significance of the queried DNA/protein sequences. Alignment of protein and DNA sequences using algorithm software to deduce homology and interpretation of data.

UNIT III (15 Hours)

Nanotechnology: Origin, scope and importance. Nanoparticles - definition. Principles: quantization effects - inverse relationship between size and reactive surface area. Properties: surface effects, the effects of size, shape, surface and bulk composition, and solubility and persistence.

UNIT IV (15 Hours)

Essentials of nanostructure generation: top-down vs. bottom-up. Chemical and physical self assembly. Physical, chemical and biogenic synthesis of nanomaterials - biomimetics, green plants, and microorganisms. Role of biomolecules - reducing and/or capping agents: proteins, viruses and carbohydrates, Preparation and characterization of nanoparticles (UV, FTIR, SEM, DLS and zeta potential, X-ray diffraction).

UNIT V (15 Hours)

Targeted nanoparticles: active and passive targeting. Application: medicine, manufacturing & materials, delivery vehicles, cancer therapy, tissue engineering, fluorescent biological labels, biological assays, nano-imaging, biosensors, micromanipulation techniques, metabolic engineering and gene therapy, environmental management; nanotechnology in agriculture; Interactions of nanoparticles, uptake, transport and toxicity.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Sharon, M., & Sharon, M. (2012). *Bio-Nanotechnology - Concepts and Applications*. CRC Press.
2. Rastogi, S.C., Mediratta, N., & Rastogi, P. (2004). *Bioinformatics, methods and applications, genomics, proteomics and drug discovery*. Prentice Hall of India, pvt. Ltd.

Books for Reference

1. Attwood, T. K., & Parry-Smith, D. J. (2001). *Introduction to Bioinformatics Delhi*. Pearson Education Ptd. Ltd.
2. Jain, K. K. (2006). *Nanobiotechnology molecular diagnostics: Current techniques and application (Horizon Bioscience)*, (1st Ed.). Taylor & Francis.
3. Mailander, V., & Landfester, K. (2009). *Interaction of nanoparticles with cells. Biomacromolecules*.

Websites and eLearning Sources

1. [http://ieet.org/index.php/IEET/more/bionanotechnology20141007Institute of Ethics & Emerging Technologies](http://ieet.org/index.php/IEET/more/bionanotechnology20141007Institute_of_Ethics_&Emerging_Technologies)
2. <https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html>

3. <http://www.particle-works.com/applications/controlled-drug-release/Applications>
4. <https://jnanobiotechnology.biomedcentral.com/articles/10.1186/1477-3155-2-3DOI:10.1186/1477-3155-2-3>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3865110/>
6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419715/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	have knowledge and awareness of basic concepts of biology, computer science and mathematics	K1
CO2	develop problem-solving skills including the ability to develop new algorithms and analysis methods	K2
CO3	implement phylogenetic tree construction	K3
CO4	understand the strengths, limitations and potential uses of nanomaterials.	K4
CO5	develop skill in Functional principles of Bionanotechnology therapies	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53ES01B		Discipline Specific Elective - 1: Bioinformatics and Bionanotechnology							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	1	2	2	3	2	1	2	2.1
CO2	2	3	2	2	2	2	3	2	2	3	2.3
CO3	2	2	3	2	1	2	2	3	2	2	2.1
CO4	1	2	2	3	2	2	3	2	3	2	2.2
CO5	1	2	2	3	2	2	3	2	1	3	2.1
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53ES02A	Discipline Specific Elective - 2: Research Methodology	5	3

Course Objectives				
To obtain knowledge on basic concepts in research.				
To understand the objective of research.				
To evaluate the significance of databases and citation index.				
To plan basic research and the research process.				
To acquire skill in writing research articles and formatting the papers.				

UNIT I (15 Hours)

Research: Meaning, Definition and Objectives. Hypothesis: definition and types. Understanding the language of research - Concept, Construct, Variable. Research Process.

UNIT II (15 Hours)

Research Design: Concept, classification and Importance in Research. Features of a good research design. Experimental Design: Concept of Independent and group research.

UNIT III (15 Hours)

Bibliometrics: definition and relevance; Bibliometrics databases, h-index, SNIP, Page Rank, Impact Factor and evaluation. The use of bibliometrics in research: Citation Research, Science Citation Index. Patent: definition, types and Indian Patent Act.

UNIT IV (15 Hours)

Interpretation of Data and Paper Writing. Types of manuscript in journals. Layout of a Research paper and proof correction. Journals in Life Science, Impact factor of Journals, Software for paper formatting like LaTeX/MS Office, BEAMER for presentation.

UNIT V (15 Hours)

Structure of thesis. Literature collection: Books, Research articles and e- resources. Structure and components of research proposal, National and International funding sources. Ethical issues related to publishing. Plagiarism and Software for detection of Plagiarism.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Kothari, C. R. (2014). *Research Methodology-Methods & Techniques*. WishwaPrakashan
2. Misra, R. P. (2000). *Research Methodology - A Handbook*. Concept Pub. Company.
3. Pillai., & Bagavathi. (2008). *Statistics*. S. Chand & Company Ltd.

Books for Reference

1. Gupta, S.P. (1990). *Statistical Methods*. Sultan Chand & Sons.
2. Rao, N. G. (1983). *Statistics for Agricultural Science*. Oxford & IBH.
3. Gupta, S.C. (2013). *Fundamentals of statistics*. Himalaya Publishers.

Websites and eLearning Sources

1. <https://www.trueeditors.com/blog/components-of-a-thesis/>
2. <https://www.aresearchguide.com/4format.html>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand and comprehend the basics in research methodology and applying them in research/ project work.	K1
CO2	demonstrate the ability to choose methods appropriate to research objectives.	K2
CO3	develop advanced critical thinking skills and Demonstrate enhanced writing skills	K3
CO4	help them to select an appropriate research design	K4
CO5	enable them to collect the data, edit it properly and analyse it accordingly. Thus, it will facilitate students' prosperity in higher education.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53ES02A		Discipline Specific Elective - 2: Research Methodology							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	2	3	2	2	1	2.2
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	1	3	3	2	3	1	2.4
CO5	2	2	2	2	1	2	2	2	2	1	1.8
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53ES02B	Discipline Specific Elective - 2: Biopesticides	5	3

Course Objectives				
To study the importance of appropriate control measures for managing insect pests in crops.				
To acquire knowledge on present use of biopesticides as part of integrated pest management.				
To illustrate the mass production techniques of microbial biopesticides.				
To analyze how to use the variable biopesticide methods for managing different kinds of pests.				
To design various types of biopesticide formulations.				

UNIT I (15 Hours)

Biological control of insect pests: scope and principles, factors affecting biological control. Biopesticides: introduction, importance and classification- living creatures to control pests - weeds for controlling pest. Pest Control in Organic Farming. Application methods of biopesticides.

UNIT II (15 Hours)

Botanical pesticides: present status and future prospects; opportunities for botanical pesticides in crop rotation; multiple cropping for controlling pests, Trap Crops. Plants as a source of natural pesticides: Neem, Chrysanthemum, Pongamia, Garlic, Turmeric, Tobacco and Citronella.

UNIT III (15 Hours)

Biocontrol agents: Isolation, identification, mode of action and mass production of *Pseudomonas fluorescens* (bacterial agent), *Trichoderma viride* (fungal agent).

UNIT IV (15 Hours)

Biological pesticides: isolation, identification. Bacterium as biopesticide (*Bacillus thuringiensis*) - production and field applications. Fungus as biopesticide (*Entomophagous - Beauveria bassiana*). Insect as biopesticide (Reduviid predators - *Rhynocoris kumarii*, *R. fuscipes*, *R. marginatus*). *Trichogramma*. Virus as biopesticide (Baculovirus - NPV). Virulence, pathogenicity and symptoms of entomopathogenic nematodes.

UNIT V (15 Hours)

Production methods of biopesticides: liquid culture fermentation and solidstate fermentation - Types of biopesticide formulations: dry inoculum, granules, pellets, capsules, wettable powder and liquid formulations. Impediments and limitation in production and use of biopesticide.

Teaching Methodology	Chart, PPT, Videos, Chalk and talk.
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Books for Study

1. Ghosh, G. K. (2000). *Biopesticide and Integrated pest Management*. A P H Publishing Corporation.
2. Bhattacharyya, P., & Purohit, S.S. (2008). *Organic Farming: Biocontrol and Biopesticide Technology*.
3. Saleem, F., & Shakoori, A. R. (2012). *Development of Bioinsecticide*. Lap Lambert Academic Publishing.

Books for Reference

1. Chandra, K., Greep., & Srivathsa. (2005). *Bio Control Agents & Biopesticides*.
2. Dent, D. (2000). *Insect Pest Management*, (2nd Ed.). ABI Publishers.

Websites and eLearning Sources

1. <https://www.sciencedirect.com/science/article/abs/pii/B978012823355900010>
2. https://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20bio%20pesticides.html

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	describe about the importance of biopesticides in agriculture.	K1
CO2	produce biopesticides on large scale	K2
CO3	quality control of different biopesticides	K3
CO4	make students to think about the prones and cones of new technologies since they are living in a world where there is an outburst of newer technologies everyday	K4
CO5	strengthen and exploring entrepreneurship opportunities	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53ES02B		Discipline Specific Elective - 2: Biopesticides							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	3	2	2	2	2	2	3	2	2.2
CO2	2	3	2	1	2	2	3	2	2	3	2.2
CO3	2	2	3	2	1	2	3	2	2	2	2.1
CO4	1	2	2	2	2	2	3	2	3	2	2.1
CO5	1	2	2	3	2	2	3	2	1	3	2.1
Mean Overall Score											2.14 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23UBO53SP01	Self-paced Learning: Economic Botany	-	2

Course Objectives
To learn the origin and history of various crop plants.
To understand the cultivation of various economically important crops.
To acquire knowledge on the binomial nomenclature and morphology of economic crops.
To acquire the skill for preparation plant-based products.
To produce beverages and narcotics from specific plants.

UNIT I: Cereals and Legumes

Origin and History, Botanical description, Cultivation, Harvesting and uses of Cereals and Legumes: Wheat, Rice, Maize, Black gram, Redgram, Chick pea and Pigeon pea.

UNIT II: Vegetables and Fruits

Origin and History, Botanical description and economic importance of Vegetables and Fruits: Apple, Banana, Mango, Brinjal, Tomato and Potato.

UNIT III: Spices and Condiments

Origin and History, Botanical description, Cultivation and uses of Spices and Condiments: Pepper, Cardamom, Clove, Chilly, Coriander and Turmeric.

UNIT IV: Beverages Plants, Fibres and Timber

Origin and History, Botanical description, Cultivation, Processing and uses of Beverages plants: Tea, Coffee and Cocoa. Fibers and Timber: Cotton and Jute, Teak, Rosewood, and Mahogany.

UNIT V: Oil Yielding Plants

Origin and History, Botanical description, Harvesting, Extraction and uses of Fatty oils and Vegetable Fats: Sun flower, Soya bean, Coconut and Gingelly. Medicinal Plants: Rauwolfia, Chinchona and Digitalis.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

- Kochhar, S. L. (2012). *Economic Botany in Tropics*. MacMillan & Co.
- Panday, B. P. (2000). *Economic Botany*. S Chand Publishing Company.

Books for Reference

- Wickens, G. E. (2001). *Economic Botany: Principles & Practices*. Kluwer Academic Publishers.
- Chrispeels, M. J., & Sadava, D. E. (2003). *Plants, Genes and Agriculture*. Jones & Bartlett Publish

Websites and eLearning Sources

- <https://cereal-sciencetech.blogspot.com/2011/12/economic-importance-of-cereal-grains.html>
- [https://dpd.gov.in/iv\)%20Economic%20Importance%20&%20Value%20Added%20Products%20of%20%20Pulses.pdf](https://dpd.gov.in/iv)%20Economic%20Importance%20&%20Value%20Added%20Products%20of%20%20Pulses.pdf)

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand Economic Botany and types of fibers.	K1
CO2	current trends in Fiber industries, Spices and condiments, Commercial market of spices	K2
CO3	preparation of plant based products	K3
CO4	preparation of various beverages in industries	K4
CO5	formulation of active ingredients and its commercialization	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23UBO53SP01		Self-paced Learning: Economic Botany							-	2
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	1	2	3	1	2	3	3	2.2
CO3	2	2	2	3	1	2	2	3	2	2	2.1
CO4	3	2	2	1	3	3	1	3	2	3	2.4
CO5	2	3	2	3	1	3	2	3	2	1	2.2
Mean Overall Score											2.3 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	23USS54SE01	Skill Enhancement Course - 2: Soft Skills	2	1

Course Objectives
To help students understand, practice, and improve their communication skills
To enable students with effective presentation skills
To help students attend interviews confidently and participate effectively in group discussions
To make students realise their potential and excel on personal as well as professional grounds
To develop the thinking skills of students for better performance in competitive exams, interviews and group discussions

UNIT I: Communication Skills

Basics of Communication: Importance of Good Communication Skills, Types of Communication Skills, Verbal Communication, Non-verbal Communication, Tips for Improving Nonverbal Communication, Communication Styles, Barriers to Communication, Ways To Improve Communication Skills, Practicum

Professional Grooming: How to Create the Impact for that First Impression, Presentation Skills, Developing Handouts, Developing Notes, Adding Visual and Audio Effects, Practicum

UNIT II: Resume Writing & Interview Skills

Resume Writing: The Purpose of a Resume, Finding a Job & Making a Career, Length of Resume, Order of Resume, Tailoring the Resume, What your Resume should include, Some Tips for Listing a Bachelor's degree on Your Resume, What NOT to put on your Resume, Formatting Resume, Difference between Resume, Biodata and Curriculum Vitae, Preparation of a Resume

Interview Skills: Meaning of Interview, Types of Interviews, How to get ready for the big day?, Appropriate Attire, Etiquette, Mastering the Art of Meet and Greet, Resume – Points to Remember, Practicum

Group Discussion: Why is GD Essential?, Factors that influence GD, Outcome of GD, Tips for participation in a GD, Useful phrases for GD, Success Tips in GD, Practicum

UNIT III: Personal Effectiveness

Self-Discovery: Characteristics of Personality, Kinds of Self, Who am I?, Personality Inventory Table

Goal Setting: Why do Goal Setting?, Goal Setting Process, Smart Goals

UNIT IV: Numerical Ability

Average, Simple Interest, Compound Interest, Profit and Loss, Area, Volume and Surface Area

UNIT V: Test of Reasoning

Verbal Reasoning: Series Completion, Analogy. *Non-Verbal Reasoning*

Book for Study

1. Balaiah, J., & Joy, J. L. (2024). *Straight from the Traits: Securing Soft Skills*, (Revised 3rd Ed.). St. Joseph's College, Tiruchirappalli.

Books for Reference

1. Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non-Verbal Reasoning*, S. Chand.
2. Balaiah, J. & Joy, J. L. (2018). *Winners in the Making: A primer on soft skills*. St. Joseph's College, Tiruchirappalli.
3. Covey S. R. (2004). *The 7 Habits of Highly Effective People: Restoring the Character Ethic* (Rev. ed.). Free Press.
4. Egan, G. (1994). *The Skilled Helper* (5th Ed.). Pacific Grove, Brooks/Cole.

5. Khera, S. (2014). *You Can Win*. Macmillan Books.
6. Martin, Y. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting*, (5th Ed.). Adams Media.
7. Sankaran, K., & Kumar, M. (2010). *Group Discussion and Public Speaking*, (5th Ed.). M.I. Publishers.
8. Trishna. (2012). *How to do well in GDs & Interviews*, (3rd Ed.). Pearson Education.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	analyse problems directed at testing their cognitive abilities	K3
CO2	present the best of themselves as job seekers and communicate effectively in all contexts	K4
CO3	assess themselves, set goals, and manage conflicts that are expected of a good leader	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
5	23USS54SE01		Skill Enhancement Course - 2: Soft Skills							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	3	3	3	2	2	2	2	3	2	3	2.5
CO2	2	3	3	2	3	3	2	3	2	2	2.5
CO3	2	2	3	3	2	3	3	3	2	2	2.5
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63CC10	Core Course - 10: Plant Physiology	4	3

Course Objectives
To learn the underlying principles of various physiological process of plants in relation to water
To study and understand nutrition in plants and nitrogen metabolism
To understand the various mechanism of photosynthesis in plants.
To understand the various mechanism of respiration process in plants
To learn the various action of plant regulator and its physiological function in relations to various morphogenetic activities.

UNIT I (12 Hours)

Water, Mineral and Solute: Uptake and Transport. Molecular Structure and properties of water. Diffusion and osmosis - osmotic pressure, turgor pressure and significance of osmosis. Plasmolysis and its importance. Mechanism of absorption of water - passive and active absorption. Ascent of sap - theories on absorption. Absorption, mechanism and transport of mineral salts. Transpiration - types, mechanism, significance and factors affecting transpiration.

UNIT II (12 Hours)

Mineral nutrition: plant nutrients - essential and non-essential elements - micro and macro nutrients. Source, physiological role and deficiency symptoms of minerals. Hydroponics and aeroponics. Nitrogen metabolism: importance of nitrogen to plants. Sources of nitrogen, nitrogen cycle, nitrogen, ammonium assimilation and transamination.

UNIT III (12 Hours)

Photosynthesis: Photosynthetic apparatus and pigment system, Emerson Enhancement Effect and two pigment systems, Antenna complexes and reaction centers, Photosynthetic electron transport system and its mechanism, photophosphorylation and types - cyclic, non-cyclic and pseudocyclic pathway of carbon, CO₂ fixation - C₃, C₄ and CAM plants.

UNIT IV (12 Hours)

Respiration: Definition, types of respiration: Glycolysis (EMP pathway), Krebs cycle, Terminal oxidation, Electron transport chain (modern view) and oxidative phosphorylation. ATP synthesis, Photorespiratory carbon, Oxidative cycle, Pentose Phosphate pathway: its significance, Respiratory Quotient.

UNIT V (12 Hours)

Plant Growth: Plant growth substance: discovery and physiological effects of Auxin, Gibberellins and cytokinins. Growth inhibitor hormone: Ethylene and Absciscic acid. Physiology of flowering: Photoperiodism and Phytochrome, Vernalisation: techniques and mechanism. Seed dormancy and germination: physiological and biochemical changes.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Verma, V. (2007). *Text book of Plant Physiology*. Ane Books India.
2. Jain, V. K. (2006). *Fundamentals of Plant Physiology*, (18th Ed.). Chand & Co.
3. Pandey, S. N., & Sinha, B.K. (2006). *Plant Physiology*, (4th Ed.). Vikas Publishing House Ltd.

Books for Reference

1. Noggle., & Fritz. (1976). *Introductory Plant Physiology*. Prentice Hall.
2. Bajjal, B. D., & Ravisharma. (1981). *A Textbook of Plant Physiology*. Shiva Lal Agarwal
3. Salisbury, F.B., & Ross, C.N. (1995). *Plant Physiology*. CBS Publishers.

Websites and eLearning Sources

1. <https://unacademy.com/content/neet-ug/study-material/biology/plant-water-relation>.
2. <https://www.agry.purdue.edu/ext/pubs/agry>.
3. <https://www.toppr.com/guides/biology/mineral-nutrition/metabolism-of-nitrogen>.

4. <https://www.youtube.com/watch?v=XSMjfvDdTY>.
5. <https://unacademy.com/content/wp-content//Respiration-in-Plants>.
6. <https://bio.libretexts.org/Bookshelves/Botany/>.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recall and describe fundamental principles of plant physiology, such as water relations, nutrient uptake, photosynthesis, and respiration, demonstrating basic knowledge retention.	K1
CO2	explain the intricate molecular and cellular mechanisms underlying key physiological processes in plants, showcasing a deeper understanding of plant physiology concepts.	K2
CO3	applying advanced knowledge of plant physiology to design and conduct various experiments, demonstrating the ability to integrate theoretical concepts into practical research.	K3
CO4	analyse and interpret complex data sets related to plant physiological experiments, showcasing proficiency in data analysis and critical thinking skills.	K4
CO5	communicate scientific findings effectively through well-structured written reports and articulate presentations, demonstrating advanced communication skills tailored to diverse audiences.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63CC10		Core Course - 10: Plant Physiology							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	1	2	3	1	2	3	2.1
CO2	2	2	3	1	2	3	2	2	3	2	2.2
CO3	1	3	2	2	3	1	2	3	2	3	2.2
CO4	2	3	2	3	1	2	3	1	2	3	2.3
CO5	1	3	3	2	2	2	3	2	1	3	2.2
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63CP06	Core Practical - 6: Plant Physiology	3	2

Detailed Study

1. Effect of temperature on membrane permeability.
2. Osmosis - Thistle funnel, potato osmoscope.
3. Determination of water potential and solute potential.
4. Determination of root pressure and sap exudation.
5. Effect of environmental factors on the rate of transpiration.
6. Extraction and separation of leaf pigments.
7. Effect of light and CO₂ on photosynthesis.
8. Aerobic respiration - Ganong's respiroscope.
9. Ascent of sap - Balsam plant experiment.
10. Measurement of lipase activity.
11. Demonstration experiments:
 - i. Phototropism,
 - ii. Geotropism,
 - iii. Arc Auxanometer
 - iv. Dialatometer
 - v. Hydroponics

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63CC11	Core Course - 11: Genetic Engineering and Biotechnology	4	3

Course Objectives				
To define the principles and application of intellectual property rights.				
To understand the principles of genetic engineering.				
To learn the types and application of cloning vectors.				
To study and analyze different types of gene transfer methods.				
To design protocol for plant tissue culture.				

UNIT I (12 Hours)

Basic principle and important steps in recombinant DNA Technology. *Agrobacterium*- mediated gene transfer and Crown gall disease. Steps in Methods to generate desired foreign genes: isolation of prokaryotic gene by restriction enzymes and of eukaryotic gene by cDNA synthesis. Joining DNA molecules: ligases, linkers and homopolymers.

UNIT II (12 Hours)

Cloning vectors: natural vectors - *E. coli* plasmids; *in vitro* vectors - pBR; cosmids; single- stranded DNA vectors - M13; and shuttle vectors - *E. coli*; Yeast shuttle vector. Selectable markers. Gene cloning strategies: cDNA library and genomic library.

UNIT III (12 Hours)

Methods of gene transfer to bacteria, plants and animals: Ca-transfection, microinjection, electroporation, shotgun, lipofection, somatic cell nuclear transfer, and embryonic stem cells.

UNIT IV (12 Hours)

Various methods of Plant Tissue Culture and Applications. Protoplast fusion technology. Applications of plant tissue culture in agriculture and forestry. Transgenic plants against herbicide, insects, drought and salinity. Genetic Use Restriction Technology. Anti-sense RNA technology and the FlavrSavr tomato.

UNIT V (12 Hours)

Production technology of plantibodies and monoclonal antibodies by hybridoma technology. Gene therapy. Cloning animals (therapeutic and reproductive). Xenografting. Release of GMOs: *Bt* brinjal in India. Concerns of genetic engineering. IPRs - meaning, types (IP, Copyrights & Patents). Arguments for and against patenting genes and life forms.

Teaching Methodology	Chart, PPT, Chalk and Talk.
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Books for Study

1. Glick, B. R., & Pasternak, J. J. (2001). *Molecular biotechnology - principles and applications of recombinant DNA*, (2nd Ed.). ASM Press, Washington, D.C.
2. Old, R.W., & Primrose, S.B. (2001). *Principles of Gene Manipulation-an introduction to genetic engineering*. Black Well Science Ltd.

Books for Reference

1. Gamborg, O.L., & Phillips, G.C. (1995). *Plant cell, Tissue and Organ culture*. Narosa publishing House.
2. George, E.F., & Sherrington, P.D. (1984). *Plant propagation by Tissue culture*. Exegetics Limited.
3. Watson, J.D., & Gilman, M., Witkowski, J., & Zoller, M. (1992). *Recombinant DNA*, (2nd Ed.). WH Freeman Co.

Websites and eLearning Sources

1. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/agrobacterium>
2. <https://www.frontiersin.org/articles/10.3389/fmicb.2021.766364/full>
3. <https://www.genome.gov/about-genomics/policy-issues/Synthetic-Biology>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the basics of gene cloning, role of enzymes and vectors for genetic engineering	K1
CO2	understand the basics of Gene transfer methods	K2
CO3	learn the techniques and safety measures of genetic engineering, genome mapping and gene therapy	K3
CO4	understand Totipotency and cytodifferentiation	K4
CO5	learn the concepts of callus culture, cell suspension culture, micropropagation, organogenesis, somatic embryogenesis and protoplast culture	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63CC11		Core Course - 11: Genetic Engineering and Biotechnology							4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	3	2	3	2	2.5
CO2	2	3	2	3	2	2	3	2	2	3	2.4
CO3	2	2	3	2	3	3	3	2	3	1	2.4
CO4	3	3	3	3	1	3	3	3	3	1	2.6
CO5	1	2	2	2	3	1	2	2	2	3	2.0
Mean Overall Score											2.38 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63CP07	Core Practical - 7: Genetic Engineering and Biotechnology	3	2

Detailed Study:

Genetic Engineering, Biotechnology

1. Culture media and sterilization techniques
2. Generation of In vitro plants
3. Embryo culture
4. Callus induction and differentiation
5. Somatic embryogenesis.
6. Micropropagation and Synthetic seeds

Biochemistry

7. Qualitative estimation of sugars.
8. Estimation of total lipids (gravimetric).
9. Estimation of amino acids.
10. Determination of strength of amino acids.
11. Quantitative estimation of total protein.
12. Effect of pH/temperature on enzyme activity
13. Estimation of total phenolics

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63ES03A	Discipline Specific Elective - 3: Biochemistry	5	3

Course Objectives				
To acquire knowledge about chemical and molecular foundations of life.				
To compile the structure, properties and roles of carbohydrates, proteins and lipids.				
To analyze the structure, function and acid base properties of amino acids.				
To critique the role of vitamins and enzymes in biological systems.				
To evaluate the importance of secondary metabolites to mankind.				

UNIT I (15 Hours)

Carbohydrates: Classification of carbohydrates; Stereochemistry of simple sugars; α , β - glycosidic linkages, Structure and properties of monosaccharide (glucose, fructose, mannose), disaccharide (maltose, lactose, sucrose) and oligosaccharides; Polysaccharides: Chemical structure and functions of starch, glycogen, plant cell wall and bacterial cell wall.

UNIT II (15 Hours)

Lipids: Classification, structure, properties and synthesis of lipids; Saturated and Unsaturated fatty acids; Structure and function of phospholipids, glycolipids; cholesterol-biological importance; Membranes and fluid mosaic model.

UNIT III (15 Hours)

Amino acids: Structure & properties, Non-protein amino acids and their functions; Proteins: classification, peptide bond, structure- primary, secondary, tertiary (collagen), quaternary and the forces stabilizing protein structure.

UNIT IV (15 Hours)

Enzymes: biocatalysts - definition and characteristics, IUB classification; principles of catalysis, activation energy, transition state, active site and Michaelis-Menten equation; Mode of action - Lock & Key and Induced Fit models; Factors affecting enzyme action - pH, temperature, substrate & enzyme concentration; Enzyme regulation by inhibition: competitive, non-competitive & feedback.

UNIT V (15 Hours)

Secondary metabolites and their functions in plants: Terpenoids: N- containing metabolites (alkaloids), Phenolics: classification, properties and significance; Shikimic acid and mevalonic acid pathway; Synthesis of alkaloids from amino acids.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Lubert, S. (2005). *Biochemistry*. W.H. Freeman & Co.
2. Lehninger. (2008). *Principles of Biochemistry by Nelson*, (5th Ed.). D. L., Lehninger, A. L., & Cox, M. M. Publisher: W. H. Freeman and Company.
3. Judith, G. V. (2011). *Biochemistry by Donald Voet*, (4th Ed.). Publisher: John Wiley & Sons.

Books for Reference

1. Caret. *et al.* (1993). *Inorganic, Organic and Biological Chemistry*. WMC Brown.
2. Jeremy, M. B., John, L. T., & Lubert, S. (2010). *Biochemistry*, (17th Ed.). 74 Publisher: W. H. Freeman.

Websites and eLearning Sources

1. <https://www.medicalnewstoday.com/articles/161547#chemistry>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2642958/>
3. [https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_\(Jakubowski_and_Flatt\)/01%3A_Unit_I](https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(Jakubowski_and_Flatt)/01%3A_Unit_I)
4. [_Structure_and_Catalysis/03%3A_Amino_Acids_Peptides_and_Proteins/3.01%3A_Amino_A](#)

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, the students will be able to	
CO1	able to understand physical and chemical properties of molecules as a linkage of biochemistry	K1
CO2	able to undertake investigations and perform analyses that provide information about biochemical questions and help to solve biochemical problems.	K2
CO3	students will equip themselves with the basic biochemistry techniques which can later applied for their laboratory research and also for many other industrial researches.	K3
CO4	understand factors affecting enzyme reactions	K4
CO5	recognize drugs containing tannis as active principles.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63ES03A		Discipline Specific Elective - 3: Biochemistry							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	3	1	3	3	2	2	2	2.2
CO2	3	2	2	1	2	2	3	1	2	3	2.1
CO3	1	2	3	2	3	2	3	2	3	2	2.3
CO4	1	2	2	3	1	2	3	2	2	3	2.1
CO5	2	2	1	2	3	2	3	2	2	3	2.2
Mean Overall Score										2.2 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63ES03B	Discipline Specific Elective - 3: Agricultural Botany	5	3

Course Objectives				
To understand the scope and importance of various branches of agriculture.				
To gain knowledge in agricultural development at global level.				
To acquire skills of various crops cultivation in India.				
To classify various agricultural operational procedures of various crops.				
To prioritize various harvesting procedures.				

UNIT I: Introduction to Agriculture (15 Hours)

Agriculture - Definition - Importance and scope - Branches of agriculture- Agronomy - Definition - Meaning and scope. National and International Agricultural Research Institutes. Indian economy - National income.

UNIT II: History of Agriculture Development (15 Hours)

Evolution of human beings and agriculture - Era of civilization- Importance of Neolithic civilization - History of Agricultural development in world and India - Agriculture in ancient India -- Development of scientific Agriculture - Stages of agriculture development - Chronological agricultural technology development in India.

UNIT III: Crop Classification and Crop Production (15 Hours)

Crops and their classification-Major crops of India and TamilNadu-Economic importance. Major soil types of India and Tamil Nadu. Factors affecting crop production - climate - edaphic- biotic - physiographic and socioeconomic factors - Agricultural seasons of India and Tamil Nadu. Tillage - Definition - Types- Objectives - Modern concepts of tillage.

UNIT IV: Basic Agricultural Operations (15 Hours)

Seed treatment. Nursery. Sowing methods. Germination - Factors affecting germination. Plant population and geometry - effect on growth and yield. After cultivation - Thinning - Gap filling. Weeds - Definition - Beneficial and Harmful effects of weed. Irrigation and its role on plant growth. Manures and fertilizers - Time and methods of application.

UNIT V: Harvesting and Storage (15 Hours)

Maturity symptoms of field crops - methods of harvesting - Cleaning and drying -methods of storage. Current stream of developments.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Books for Study

1. Rao, S. G. B., Thiruppathi, M., Kumar, R., & Kumar, S. M. P. (2015). *Basic Agronomy*. Manibharathi Publications.
2. Chandrasekaran, B., Annadurai, K., & Somasundaram, E. (2010). *A Textbook of Agronomy*. New Age International Publishers.

Books for Reference

1. Balasubramanian, P. & SP. Palaniappan. (2010). *Principles and Practices of Agronomy*. Agrobios.
2. ICAR. (2011). *Handbook of Agriculture*. Indian Council of Agricultural Research.
3. Panda, S.C. (2010). *Agronomy*. Agro bios (India).
4. Reddy, Y. T. & Reddi, S. G. H. (2010). *Principles of Agronomy*. Kalyani Publishers.

Websites and eLearning Sources

1. http://www.dphu.org/uploads/attachements/books/books_2248_0.pdf
2. <https://www.scribd.com/doc/119183030/principles-of-agronomy-andagrometerology>
3. <http://www.newagepublishers.com/samplechapter/001757.pdf>
4. [http:// www.sun.worldcat.org/title/principles of agronomy/oclc/689265](http://www.sun.worldcat.org/title/principles of agronomy/oclc/689265)

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	demonstrate the knowledge of, and need for sustainable development	K1
CO2	develop innovative processes, products, and technologies to meet the challenges in agriculture and farming practices.	K2
CO3	understand the impact of the professional agricultural solutions in societal and environmental contexts	K3
CO4	recognize and examine the relationships between inputs and outputs in their agricultural fields to make effective and profitable decisions.	K4
CO5	understand mechanics of agri-preneurship	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63ES03B		Discipline Specific Elective - 3: Agricultural Botany							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	2	3	2	2	1	2.2
CO3	2	2	3	2	3	3	3	2	3	2	2.4
CO4	3	3	2	3	1	3	3	2	3	1	2.4
CO5	2	2	1	2	1	2	2	1	2	1	1.6
Mean Overall Score										2.2 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63ES04A	Discipline Specific Elective - 4: Medicinal Botany	5	3

Course Objectives
To acquire the knowledge about understanding of principle and efficacy of various Indian system of medicines.
To learn the identification, pharmacological importance and processing of medicinal plants based on their classification and characterization.
To analyze the suitable conservation method for medicinal plants using modern biotechnology tools to ensure the sustainable utilization.
To evaluate the medicinal plants based drug efficacy and its various applications for different ailments
To create new methods for identification and characterization of drug adulteration and formulations for the human welfare.

UNIT I (15 Hours)

Medicinal Plants: History, Scope and Importance. Traditional medicinal systems: Ayurvedha, Siddha, Naturopathy, Aromatherapy and Acupuncture. Definition of drug classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical and pharmacological.

UNIT II (15 Hours)

Ethnobotany: definition, major tribes of South India and their ethno botanical heritage. Ethnobotany and conservation of plants with special reference to India. Mythology and conservation of ecosystems (sacred groves). Role of ethnic groups in conservation of medicinal plant genetic resources. Endangered taxa and forest management.

UNIT III (15 Hours)

Cultivation, collection and preparation of natural drugs macroscopic (physical and organoleptic characters), therapeutic and pharmaceutical characterization of the following medicinal plants: *Adathoda vasica*, *Aloe vera*, *Centella asiatica*, *Piper nigrum*, *Allium sativum*, *Curcuma longa*, *Ocimum sanctum* and *Catharanthes roseus*. Conservation of endangered and endemic medicinal plants using Plant Tissue Culture.

UNIT IV (15 Hours)

Drugs from leaves (Eucalyptus), flower (Eugenia), fruits and seeds (Coriander), roots (Withania), underground stem (Ginger), bark (Cinchona) and wood (Ephedra). Cultivation and utilization of selected medicinal plants *Bacop amonnieri*, *Cassia senna*, *Andrographis paniculata*, *Gloriosa superba*, *Phyllanthus amarus* and *Rauvolfia serpentina*.

UNIT V (15 Hours)

Drug adulteration and types. Drug evaluation: physical, chemical and biological. Quality control of herbal drugs. Role of NMPB, AYUSH and CDRI.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Book for Study

1. Gokhale, S. B., Kokate, C. K., & Purohit, A.P. (2003). *Pharmacognosy*. NiraliPrakashan.

Books for Reference

1. Bhattacharjee, S. K. (2004). *Hand Book of Medicinal plants*. Pointer Publishers.
2. Harbourne, J. B. (1998). *Phytochemical methods: A Guide to Modern Techniques of Plant Analysis*, (3rd Ed.). Chapman and Hill Co.
3. Joshi, S. G. (2001). *Medicinal plants*. Oxford & IBH Publishing Co. Pvt. Ltd.
4. Arber, A. (1999). *Herbal plants and Drugs*. Mangal Deep Publications.

Websites and eLearning Sources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3358962/>
2. <https://faculty.washington.edu/stevehar/Ethnobotany.pdf>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	know about history and relevance of herbal drugs in Indian system of medicine	K1
CO2	Know about the major and minor ethnic groups or Tribals of India, and their life styles.	K2
CO3	get awareness on the conservation practices of medicinal plants	K3
CO4	understand the techniques for drug evaluation (Chemical, Physical and Biological), Phytochemical investigations, standardization and quality control of herbal drugs	K4
CO5	know the technique of medicinal gardening - Cultivation practices, marketing and utilization of selected medicinal plants	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63ES04A		Discipline Specific Elective - 4: Medicinal Botany							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	1	3	3	3	1	2	2	2.3
CO2	2	2	3	2	2	1	3	3	2	3	2.3
CO3	3	3	3	2	3	1	3	3	2	3	2.6
CO4	3	1	3	2	3	2	3	1	2	2	2.2
CO5	2	3	2	2	3	1	1	2	3	3	2.2
Mean Overall Score											2.32 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63ES04B	Discipline Specific Elective - 4: Biological Techniques	5	3

Course Objectives				
To learn the microtechnique preparation of slides				
To understand the stain preparation and staining techniques				
To study about the specimen preservation techniques				
To understand about the organic farming development techniques				
To know about the various clinical and immunological tests				

UNIT I (15 Hours)

Microtechniques - selection of material, fixation, fixation images- acid and basic. Preparation of permanent slide-Dehydration process, Infiltration of wax, embedding, sectioning (microtome), mounting. Leaf clearing, smear and squash techniques.

UNIT II (15 Hours)

Stains: Classification- single, double, triple staining. Florescent image processing Nuclear, cytoplasmic, cell wall stains and their rationale. Herbarium - collection, drying, pasting of plant specimen, Protection of Herbarium- importance.

UNIT III (15 Hours)

Techniques of the preparation of vertebrate skeletons and transparency preparations (Alizarian red) cartilage staining, museum techniques: dry and wet preparation. Taxidermy Arthropod squash. Blood grouping ABO and Rh, blood smear preparation. Haemocytometer.

UNIT IV (15 Hours)

Earthworm and its types. Preparatory methods of vermiculture techniques. Vermin compost - panchakavia; fish extract, Economic and ecological importance of vermicompost. Biofertilizers- Cultivation of Spirulina and Scenedesmus. Animal rearing: albino rats, rabbits and fruit fly.

UNIT V (15 Hours)

PCR - principles, technique and applications- Types of PCR -Reverse Transcriptase (RT) Blotting techniques -Northern. DNA finger printing and barcoding. Immunological test - WIDAL, RPR, RF and ELISA.

Teaching Methodology	Chart, PPT, Chalk and talk & Instrumentation and Museum visit.
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Books for Study

1. Yadav, P. R. (2006). *Biological Techniques*. Discovery Publishing House.
2. Swargiary, A. (2017). *Biological Tools & Techniques*. Kalyani Publishers.

Books for Reference

1. Ramakrishnan, S. (2012). *Manual of Medical Laboratory Techniques*. Jaypee Brothers Medical Publishers.

Websites and eLearning Sources

1. <https://nios.ac.in/media/documents/dmlt/HC/Lesson-20.pdf>
2. <https://www.sciencedirect.com/science/article/pii/S2405580819303449>
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/serology.pdf
4. <https://www.ndvsu.org/images/StudyMaterials/Micro/Stains---staining.pdf>
5. https://faculty.ksu.edu.sa/sites/default/files/plant_microtechnique_part_1_a_0.pdf

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the various micro techniques in biology.	K1
CO2	learn the principles and applications of microscopy.	K2
CO3	construct immunological techniques and applications.	K3
CO4	distinguish and identify techniques used to preserve organisms in museum.	K4
CO5	prepare biofertilizers and animal rearing.	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
6	23UBO63ES04B		Discipline Specific Elective - 4: Biological Techniques							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	1	2	2	3	2	1	2	2.1
CO2	2	3	2	2	3	2	3	2	2	1	2.2
CO3	2	2	3	2	1	2	2	3	2	2	2.1
CO4	1	2	2	3	2	1	3	2	3	2	2.1
CO5	1	2	2	3	2	2	3	2	2	3	2.2
Mean Overall Score											2.1 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	23UBO63CE01	Comprehensive Examination	-	2

Course Objectives
To assess the student's knowledge of the area of specialization
To evaluate the ability of a student to formulate an original research problem
To Comprehensiveness and relevance
To present the knowledge, skills and practical they undertake
To show their deep understanding of concepts related to their field of study

UNIT I

Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Plant diseases and defense mechanism. Ecology and Evolutionary trends. Binomial nomenclature, Numerical Taxonomy and Chemotaxonomy, Tissues, totipotency, properties of wood; Microsporangogenesis, megasporogenesis, double fertilization and polyembryony.

UNIT II

Cell Biology - Cell as a unit structure and function, Cell division: Mitosis and Meiosis Chromosomal behaviour and their cytological significance; Mendelian Genetics- linkage and crossing over, Chromosome mapping, Human genome project; Protein synthesis and gene expression, DNA replication; Polyploidy and mutations in crop improvement. Heterosis and Inbreeding Depression; theories of evolution and variations in speciation

UNIT III

Photosynthesis: mechanism and importance, Nitrogen Metabolism. Physiology of seed dormancy and germination, Plant growth Regulator, Phytochrome and its role. Biopolymers- carbohydrates, proteins and lipids; Enzyme kinetics and Mode of enzyme action. Secondary metabolites- Alkaloids, phenolics and terpenoids. Bioenergetics, redox potential and coupled reaction, photobiology.

UNIT IV

Whittaker's five kingdom concept, food spoilage and preservation, Role of microbes in waste water treatment, Biofertilizer, protoplast culture, Somatic hybrid and Cybrids. Synthetic seeds and their application, Vectors in gene cloning - Plasmids, Cosmids, Bacteriophages, fermentation as a biochemical process, Microbial Single Cell Protein (SCP) production, humoral and cellular immunity, Antibody types and immunological role.

UNIT V

Sampling techniques, Central values (mean, mode, median), T-test, Chi square Test; Concept of Ecosystem, Method of studying plant communities, Vegetation types of India, Biotic interactions - Succession and its types, Biogeochemical cycles. Ethnobotany- scope and Tribes of Tamil Nadu, Conservation - in situ and ex situ conservation.

Teaching Methodology	Chart, PPT, Chalk and talk.
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Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	engage theory in light of a given topic, issue, or problem and vice-versa	K1
CO2	substantive knowledge of theories, concepts, and methodologies	K2
CO3	demonstrate the Intellectual maturity in study area	K3
CO4	maximize their time and performance	K4
CO5	think critically and the ability to articulate reflective and knowledgeable responses to challenging questions.	K5

M Sc BOTANY

LOCF SYLLABUS 2023



Department of Botany

School of Biological Sciences
St. Joseph's College (Autonomous)
Tiruchirappalli - 620002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) POSTGRADUATE COURSES

St. Joseph's College (Autonomous), an esteemed institution in the realm of higher education in India, has embarked on a journey to uphold and perpetuate academic excellence. One of the pivotal initiatives in this pursuit is the establishment of five Schools of Excellence commencing from the academic year 2014-15. These schools are strategically designed to confront and surpass the challenges of the 21st century.

Each School amalgamates correlated disciplines under a unified umbrella, fostering synergy and coherence. This integrated approach fosters the optimal utilization of both human expertise and infrastructure. Moreover, it facilitates academic fluidity and augments employability by nurturing a dynamic environment conducive to learning and innovation. Importantly, while promoting collaboration and interdisciplinary study, the Schools of Excellence also uphold the individual identity, autonomy, and distinctiveness of every department within.

The overarching objectives of these five schools are as follows:

1. **Optimal Resource Utilization:** Ensuring the efficient use of both human and material resources to foster academic flexibility and attain excellence across disciplines.
2. **Horizontal Mobility for Students:** Providing students with the freedom to choose courses aligning with their interests and facilitating credit transfers, thereby enhancing their academic mobility and enriching their learning experience.
3. **Credit-Transfer Across Disciplines (CTAD):** The existing curricular structure, compliant with regulations from entities such as TANSCHÉ and other higher educational institutions, facilitates seamless credit transfers across diverse disciplines. This underscores the adaptability and uniqueness of the choice-based credit system.
4. **Promotion of Human Excellence:** Nurturing excellence in specialized areas through focused attention and resources, thus empowering individuals to excel in their respective fields.
5. **Emphasis on Internships and Projects:** Encouraging students to engage in internships and projects, serving as stepping stones toward research endeavors, thereby fostering a culture of inquiry and innovation.
6. **Addressing Stakeholder Needs:** The multi-disciplinary nature of the School System is tailored to meet the requirements of various stakeholders, particularly employers, by equipping students with versatile skills and competencies essential for success in the contemporary professional landscape.

In essence, the Schools of Excellence at St. Joseph's College (Autonomous) epitomize a holistic approach towards education, aiming not only to impart knowledge but also to cultivate critical thinking, creativity, and adaptability – qualities indispensable for thriving in the dynamic global arena of the 21st century.

Credit system

The credit system at St. Joseph's College (Autonomous) assigns weightage to courses based on the hours allocated to each course. Typically, one credit is equivalent to one hour of instruction per week. However, credits are awarded regardless of actual teaching hours to ensure consistency and adherence to guidelines.

The credits and hours allotted to each course within a programme are detailed in the Programme Pattern table. While the table provides a framework, there may be some flexibility due to practical sessions, field visits, tutorials, and the nature of project work.

For postgraduate (PG) courses, students are required to accumulate a minimum of 110 credits, as stipulated in the programme pattern table. The total minimum number of courses offered by the department is outlined in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

OBE is an educational approach that revolves around clearly defined goals or outcomes for every aspect of the educational system. The primary aim is for each student to successfully achieve these predetermined outcomes by the culmination of their educational journey. Unlike traditional methods, OBE does not prescribe a singular teaching style or assessment format. Instead, classes, activities, and evaluations are structured to support students in attaining the specified outcomes effectively.

In OBE, the emphasis lies on measurable outcomes, allowing educational institutions to establish their own set of objectives tailored to their unique context and priorities. The overarching objective of OBE is to establish a direct link between education and employability, ensuring that students acquire the necessary skills and competencies sought after by employers.

OBE fosters a student-centric approach to teaching and learning, where the delivery of courses and assessments are meticulously planned to align with the predetermined objectives and outcomes. It places significant emphasis on evaluating student performance at various levels to gauge their progress and proficiency in meeting the desired outcomes.

Here are some key aspects of Outcome-Based Education:

Course: A course refers to a theory, practical, or a combination of both that is done within a semester.

Course Outcomes (COs): These are statements that delineate the significant and essential learning outcomes that learners should have achieved and can reliably demonstrate by the conclusion of a course. Typically, three or more course outcomes are specified for each course, depending on its importance.

Programme: This term pertains to the specialization or discipline of a degree programme.

Programme Outcomes (POs): POs are statements that articulate what students are expected to be capable of by the time they graduate. These outcomes are closely aligned with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs outline the specific skills and abilities that students should possess upon graduation within a particular discipline or specialization.

Programme Educational Objectives (PEOs): PEOs encapsulate the expected accomplishments of graduates in their careers, particularly highlighting what they are expected to achieve and perform during the initial years postgraduation.

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The Learning Outcomes-Centric Framework (LOCF) places the learning outcomes at the forefront of curriculum design and execution. It underscores the importance of ensuring that these outcomes are clear, measurable, and relevant. LOCF orchestrates teaching methodologies, evaluations, and activities in direct correlation with these outcomes. Furthermore, LOCF adopts a backward design approach, focusing on defining precise and attainable learning objectives. The goal is to create a cohesive framework where every educational element is in harmony with these outcomes.

Assessment practices within LOCF are intricately linked to the established learning objectives. Evaluations are crafted to gauge students' achievement of these outcomes accurately. Emphasis is often placed on employing authentic assessment methods, allowing students to showcase their learning in real-life scenarios. Additionally, LOCF frameworks emphasize flexibility and adaptability, enabling educators to tailor curriculum and instructional approaches to suit the diverse needs of students while ensuring alignment with the defined learning outcomes.

Some important terminologies

Core Courses (CC): These are compulsory courses that students must undertake as essential components of their curriculum, providing fundamental knowledge within their primary discipline. Including core courses is essential to maintain a standardized academic programme, ensuring recognition and consistency across institutions.

Common Core (CC): A common core course is a shared educational element encompassing fundamental topics across disciplines within a school. It promotes interdisciplinary comprehension and collaboration among students by providing a foundational understanding of key subjects essential for academic and professional success across diverse fields of study.

Elective Courses (ES): Elective courses are offered within the main discipline or subject of study. They allow students to select specialized or advanced options from a range of courses, offering in-depth exposure to their chosen area of study. Typically, ES are more applied in nature and provide a deeper understanding of specific topics.

Generic Elective Courses (EG): These elective courses are chosen from disciplines unrelated to the student's main area of study, aiming to broaden their exposure and knowledge base. As per the Choice Based Credit System (CBCS) policy, students may opt for generic elective courses offered by other disciplines within the college, enhancing the diversity of their learning experience.

Ability Enhancement Course (AE): AE is designed to enhance skills and proficiencies related to the student's main discipline. It aims to provide practical training and hands-on experience, contributing to the overall development of students pursuing academic programmes.

Skill Enhancement Course (SE): SE focus on developing specific skills or proficiencies relevant to students' academic pursuits. While it is open to students from any discipline, SE is particularly beneficial for those within the related academic programme.

Self-paced Learning (SP): This course promotes independent learning habits among students and they have to undergo the course outside the regular class hours within a specified timeframe.

Comprehensive Examinations (CE): These examinations cover detailed syllabi comprising select units from courses offered throughout the programme. They are designed to assess crucial knowledge and content that may not have been covered extensively in regular coursework.

Extra Credit Courses: To support students in acquiring knowledge and skills through online platforms such as Massive Open Online Courses (MOOCs), additional credits are granted upon verification of course completion. These extra credits can be availed across five semesters (2 - 6). In line with UGC guidelines, students are encouraged to enhance their learning by enrolling in MOOCs offered by portals like SWAYAM, NPTEL, and others. Additionally, certificate courses provided by the college are also considered for these extra credits.

Outreach Programme (OR): It is a compulsory course to create a sense of social concern among all the students and to inspire them to dedicated service to the needy.

Course Coding

The following code system (10 alphanumeric characters) is adopted for Postgraduate courses:

23	UXX	0	XX	00/X
Year of Revision	PG Department Code	Semester Number	Course Specific Initials	Running Number/with Choice

Course Specific Initials

CC - Core Course

CP - Core Practical

ES - Elective

AE - Ability Enhancement Course

SP - Self-paced Learning

EG - Generic Elective

PW - Project and Viva Voce

CE - Comprehensive Examination

OR - Outreach Programme

IS – Internship

EVALUATION PATTERN

Continuous Internal Assessment

Sl No	Component	Marks Alloted
1	Mid Semester Test	30
2	End Semester Test	30
3	*Three Components (15 + 10 + 10)	35
4	Library Referencing (30 hours)	5
Total		100

Passing minimum: 50 marks

* The first component is a compulsory online test (JosTEL platform) comprising 15 multiple choice questions (10 questions at K1 level and 5 questions at K2 level); The second and the third components are decided by the course in-charge.

Question Paper Blueprint for Mid and End Semester Tests

Duration: 2 Hours							Maximum Marks: 60	
Section		K levels						Marks
		K1	K2	K3	K4	K5	K6	
A (compulsory)		7						$7 \times 1 = 7$
B (compulsory)			5					$5 \times 3 = 15$
C (either...or type)				3				$3 \times 6 = 18$
D (2 out of 3)	For courses with K5 as the highest cognitive level, one K4 and one K5 question is compulsory. (Note: two questions on K4 and one question on K5)				1	1*		$2 \times 10 = 20$
	For courses with K6 as the highest cognitive level: Mid Sem: two questions on K4 and one question on K5; End Sem: two questions on K5 and one question on K6)				Mid Sem			
						End Sem		
					1	1	1*	
Total								60

* Compulsory

Question Paper Blueprint for Semester Examination

Duration: 3 Hours				Maximum Marks: 100		
UNIT	Section A (Compulsory)	Section B (Compulsory)	Section C (Either...or type)	Section D (3 out of 5)		
	K1	K2	K3	K4	K5	K6
UNIT I	2	2	2	2*	2*	1*
UNIT II	2	2	2			
UNIT III	2	2	2			
UNIT IV	2	2	2			
UNIT V	2	2	2			
Marks	10 × 1 = 10	10 × 3 = 30	5 × 6 = 30	3 × 10 = 30		

* For courses with K6 as the highest cognitive level wherein one question each on K4, K5 and K6 is compulsory.
(Note: two questions each on K4 and K5 and one question on K6)

Evaluation Pattern for One/Two-credit Courses

Title of the Course	CIA	Semester Examination	Total Marks
• Ability Enhancement Course	20 + 10 + 20 = 50	50 (A member from the Department other than the course instructors)	100
• Self-paced Learning • Comprehensive Examination	25 + 25 = 50	50 (CoE)	100
• Internship	100	-	100
• Skill Enhancement Course: Soft Skills	100	-	100
• Project Work and Viva Voce	100	100	100

Grading System

The marks obtained in the CIA and semester for each course will be graded as per the scheme provided in Table - 1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$SGPA \text{ and } CGPA = \frac{\sum_{i=1}^n C_i Gp_i}{\sum_{i=1}^n C_i}$$

$$WAM = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$$

Where,

C_i - credit earned for the Course i

Gp_i - Grade Point obtained for the Course i

M_i - Marks obtained for the Course i

n - Number of Courses **passed** in that semester

WAM - Weighted Average Marks

Table - 1: Grading of the Courses for PG

Mark Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
Below 50	0	RA

Table - 2: Grading of the Final Performance for PG

CGPA	Grade	Performance
9.00 and above	O	Outstanding*
8.00 to 8.99	A+	Excellent*
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	RA	Re-appear

**The Candidates who have passed in the first appearance and within the prescribed duration of the PG programme are eligible. If the Candidates Grade is O/A+ with more than one attempt, the performance is considered "Very Good".*

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.
- Nurturing comprehensive learning and best practices through innovative and value- driven pedagogy.
- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

1. Graduates will be able to accomplish professional standards in the global environment.
2. Graduates will be able to uphold integrity and human values.
3. Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to apply assimilated knowledge to evolve tangible solution to emerging problems.
2. Graduates will be able to analyze and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professional and entrepreneurs upholding human values.
5. Graduates imbued with ethical values and social concern will be able to understand and appreciate cultural diversity, social harmony and ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Graduates will acquire the basic concepts to utilize them for lifelong learning, communicative skills and to imbibe ethical values to create a better world.
2. Graduates will learn about the systematics, structure and functions of plants for effective management of cultivation practices for improved plant performance.
3. Graduates will develop laboratory skills utilizing modern tools, techniques and protocols to collect and process data to design innovative scientific problems and solutions.
4. Graduates will apply the skills for the benefit of the society through teamwork and project management practices for employability and entrepreneurship.
5. Graduates will exploit the knowledge gained through various courses for sustainable environment and human welfare.

PROGRAMME STRUCTURE				
Semester	Specification	Number of Courses	Hours	Credits
1 - 4	Core Course	10	51	50
1 - 4	Core Practical	6	24	19
1, 2, 4	Elective	4	20	14
1	Ability Enhancement Course	1	2	1
2	Self-paced Learning	1	-	2
2	Skill Enhancement Course	1	4	3
2, 3	Generic Elective	2	8	6
3	Common Core	1	5	4
2 - 4	Extra Credit Course	3	-	(9)
4	Project Work and Viva Voce	1	6	5
4	Comprehensive Examination	1	-	2
2 - 4	Outreach Programme (SHEPHERD)	-	-	4
Total		30	120	110(9)

M Sc BOTANY							
Course Details					Scheme of Exams		
Sem	Course Code	Title of the Course	Hours	Credits	CIA	SE	Final
1	23PBO1CC01	Core Course - 1: Plant Diversity - 1 (Algae, Fungi, Lichens and Bryophytes)	6	6	100	100	100
	23PBO1CC02	Core Course - 2: Plant Diversity - 2 (Pteridophytes, Gymnosperms and Paleobotany)	6	6	100	100	100
	23PBO1CP01	Core Practical - 1: Plant Diversity - 1 and 2	6	4	100	100	100
	23PBO1ES01	Elective - 1: Microbiology, Immunology and Plant Pathology	5	3	100	100	100
	23PBO1ES02	Elective - 2: Herbal Technology	5	3	100	100	100
	23PBO1AE01	Ability Enhancement Course: Nursery and Gardening	2	1	100	-	100
	Total		30	23			
2	23PBO2CC03	Core Course - 3: Plant Physiology	6	6	100	100	100
	23PBO2CC04	Core Course - 4: Plant Anatomy, Embryology and Morphogenesis	5	5	100	100	100
	23PBO2CP02	Core Practical - 2: Plant Physiology	3	2	100	100	100
	23PBO2CP03	Core Practical - 3: Plant Anatomy, Embryology and Morphogenesis	3	2	100	100	100
	23PBO2SP01	Self-paced Learning: Plant Breeding and Evolution*	-	2	50	50	50
	23PBO2ES03A	Elective - 3: Biophysics and Instrumentation	5	4	100	100	100
	23PBO2ES03B	Elective - 3: Plant Pathology					
	23PSS2SE01	Skill Enhancement Course: Soft Skills	4	3	100	-	100
	-	Generic Elective - 1: Refer ANNEXURE 1	4	3	100	100	100
	-	Extra Credit Courses (MOOC/Certificate Courses) - 1	-	(3)			
	Total		30	27(3)			
3	23PBO3CC05	Core Course - 5: Plant Systematics	5	5	100	100	100
	23PBO3CP04	Core Practical - 4: Plant Systematics	4	4	100	100	100
	23PBO3CC06	Core Course - 6: Biochemistry	5	5	100	100	100
	23PBO3CP05	Core Practical - 5: Biochemistry	4	4	100	100	100
	23PBO3CC07	Core Course - 7: Pharmacognosy	3	3	100	100	100
	23SBS3CC01	Common Core: Intellectual Property Rights	5	4	100	100	100
	-	Generic Elective - 2: Refer ANNEXURE 2	4	3	100	100	100
	-	Extra Credit Courses (MOOC/Certificate Courses) - 2		(3)			
	Total		30	28(3)			
4	23PBO4CC08	Core Course - 8: Research Methodology	5	5	100	100	100
	23PBO4CC09	Core Course - 9: Genetic Engineering and Biotechnology	5	5	100	100	100
	23PBO4CC10	Core Course - 10: Cell and Molecular Biology	5	4	100	100	100
	23PBO4CP06	Core Practical - 6: Research Methodology, Genetic Engineering and Biotechnology	4	3	100	100	100
	23PBO4ES04A	Elective - 4: Organic Farming	5	4	100	100	100
	23PBO4ES04B	Elective - 4: Genetics					
	23PBO4PW01	Project Work and Viva Voce	6	5	100	100	100
	23PBO4CE01	Comprehensive Examination*	-	2	50	50	50
	-	Extra Credit Courses (MOOC/Certificate Courses) - 3		(3)			
	Total		30	28(3)			
2 - 4	23PCW4OR01	Outreach Programme (SHEPHERD)		4			
1 - 4	Total (2 years)		120	110			

*- for grade calculation 50 marks are converted into 100 in the mark statements

Passed by	Board of Studies held on 18.12.2023
Approved by	48th Academic Council Meeting held on 27.03.2024

ANNEXURE 1
Generic Elective - 1 (WS)*

Course Details		
School	Course Code	Title of the Course
SBS	23PBI2EG01	Biochemistry of Natural Products
	23PBT2EG01	Medical Biotechnology

**Offered to students from other Departments within School*

ANNEXURE 2
Generic Elective - 1 (BS)*

Course Details		
School	Course Code	Title of the Course
SCS	23PCA3EG02	Web Design
	23PCS3EG02	Advances in Computer Science
	23PDS3EG02	Information Security and Ethics
	23PMA3EG02	Operations Research
SLAC	23PEN3EG02	English for Effective Communication
SMS	23PCO3EG02	Basics of TallyPrime
	23PCC3EG02	Dynamics of Human Behaviour in Business
	23PCP3EG02	Social Psychology
	23PEC3EG02	Managerial Economics
	23PHR3EG02	Counselling and Guidance
SPS	23PCH3EG02	Health Science
	23PEL3EG02	Computer Hardware and Networks
	23PPH3EG02A	Physics for Competitive Exams
	23PPH3EG02B	Nanoscience

**Offered to students from other Schools*

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1CC01	Core Course - 1: Plant Diversity - 1 (Algae, Fungi, Lichens & Bryophytes)	6	6

Course Objectives
To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes.
To spark interest in the evolutionary roots of plant development.
To study the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.
To expose the beneficial and harmful viewpoint.

UNIT I: Algae (18 Hours)

General account of algology, Contributions of Indian Phycologist (M.O.P. Iyanger, T.V. Desikachary and V. Krishnamurthy), Classification of algae by F.E. Fritsch (1935-45) & Silva (1982). Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Range of thallus organization, algae of diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles. Phylogeny and inter-relationships of algae, origin and evolution of sex in algae. Structure, reproduction and life histories of the following genera: *Oscillatoria*, *Scytonema*, *Ulva*, *Codium*, Diatoms, *Dictyota* and *Gelidium*.

UNIT II: Fungi (18 Hours)

General Characteristics, occurrence and distribution. Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V. Subramanian), Classification of Fungi by G.C. Ainsworth (1973) and Alexopoulos and Mims (1983) Phylogeny and inter-relationships of major groups of fungi. General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Heterothallism in fungi, Para sexuality, sex hormones in fungi. Structure and reproduction of the following: Mastigomycotina - *Albugo*; Zygomycotina - *Rhizopus*; Ascomycotina - *Saccharomyces*; Basidiomycotina - *Puccinia*; Deuteromycotina - *Cercospora*.

UNIT III: Lichens (18 Hours)

Introduction and Classification (Hale, 1969). Occurrence and inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens and Deuterolichens.

UNIT IV: Bryophytes (18 Hours)

General characters and Classification of Bryophytes by Watson (1971). Distribution, structural variations and evolution of gametophytes and sporophytes in Hepaticopsida, Anthocerotopsida and Bryopsida. General characters of major groups - Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Reproduction - Vegetative, asexual and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes. Structure, reproduction and life histories of the following genera: *Marchantia*, *Porella*, *Anthoceros*, and *Polytrichum*.

UNIT V: Economic Importance (18 Hours)

Algae - Economic importance in Food and feed - Single cell protein, Industrial products (Agar-Agar, Carrageenan, Alginic acid, Iodine, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth. Fungi - Economic importance in food, industries and medicine. Culturing and cultivation of mushrooms (*Pleurotus*). Lichen - Ecological and economic importance. Bryophytes - Ecological and economic importance - industry, horticulture and medicine.

Teaching Methodology	Chalk and talk, PPT, charts, Video
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Books for Study

1. Kumar, H. D. (1999). *Introductory Phycology*. Affiliated East-West Press.
2. Barsanti, L., & Guadtieri, P. (2014). *Algae: Anatomy, Biochemistry and Biotechnology*. (2nd Ed.). CRC Press.
3. Sharma, O. P. (2011). *Fungi and Allied Microorganisms*. McGraw-Hill.
4. Kavanagh, K. (2018). *Fungi Biology and Applications*, (3rd Ed.). Wiley Blackwell.
5. Pandey, P. B. (2014). *College Botany 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant pathology, Industrial microbiology and Bryophyta*. Chand Publishing.
6. Singh, V. P., & Jain, D. K. (2020). *A textbook of botany*, (5th Ed.). Rastogi Publications.
7. Sharma, O. P. (2014). *Bryophyta*. McGraw-Hill.

Books for Reference

1. Sundaralingam, V. (1991). *Marine Algae*. Bishen Singh and Mahendra Pal Singh Publishers.
2. Lee, R. E. (2018). *Phycology*, (5th Ed.). Cambridge University Press.
3. Nash, T. H. (2008). *Lichen Biology*. Cambridge University press.
4. Johri, R. M., Lata, S., & Tyagi, K. (2012). *A Textbook of Bryophyta*. Dominant Publishers & Distributors Pvt. Ltd.
5. Alexopoulos, C. J., & Mims, M. (2007). *Introductory mycology*, (4th Ed.). Wiley Publishers.

Websites and eLearning Sources

1. <https://www.britannica.com/science/algae>
2. <https://en.wikipedia.org/wiki/Bryophyte>
3. <https://www.britannica.com/plant/bryophyte/Ecology-and-habits>
4. <https://www.livescience.com/53618-fungus.html>
5. http://www.uobabylon.edu.iq/eprints/paper_11_20160_754.pdf
6. <https://www.youtube.com/watch?v=vcYPI6y-Udo>
7. https://www.youtube.com/watch?v=XQ_ZY57MY64
8. <http://www.plb.ucdavis.edu/courses/bis/1c/text/Chapter22nf.pdf>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	relate to the structural organizations of algae, fungi, lichens and Bryophytes.	K1
CO2	demonstrate both the theoretical and practical knowledge understanding the diversity of basic life forms and their importance.	K2
CO3	explain life cycle patterns in algae, fungi, lichens and Bryophytes.	K3
CO4	compare and contrast the mode of reproduction in diverse groups basic plant forms.	K4
CO5	discuss and develop skills for effective conservation and utilization of lower plant forms.	K5
CO6	develop entrepreneurship skill through industrially important organisms	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23PBO1CC01		Core Course - 1: Plant Diversity - 1 (Algae, Fungi, Lichens & Bryophytes)							6	6
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1CC02	Core Course - 2: Plant Diversity - 2 (Pteridophytes, Gymnosperms and Paleobotany)	6	6

Course Objectives
To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
To identify and characterize diversity of lower vascular plants in order to comprehend the dynamics of diversity to realize the importance of diversity.
To research the classification, phylogeny and economic importance of Pteridophytes and Gymnosperms.
To study and understand the phylogeny and Palaeontology of Pteridophytes and Gymnosperms.
To learn about the concept of fossils and process of fossilization; distinctive characteristics of fossil records of Pteridophytes and Gymnosperms.

UNIT I: Pteridophytes (18 Hours)

General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types - sex organs. Apogamy and Apospory. Life cycles. Stellar evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance of Pteridophytes.

UNIT II: Pteridophytes (18 Hours)

Structure, anatomy, reproduction and life histories of the following genera: *Isoetes*, *Equisetum*, *Angiopteris*, *Osmunda*, *Pteris* and *Azolla*.

UNIT III: Gymnosperms (18 Hours)

General characters - A general account of distribution of Gymnosperms. Morphology, anatomy, reproduction, phylogeny and classification (K.R.Sporne, 1965). Economic importance of Gymnosperms.

UNIT IV: Gymnosperms (18 Hours)

Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of the following genera: *Cycas*, *Pinus*, *Araucaria*, *Podocarpus*, *Gnetum* and *Ephedra*.

UNIT V: Paleobotany (18 Hours)

Geological Scale; Radiocarbon dating; Contribution of Birbal Sahni to Paleobotany. Gondwana flora of India. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils - fossil fuels and industrial raw materials and uses. Study of organ genera: *Rhynia*, *Lepidocarpon*, *Calamites*, *Cordaite* and *Lyginopteris*.

Teaching Methodology	PPT, Video, Chalk and talk, charts
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Books for Study

1. Vashishta, P. C., Sinha, A. K., & Kumar, A. (2016). *Botany for degree students - Gymnosperms*. S. Chand and Company Ltd.
2. Singh, V. P., Pande, C., & Jain, D. K. (2021). *A Textbook of Botany*. Rastogi Publications.
3. Bhatnagar, S. P. & Moitra, A. (2020). *Gymnosperms*. New Age International (P) Ltd.
4. Sharma, O. P. (2017). *Pteridophyta*. McGraw Hill Education.
5. Vashishta, P. C., Sinha, A. K., & Kumar, A. (2018). *Botany for degree students - Gymnosperms*. S. Chand and Company Ltd.
6. Johri, R. M., Lata, S. & Tyagi, K. (2005). *A Textbook of Gymnosperm*. Dominate Publishers and Distributors.

Books for Reference

1. Parihar, N. S. (2019). *An Introduction to Embryophyta: Pteridophytes*, (5th Ed.). Surjeet Publications.
2. Pandey, S. N., & Trivedi, P. S. (2015). *A textbook of botany* (Vol. 2), (12th Ed.) (Paperback). Vikas Publishing.
3. Rashid, A. (2013). *An Introduction to Pteridophyta - Diversity, Development and Differentiation*, (2nd Ed.). Vikas Publications.
4. Arnold, A. C. (2005). *An Introduction to Paleobotany*. Agrobios (India).
5. Sporne, K. R. (2017). *The Morphology of Pteridophytes (The structure of ferns and allied plants)* (Paperback). Andesite Press.
6. Sporne, K. R. (1967). *The Morphology of Gymnosperms*. Hutchinson & Co.
7. Taylor, E., Taylor, T., & Krings, M. (2008). *Paleobotany: The Biology and Evolution of Fossil Plants*, (2nd Ed.). Academic Press.

Websites and eLearning Sources

1. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
2. http://www.bsienviis.nic.in/Database/Pteridophytes-in-India_23432.aspx
3. https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false
5. https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y
7. <https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC>
8. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-anintroduction-to-gymnosperms.pdf>
9. <https://www.palaeontologyonline.com/>
10. <https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ>
11. <https://trove.nla.gov.au/work/11471742?q&versionId=46695996>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recall on classification, recent trends in phylogenetic relationship, general characters of Pteridophytes and Gymnosperms.	K1
CO2	learn the morphological/anatomical organization, life history of major types of Pteridophytes and Gymnosperms.	K2
CO3	comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.	K3
CO4	understanding the evolutionary relationship of Pteridophytes and Gymnosperms.	K4
CO5	awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.	K5
CO6	develop entrepreneurship skill through industrially important organisms.	K6

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
1	23PBO1CC02	Core Course - 2: Plant Diversity - 2 (Pteridophytes, Gymnosperms and Paleobotany)								6	6
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1CP01	Core Practical - 1: Plant Diversity 1 and 2	6	4

Course Objectives
To learn how to employ the use of instruments, technologies and methodologies related to thallophytes and non-flowering plant groups.
To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of algae, and fungi.
To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
To develop the technical abilities in staining, sectioning, sterilizing, and characterizing. Thallophytes and other varieties of non-flowering plants.
To compare the structural diversity of fossil and extant plant species.

Experiments

UNIT I: Algae

Study of algae in the field and laboratory of the genera included in theory.

External morphology and internal anatomy of the vegetative and reproductive structures of the following living forms: *Oscillatoria*, *Caulerpa*, *Ulva*, *Codium*, Diatoms, *Sargassum* and *Gracillaria* (depending on availability of the specimen).

To record the local algal flora-Study of their morphology and structure.

Identification of algae to species level (at least One).

Preparation of culture media and culture of green algae in the laboratory (Demonstration).

UNIT II: Fungi

Study of morphological and reproductive structures of the following living forms: *Plasmodiophora*, *Rhizopus*, *Pilobulus*, *Polyporus* and *Colletotrichum* (depending on availability of the specimen).

Preparation of culture media and culture of fungi in the laboratory.

Isolation and identification of fungi from soil, air, and Baiting method.

LICHENS: Study of morphological and reproductive structures of the genera *Usnea*.

UNIT III: Bryophytes

External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Marchantia*, *Porella*, *Anthoceros* and *Polytrichum* (depending on availability of the specimen).

UNIT IV: Pteridophytes

External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Isoetes*, *Equisetum*, *Angiopteris*, *Osmunda*, *Pteris* and *Azolla* (depending on availability of the specimen).

Fossil slides observation: *Rhynia*, *Lepidocarpon*, *Calamites*.

UNIT V: Gymnosperms

External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Cycas*, *Pinus*, *Araucaria*, *Podocarpus*, *Gnetum* and *Ephedra* (depending on availability of the specimen).

Fossil slides observation: *Cordaites* and *Lyginopteris*.

Teaching Methodology	Demonstration, videos, chart, PPT,
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Books for Study

1. Kumar, H. D. (1999). *Introductory Phycology*. Affiliated East-West Press.
2. Das, S., & Saha, R. (2020). *Microbiology Practical Manual*. CBS Publishers and Distributors (P) Ltd.

3. Sharma, O. P. (2012). *Pteridophyta*. Tata McGraw-Hills Ltd.
4. Sharma, O. P., & Dixit S. (2002). *Gymnosperms*. Pragati Prakashan.
5. Johri, R. M., Lata, S., & Tyagi, K. (2005). *A Textbook of Gymnosperm*. Dominate Publishers and Distributors.

Books for Reference

1. Chmielewski, J. G., & Krayesky, D. (2013). *General Botany Laboratory Manual*. Author House.
2. Webster, J., & Weber, R. (2007). *Introduction to Fungi*, (3rd Ed.). Cambridge University Press.
3. Sharma, O. P. (2017). *Bryophyta*. MacMillan India Ltd.
4. Bendre, A., & Kumar, A. (2010). *A Textbook of Practical Botany: Algae, Fungi, Lichen, Bryophyta, Pteridophyta, Gymnosperms and Palaeobotany*, (Rev. Ed.). Revised edition. Rastogi Publications.
5. Gangulee, H. C., & Kar, A. K. (2013). *College botany*, (5th Ed.). S. Chand.

Websites and eLearning Sources

1. <https://www.frontiersin.org/articles/10.3389/fmicb.2017.00923/full>
2. <https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>
3. http://www.cuteri.eu/microbiologia/manuale_microbiologia_pratica.pdf
4. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>
5. <https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883>
6. <https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover>
7. <https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recall and applying the basic keys to distinguish at species level identification of important algae and fungi through its structural organizations	K1
CO2	demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms	K2
CO3	describe the structure of algae, fungi, lichens, Bryophytes, Pteridophytes and Gymnosperms	K3
CO4	determine the importance of structural diversity in the evolution of plant forms	K4
CO5	formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant forms	K5
CO6	develop entrepreneurship skill through industrially important organisms	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23PBO1CP01		Core Practical - 1: Plant Diversity - 1 and 2							6	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1ES01	Elective - 1: Microbiology, Immunology and Plant Pathology	5	3

Course Objectives				
The goal of the course is to provide students with basic understanding of microbiology, immunology, plant pathology and the etiology of specific plant diseases.				
To provide comprehensive knowledge about microbes and its effect on man and environment.				
To provide comparative analysis of major groups of microbes.				
To study the principles of immune system, immunizing agents like antibodies and vaccines and gene therapy methods.				
To enhance the knowledge and skills needed for self-employment using the microbial derived products.				

UNIT I: Bacteria

(15 Hours)

General characteristic of bacteria - Outline classification of Bergey's manual of 9th edition. Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics. Bacterial growth - batch culture and continuous culture. Growth Curve. Factors affecting growth, Reproduction: Methods of preservation of Bacterial cultures.

UNIT II: Viruses

(15 Hours)

General characters, Classification, Structure, Multiplication. Overview of Phycoviruses and Mycoviruses. Viruses of Eukaryotes - Animal & Plant viruses. Cultivation of viruses - in embryonated egg and in plants. Control of viral infections. Bacteriophages- classification, replication of DNA and RNA phages -Lytic and Lysogenic cycle. Viroids and prions. Mycoplasma: Structure and classification.

UNIT III: Food Microbiology

(15 Hours)

Beneficial role of microbes - yoghurt, Olives, Cheese, Bread, Wine, Tempeh, Miso and Fermented green tea. Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products and dairy products. Food poisoning and Food borne infections. Methods of food preservation. Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Environmental Microbiology: Microbiology of water and air. Water borne diseases: diphtheria, chicken pox. Air borne diseases: Tuberculosis and Swine flu

UNIT IV: Immunology

(15 Hours)

Introduction; Immune System; Types of Immunity - Innate and Acquired. Immune Cells - Hematopoiesis, B and T lymphocytes - Maturation, NK cells. Introduction to inflammation, Adaptive immune system, Innate Immune system. Antigen: Definition, Properties and types. Antibody - Structure, types and function. Generation of antibody diversity. Antigen - Antibody interactions. Definition, types, Precipitation, Agglutination, Complement fixation. Immune Response - Humoral and Cell Mediated. Vaccines - history, types and recombinant vaccines. Immunodiagnosis -Blood Grouping, Widal test, Enzyme-Linked Immunosorbent Assay (ELISA), Immunoelectrophoresis and Immunodiffusion.

UNIT V: Plant Pathology

(15 Hours)

Concepts of Plant disease, history and significance of plant pathology. General symptoms and Classification of plant diseases, Pathogenesis: pathogens and their mode of dissemination, prepenetration, penetration and post penetration changes. Role of Chemical Weapons (Enzymes, Toxins) in disease development. Disease triangle. Defence mechanism in plants - structural and biochemical defences. Important diseases of crop plants in India -yellow vein Mosaic of Bhindi, Bacterial blight of rice, Late blight of potato and Little leaf of Brinjal. Principles of disease management: Cultural practices, physical, chemical and biological methods.

Teaching Methodology	Demonstration, videos, chart, PPT
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Books for Study

1. Singh, R. S. (2018). *Introduction to Principles of Plant Pathology*, (4th Ed.).
2. Bilgrami, K. S., & Dube, H. C. (2010). *A Textbook of Modern Plant Pathology*. Vikas Publishing House (P) Ltd.
3. Mehrotra, R. S., & Aggarwal, A. (2017). *Plant Pathology*. McGraw Hill Publisher.
4. Dube, H. C. (2010). *A Textbook of Fungi, Bacteria and Viruses*, (3rd Ed.). Agrobios India.
5. Rao, C. V. (2006). *Immunology*, (2nd Ed.). Narosa Publisher.
6. Murphy, K. (2017). *Janeway's Immunobiology*, (9th Ed.). Garland Publisher.
7. Sullia, S. B., & Shantharam, S. (1998). *General Microbiology*. Oxford and IBH Publishing Co. Pvt. Ltd.
8. Adams, M. R. & Moss, M.O. (2008). *Food microbiology*. Royal Soc. Chem.

Books for Reference

1. Agrios, A. G. (2007). *Plant Pathology*. Elsevier.
2. Jeffery, C., & Pommerville. (2014). *Alcamo's Fundamentals of Microbiology*, (10th Ed.). John and Bartlett Learning.
3. Pelczar, M. J. (2007). *Microbiology*, (35th Ed.). Tata-McGraw Hill Publications.
4. Ravichandra, N. G. (2013). *Fundamentals of Plant Pathology*. Phi Learning.
5. Willie, J., & Sherwood, L. (2016). *Prescott's Microbiology*, (10th Ed.). McGraw-Hill Education.
6. Chaube, H. S., & Singh, R. (2015). *Introductory Plant Pathology*. CBS Publishers.
7. Rangasamy, G. (2006). *Disease of Crop Plants in India*, (4th Ed.). Tata McGraw Hill.
8. Mishra, A. B. A., & Mishra, A. (2011). *Plant pathology-disease and management*. Agro Bios.

Websites and eLearning Sources

1. <https://www.wileyindia.com/a-textbook-of-plant-pathology.html>
2. <https://www.britannica.com/science/plant-disease>.
3. <https://www.planetatural.com/pest-problem-solver/plant-disease/>
4. <https://www.elsevier.com/books/plant-pathology/agrios/978-0-08-047378-9>
5. <https://www.elsevier.com/life-sciences/immunology-and-microbiology/books>
6. <https://www.amazon.in/introduction-immunology-rafia-imran-ebook/dp/B09B66SD3J>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recognize the general characteristics of microbes, plant defense and immune cells.	K1
CO2	explain about the stages in disease development and various defense mechanisms in plants and humans.	K2
CO3	elucidate concepts of microbial interactions with plant and humans.	K3
CO4	analyze the importance of harmful and beneficial microbes and immune system.	K4
CO5	determine and interpret the detection of pathogens and appreciate their adaptive strategies.	K5
CO6	appreciate the role of immune system in conferring disease resistance.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23PBO1ES01		Elective - 1: Microbiology, Immunology and Plant Pathology							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1ES02	Elective - 2: Herbal Technology	5	3

Course Objectives
To understand various plants-based drugs used in Ayurveda, Unani, Homeopathy and Siddha.
To apply the knowledge to cultivate medical plants.
To know the pharmacological importance of medicinal plants.
To enlist phytochemicals and secondary metabolites of market and commercial value.
To design and develop their own business propositions such as the making of herbal insecticides.

UNIT I: Herbal Medicines and Pharmacognosy (15 Hours)

Definition and importance of Herbal medicines. Pharmacognosy scope and importance - source - Crude Drugs - Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection and processing of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. National Medicinal Plants Board of India.

UNIT II: Plant Tissue Culture as Source of Plant material production for Medicines (15 Hours)

Plant tissue culture as source of medicines, Role of plant tissue culture in enhancing secondary metabolite production (*Withaniasomnifera*, *Rauwolfia93erpentine*, *Catheranthusroseus*, *Andrographispaniculata* and *Dioscoreasp*) - Elicitation - Biotransformation, Hairy root culture. Factors affecting secondary metabolites production.

UNIT III: Standardization of Plant Drug Materials and Phytochemicals (15 Hours)

Methods of Drug evaluation (Morphological, microscopic, physical and chemical). Phytochemical investigations - standardization and quality control of herbal drugs. Preliminary screening, Assay of Drugs - Biological evaluation/assays, Microbiological methods - Chemical Methods of Analysis, Detection of Adulterants: Chemical estimations, Spectrophotometry and fluorescence analysis. Drug adulteration - Types of adulterants.

UNIT IV: Analysis of Phytochemicals and Biological Screening (15 Hours)

Carbohydrates and derived products: Glycosides - extraction methods (*Digitalis*, *Dioscorea*); Tannins (Hydrolysable and Condensed types); Volatile oils - extraction methods (Clove, Mentha). Study of some herbal formulation techniques as drug cosmetics.

UNIT V: Types of Phytochemicals (15 Hours)

Alkaloids - extraction methods (*Taxus*, *Cinchona*); Flavonoids- extraction methods, Resins- extraction method: Application of phytochemicals in phytopharmaceuticals; Biocides, Biofungicides, Biopesticides. Women entrepreneurship development - marketing cultivated medicinal plants.

Teaching Methodology	PPT, chalk and talk, herbal preparations and practical demonstration.
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Books for Study

1. Kokate, C. K., Purohit, A. P., & Gokhale, S.B. (1996). *Pharmacognosy*, (4th Ed.). Nirali Prakashan.
2. Roseline, A. (2011). *Pharmacognosy*. MJP publishers.
3. Tilgner, S. M. (2018). *Herbal ABC's: The Foundation of Herbal Medicine*. Wise Acres LLC.
4. Hornok, L. (1997). *Natural Products in Medicine: A Biosynthetic Approach*. Wiley.
5. Chichister, U. K. J. (1999). *Cultivation and Processing of Medicinal Plants*. Wiley & Sons. Trease and Evans.
6. Mukherjee, P. K. (2008). *Quality Control of Herbal Drugs*, (3rd Ed.). Business Horizons Pharmaceutical Publishers.
7. Kirtikar, K. R., & Basu, B. D. (2012). *Indian Medicinal Plants*. University Bookstore.
8. Biswas, P. K. (2006). *Encyclopedia of Medicinal Plants*. (Vol. 1-7). Dominant Publishers.
9. Chaudhuri, A. B. (2007). *Endangered Medicinal Plants*. Daya Publishing House.

Books for Reference

1. Wallis, T. E. (1999). *Textbook of Pharmacognosy*. CBS Publishers and Distributors,
2. Kumaresan, V., & Regland, A. (2004). *Taxonomy of Angiosperms: Systematic botany, Economic botany, Botany & Ethnobotany*.
3. Anonymous. (2004). *Cultivation of Selected Medicinal Plants*. National Medicinal Plants Board, Govt. of India.
4. Rao, A. V. (2000). *Herbal Cure for Common Diseases*. Diamond books Pvt. Ltd.
5. Dey, A. C. (1998). *Indian Medicinal Plants used in Ayurvedic Preparations*. Bishen Singh Mahendra Pal Singh.
6. Sathya, S., Jaiganesh, K. P., & Sudha, T. (2019). *Current Trends in Herbal Drug Technology*. Pharmacy Council of India.
7. Lewis, W. H., & Elwin-Lewis, M. P. F. (1976). *Medical Botany: Plants Affecting man's Health*. Wiley Inter Science Publication. John Wiley and Sons.

Websites and eLearning Sources

1. <https://www.kopykitab.com/Herbal-Science>
2. [https://kadampa.org/books/free-ebook-download-howtotyl?](https://kadampa.org/books/free-ebook-download-howtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurCIUCTdV9olKo9TbyAh4fsoFqPYWG55qBTbytD22z7lo0BoCYnUQAyD_BwE)
3. [gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurCIUCTdV9olKo9TbyAh4fsoFqPYWG55qBTbytD22z7lo0BoCYnUQAyD_BwE](https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-naturalhealing/herbal-medicine/_/N-ry0Z8qaZ11iu)
4. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-naturalhealing/herbal-medicine/_/N-ry0Z8qaZ11iu
5. [http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?](http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404)
6. [t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404](http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404)
7. <https://www.dattanibookagency.com/books-herbs-science.html>
8. <https://www.springer.com/gp/book/9783540791157>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recollect the importance of herbal technology.	K1
CO2	understand the classification of crude drugs from various botanical sources.	K2
CO3	analyze on the application of secondary metabolites in modern medicine.	K3
CO4	create new drug formulations using therapeutically valuable phytochemical compounds for the healthy life of society.	K4
CO5	comprehend the current trade status and role of medicinal plants in socio economic growth.	K5
CO6	develop entrepreneurship skill through learning preparation processes of herbal drugs and phytoconstituents.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23PBO1ES02		Elective - 2: Herbal Technology							5	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	23PBO1AE01	Ability Enhancement Course: Nursery and Gardening	2	1

Course Objectives				
To recognize the importance of nursery and gardening.				
To gain an understanding of nursery management.				
To develop skills necessary to manage a wholesale nursery.				
To acquire knowledge regarding theory and practice of rising plants.				
To develop an interest to become an entrepreneur.				

UNIT I: Nursery (6 Hours)

Definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting: direct seeding and transplants.

UNIT II: Seed (6 Hours)

Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

UNIT III: Vegetative Propagation (6 Hours)

Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glasshouse.

UNIT IV: Gardening (6 Hours)

Definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping.

UNIT V: Gardening Operations (6 Hours)

Soil laying, manuring, watering, management of pests and diseases and harvesting. Sowing/ raising of seeds and seedlings: Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomato and carrot - Storage and marketing procedures.

Teaching Methodology	PPT, videos and practical demonstration.
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Books for Study

1. Bose, T. K., & Mukherjee, D. (1972). *Gardening in India*. Oxford & IBH Publishing Co.
2. Sandhu, M. K. (1989). *Plant Propagation*. Wile Eastern Ltd.
3. Kumar, N. (1997). *Introduction to Horticulture*. Rajalakshmi Publications.
4. Agrawal, P. K. (1993). *Handbook of Seed Technology*. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.

Books for Reference

1. Prasad, S., & Kumar, U. (2005). *Greenhouse Management for Horticultural Crops*, (2nd Ed.). Agrobios.
2. Acquaah, G. (2002). *Horticulture: Principles and Practices*. Prentice Hall of India Pvt. Ltd.
3. Abraham, A., & Vatsala, P. (1981). *Introduction to Orchids*. Tropical Botanic Garden and Research Institute.
4. Hartman, H. T., & Kester, D. E. (1989). *Plant Propagation*. Prentice Hall Ltd.

Websites and eLearning Sources

1. <https://www.kopykitab.com/Nursery-And-Gardening-SEC-by-Prof-C-D-Patil-Dr-G-MRane-Dr-S-A-Patil>
2. <https://www.wonderslate.com/nursery-and-gardening-management/ebook-details?siteName=books&bookId=38078&preview=true>
3. https://books.google.co.in/books/about/Nursery_Hindi_Book_Bonsai_Plants_Nursery.html?id

=nfDDwAAQBAJ&redir_esc=y

4. <https://www.amazon.in/Gardening-Books/b?ie=UTF8&node=1318122031>

5. <https://www.worldcat.org/title/handbook-of-horticulture/oclc/688653648>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	compare and contrast cultivation of different vegetables and growth of plants in nursery and gardening.	K4
CO2	develop new strategies to enhance growth and quality of nursery plants.	K5
CO3	develop necessary skill in different propagation techniques in gardening	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	23PBO1AE01		Ability Enhancement Course: Nursery and Gardening							2	1
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	2	3	3	2	3	2	2.6
CO2	2	2	3	2	1	3	2	3	2	1	2.1
CO3	2	1	2	2	1	2	3	2	3	2	2.0
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CC03	Core Course - 3: Plant Physiology	6	6

Course Objectives
Develop an advanced understanding of plant physiological processes, including photosynthesis, respiration, and nutrient regulation at multiple levels.
Gain research expertise in plant physiology, encompassing experimental design, data analysis, and modern research tools.
Apply plant physiology knowledge to address practical challenges in agriculture, environment, and biotechnology through critical thinking.
Enhance communication skills for effectively conveying scientific ideas in both written and oral formats to diverse audiences.
Promote ethical research practices in plant physiology with a focus on sustainability and environmental responsibility.

UNIT I (18 Hours)

Water and Plant cells: Diffusion and osmosis, water potential. Water balance of plants: absorption by roots, transport through the xylem, transpiration. Mineral nutrition: essential nutrients, deficiencies, plant disorders. Solute transport: passive and active transport, molecular basis of inter and intracellular uptake and transport. Pattern, pathway and mechanism of translocation in the phloem.

UNIT II (18 Hours)

Photosynthesis: The light reactions-nature of light, properties and various roles of pigments, organisation of photosynthetic apparatus and light absorbing antenna systems, molecular basis of electron transport and its coupling to ATP synthesis. The carbon reactions- The Calvin-Benson cycle, photorespiration, inorganic carbon concentrating mechanisms (The C4 carbon cycle, Crassulacean Acid Metabolism), and carbon allocation (starch and sucrose).

UNIT III (18 Hours)

Respiration: Glycolysis, gluconeogenesis and their regulation. Oxidation of pyruvate and the Citric Acid cycle. Pasteur effect, anaplerotic reactions, amphibolic nature of the Citric Acid cycle. Oxidative pentose phosphate pathway and its roles. Respiratory chain complexes and oxidative phosphorylation, internal and external NAD(P) H dehydrogenase, alternative oxidase. Nonphosphorylating mechanisms and their roles. Bottom-upregulation of plant respiration. The Glyoxylate cycle.

UNIT IV (18 Hours)

Nitrogen in the environment; assimilation of nitrate and ammonium-GS- GOGAT; biological nitrogen fixation. Plant responses to light signals: the phytochromes and the blue-light responses (cryptochromes, phototropins and zeaxanthin). Biosynthesis, metabolism, transport, physiological and developmental effects of auxin, gibberellin, cytokinin, ethylene and abscisic acid.

UNIT V (18 Hours)

Flowering and fruit development: Floral evocation, Circadian rhythm, photoperiodism, vernalisation. Physiology of fruit development and ripening. Physiology of seed development, maturation, dormancy, germination and tropisms. Ageing and senescence-types and physiological/ biochemical changes. Abiotic stress (drought, heat and salinity): Plant responses and mechanisms of tolerance.

Teaching Methodology	Lecture, technologies, and group learning
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Books for Study

1. William, G.H., & Norman, P.A. (2009). *Introduction to Plant Physiology* (4th Ed.). John Wiley & Sons.
2. Taiz, L., Zeiger, E., Moller, I. M., & Murphy, A. (2015). *Plant Physiology*. (6th Ed.). Sinauer Associates.

Books for Reference

1. Noggle, G.R., & Fritz, G.J. (2001). *Introductory Plant Physiology*. Prentice-Hall.
2. Devlin, R. M. (2000). *Plant Physiology*. Affiliated East West Press Pvt. Ltd.
3. Epstein, E. (2000). *Mineral Nutrition in Plants - Principles and Perspectives*, Wiley.
4. Salisbury, F. B., & Ross, C. W. (1992). *Plant Physiology* (4th Ed.). Wadsworth Publishing CO.

Websites and eLearning Sources

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5593313/>
2. <https://www.nobelprize.org/prizes/chemistry/1997/boyer/25946-the-binding-change-mechanism/>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3645666/>
4. <https://www.frontiersin.org/articles/10.3389/fpls.2018.01771>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K- Level)
	On successful completion of this course, the students will be able to	
CO1	recall and describe fundamental principles of plant physiology, such as photosynthesis, respiration, and nutrient uptake, demonstrating basic knowledge retention.	K1
CO2	explain the intricate molecular and cellular mechanisms underlying key physiological processes in plants, showcasing a deeper understanding of plant physiology concepts.	K2
CO3	apply advanced knowledge of plant physiology to design and conduct experiments, demonstrating the ability to integrate theoretical concepts into practical research.	K3
CO4	analyze and interpret complex data sets related to plant physiological experiments, showcasing proficiency in data analysis and critical thinking skills.	K4
CO5	communicate scientific findings effectively through well-structured written reports and articulate presentations, demonstrating advanced communication skills tailored to diverse audiences.	K5
CO6	evaluate ethical considerations in plant physiology research, demonstrating an understanding of the importance of responsible conduct and sustainable practices in the field.	K6

Relationship Matrix												
Semester	Course Code		Title of the Course								Hours	Credits
2	23PBO2CC03		Core Course - 3: Plant Physiology								6	6
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	3	2	2	3	3	3	2	3	2.7	
CO2	3	3	3	2	2	3	3	3	2	2	2.6	
CO3	3	3	3	3	3	3	3	3	2	3	2.9	
CO4	3	3	3	2	2	3	3	3	2	2	2.6	
CO5	3	3	3	3	3	3	3	3	3	3	3	
CO6	3	3	3	2	2	3	3	3	2	2	2.6	
Mean Overall Score											2.73 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CC04	Core Course - 4: Plant Anatomy, Embryology and Morphogenesis	5	5

Course Objectives				
To understand the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.				
To attain basic knowledge of the structure and development of male and female gametophytes in plants				
To know the process of development in microsporogenesis and megasporogenesis.				
To know fertilization, post fertilization changes and developmental process in embryology.				
To understand the mechanisms underlying the developmental flexibility of plants.				

UNIT I (15 Hours)

General account on theories of organization of shoot and root apical meristem, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem, Cambium - origin, cellular structure, cell division, storied and non-storied types. Role of cambium in budding, grafting and in wound healing. Trichomes, periderm and lenticels.

UNIT II (15 Hours)

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem (Dicot and Monocot), Origin of lateral roots, Root stem transition, Anatomy of Dicot and Monocot leaf. Leaf abscission, stomata types, nodal anatomy, petiole anatomy, vascularization of flower and seedling.

UNIT III (15 Hours)

Microsporangium - Microsporogenesis, Microspores - morphology, ultrastructure, Microgametogenesis, Pollen - Stigma - Incompatibility, Methods to overcome incompatibility. Megasporangium - Megagametogenesis, Female gametophyte - Monosporic, Bisporic and Tetrasporic, Nutrition of embryo sac and fertilization.

UNIT IV (15 Hours)

Endosperm - Types, haustoria, Cytology and physiology and functions of endosperms, Embryo development - Dicot and Monocot, Nutrition of embryo. Polyembryony - Causes. Apomixis - Causes. Apospory - their role in plant improvement programs and seed development.

UNIT V (15 Hours)

Morphogenesis- Definition, morphogenesis and its relation to morphology, Turing's diffusionreaction theory, Morphogenetic factors - growth regulators, genetic and environment, polarity. Molecular basis of morphogenesis, Cellular level morphogenesis, Asymmetric divisions and their significance, Morphogenesis at tissue level - Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vitro* and *in vivo* and in wounds. Plant galls and their importance in morphogenesis.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

1. Fahn, A. (1989). *Plant Anatomy*. Maxwell Pvt. Ltd.
2. Bhojwani, S.S., & Bhatnagar, S.P. (1981). *Embryology of Angiosperms*. Vikas Publishing House Pvt. Ltd.

Books for Reference

1. Bard, J. (1990). *Morphogenesis*. Cambridge University Press.
2. Agarwal, S. B. (1990). *Embryology of Angiosperms - a fundamental approach*. Sahitya Bhawan.

- Pandey, B. P. (1989). *Plant Anatomy*. S. Chand & Co. Ltd.

Websites and eLearning Sources

- <https://academic.oup.com/book/53725/chapter-abstract/422168601?redirectedFrom=fulltext>
- <https://www.jove.com/science-education/11094/plant-morphogenesis-growth-differentiation-and-communication>
- http://www.uprtou.ac.in/other_pdf/12_01_2023_DCBY_105.pdf

CO No.	Course Outcomes	Cognitive Levels (K- Level)
	CO-Statements	
	On successful completion of this course, the students will be able to	
CO1	acquire knowledge about the tissues of stem, root and leaves in plants.	K1
CO2	describe the primary and secondary structure of dicots and monocots with reference to root, stem and leaves.	K2
CO3	attain basic knowledge of the structure and development of male and female gametophytes in plants.	K3
CO4	compare and determine the structure and development of dicot and monocot embryos.	K4
CO5	integrate the morphogenesis, endosperm development and polyembryony.	K5
CO6	gain knowledge about morphogenesis at cellular level.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
2	23PBO2CC04		Core Course - 4: Plant Anatomy, Embryology and Morphogenesis							5	5
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	2	2	2.3
CO2	2	3	2	2	1	2	3	2	2	2	2.1
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	1	1	2	1	2	1	2	2.1
CO5	2	3	2	2	3	2	3	2	2	3	2.6
CO6	2	1	2	3	2	2	3	2	1	2	2.0
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CP02	Core Practical - 2: Plant Physiology	3	2

Experiments

1. Determination of water potential (Shardakov's method).
2. Determination of solute potential.
3. Hills reaction.
4. Estimation of total acidity in CAM plants.
5. Apparent photosynthesis.
6. Effect of CO₂ concentration on photosynthesis
7. Effect of quality of light on photosynthesis
8. Estimation of total free aminoacids and proline.
9. *In vivo* assay of NR and NiR.
10. Estimation of IAA.
11. Estimation of starch by perchloric method.
12. Estimation of nitrogen (Nessler's method).
13. Determination of activity of peroxidase and lipase

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2CP03	Core Practical - 3: Plant Anatomy, Embryology and Morphogenesis	3	2

Plant Anatomy and Embryology

- Study of stem and root anatomy in dicot and monocot.
- Study of leaf anatomy - structure, types of stomata, Trichomes.
- Study the anomalous secondary features in *Boerhaavia* and *Bignonia*.
- Micrometry of xylem elements.
- study of pollen morphotypes (Malvaceae and Asteraceae)
- Isolation of different stages of embryo and polyembryony in citrus, Jamun (*Syzygium cumini*)
- Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop technique.

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2SP01	Self-paced Learning: Plant Breeding and Evolution	-	2

Course Objectives				
To outline the progress made in the field of plant breeding.				
To comprehend the principles, techniques, modes of reproduction in crops and applications of plant breeding.				
To demonstrate the theories of evolution.				
To analyse the hybridization techniques.				
To test the knowledge on heterosis, mutation and polyploidy.				

UNIT I

Plant Breeding: Historical aspect of plant breeding and genetic basis. Breeding methods: sexual, asexual and apomitic reproduction. Floral Biology in relation to selfing and crossing techniques. Centres of diversity and origin of cultivated plants. Role of National and International Institutes.

UNIT II

Hybridization: Objectives, choice of parents, problems and causes of failure of hybridization. Incompatibility and sterility, Methods of handling genetic consequence of hybridization, method of handling segregation material for isolation of superior strains - Bulk method and pedigree method of selection. Role of interspecific and intergeneric hybridization in plant improvement.

UNIT III

Inbreeding depression and heterosis: Genetic basis and application in plant breeding. Steps in the production of single cross, double cross, three-way cross; induced polyploidy in plant breeding; role of auto- and allopolyploidy, Heteroploid, Mutation and crop improvement. Population genetics: Hardy-Weinberg principle; gene frequencies and the factors that change it.

UNIT IV

Back Crossing: Theory and procedure for transferring various types of character. Preservation and utilization of germplasm. Breeding of rice, sugarcane, groundnut and maize. Application of biotechnology to plant breeding - embryo rescue, somaclonal variation, doubled haploid, protoplast fusion and transgenic.

UNIT V

Evolution: Origin of life, theories of evolution of life forms: Lamarckism, Darwinism and Speciation. Variations - Definition, causes and types, Mutations (Principles of Hugo de Vries), Role of mutations in speciation. Evidences for evolution, adaptive radiation, biological evolution. Impact of evolution on human life.

Teaching Methodology	JOSTEL, Course material
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Books for Study

1. Chaudhari, R. C. (2017). *Introductory Principles of Plant Breeding*. Kindle Edition.
2. Singh, P. (2017). *Fundamentals of Plant Breeding*. Kalyani Publishers,
3. Manokaran, K. V. (2010). *Essentials of Plant Breeding*. PHI Learning Private Limited Publishers.

Books for Reference

1. Brown, P.C., & Campos, H. (2014). *Introduction to Plant Breeding*. (2nd Ed.). Wiley Blackwell Publishers.
2. Izak, B., & Caligari, P. (2007). *Selection Methods in Plant Breeding*. Springer.

Websites and eLearning Sources

1. https://link.springer.com/chapter/10.1007/978-981-19-5434-4_1
2. <https://www.seedworld.com/the-evolution-of-plant-breeding/>
3. <https://evolution.berkeley.edu/evolution-101/an-introduction-to-evolution/>

CO No.	Course Outcomes	Cognitive Levels (K - Level)
	CO-Statements	
	On successful completion of this course, the students will be able to	
CO1	acquire knowledge on floral biology and selection of proper breeding method	K1
CO2	critically analyze information about life and its origins	K2
CO3	cultivate skill in emasculation and pollination of various crop plants	K3
CO4	gain expertise on hybrid seed production techniques	K4
CO5	learn to use the descriptors in various crops for selection of superior genotypes	K6
CO6	able to understand the importance of evolution in plant breeding.	K5

Relationship Matrix												
Semester	Course Code		Title of the Course								Hours	Credits
2	23PBO2SP01		Self-paced Learning: Plant Breeding and Evolution								-	2
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	2	2	2	2	3	3	1	2	2.3	
CO2	2	3	2	2	3	2	3	2	3	1	2.3	
CO3	2	3	2	3	1	2	3	3	2	3	2.4	
CO4	1	3	2	3	2	2	3	2	3	2	2.3	
CO5	2	2	2	3	2	2	3	2	3	3	2.4	
CO6	3	1	2	3	2	3	2	2	3	2	2.3	
Mean Overall Score											2.4 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2ES03A	Elective - 3: Biophysics and Instrumentation	5	4

Course Objectives				
To acquire knowledge on various types of centrifugation, spectroscopy and tracer techniques.				
To relate the importance of biophysics in modern biology.				
To apply the laws of thermodynamics in biology.				
To evaluate and illustrate the concept of redox potential in biological system.				
To integrate various types of microscopy and their applications.				

UNIT I (15 Hours)

Introduction to biophysics, its importance in modern biology. Bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, standard free energy change of a chemical reaction, ATP and high energy phosphate compounds.

UNIT II (15 Hours)

Biophotonics: Redox potential, Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system. Osmosis and osmotic pressure, the role of osmosis in cell volume regulation. The iso, hypo, and hypertonic solutions, their influence on the cell. Ionic diffusion. Active and passive bioelectric properties of membranes.

UNIT III (15 Hours)

Microscopy: Bright field microscopy-magnification, resolving power and contrast. Dark field microscopy, phase-contrast microscopy, fluorescent microscopy, electron microscopy (SEM and TEM). Electrophoresis: AGE, PAGE, SDS-PAGE.

UNIT IV (15 Hours)

Centrifugation: Principle, procedure and application. Types of centrifugation - density gradient centrifugation, ultracentrifugation and differential centrifugation. Chromatography: Principles, instrumentation, and applications of Paper, thin layer, column chromatography, gas chromatography, HPTLC and GC-MS.

UNIT V (15 Hours)

Spectrophotometry: principles and instrumentation of UV/Vis, Atomic absorption spectrophotometer (AAS), NMR, ESR. Tracer techniques: Important stable radioisotopes and their uses in research. Radiation hazards and precautions in handling radioisotopes. Measurement of radioactivity- autoradiography, GM counter and scintillation counter.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

1. Banerjee, P.K. (2008). *Introduction to Biophysics*. S. Chand.
2. McMahon, G. (2007). *Analytical Instrumentation: A Guide to Laboratory, Portable and Miniaturized Instruments*. John Wiley & Sons, Ltd. ISBN: 9780470027950.

Books for Reference

1. Roy, R.N. *A text book of Biophysics*. New Central Book Agency Pvt. Ltd.
2. Upadhyay, Upadhyay & Nath. *Biophysical Chemistry*. Himalaya Publ. House.
3. Mohan Arora. *Biophysics*. Himalaya Publishing House.

Websites and eLearning Sources

1. <https://microbenotes.com/microscope/>
2. <https://microbenotes.com/centrifugation-principle-types-and-applications/>
3. <https://www.nrc.gov/about-nrc/radiation/health-effects/measuring-radiation.html>

CO No.	Course Outcomes	Cognitive Levels (K - Level)
	CO-Statements	
	On successful completion of this course, the students will be able to	
CO1	know the kinds of energy and differentiate entropy and enthalpy.	K1
CO2	value the importance of cell wall and the manipulation of cell wall.	K2
CO3	understand the basic principles and applications of microscope.	K3
CO4	apply the principles of centrifugation in biology.	K4
CO5	value the importance of radioisotopes in biology.	K5
CO6	integrate various types of chromatographic and spectroscopic techniques.	K6

Relationship Matrix												
Semester	Course Code		Title of the Course								Hours	Credits
2	23PBO2ES03A		Elective - 3: Biophysics and Instrumentation								5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	3	3	2	1	2	2	3	2	1	2	2.1	
CO2	2	3	2	2	3	2	3	2	2	1	2.2	
CO3	2	2	3	2	1	2	2	3	2	2	2.1	
CO4	1	2	2	3	2	1	3	2	3	2	2.1	
CO5	1	2	2	3	2	2	3	2	2	3	2.2	
CO6	2	2	2	2	1	2	1	2	3	3	2.0	
Mean Overall Score											2.1 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PBO2ES03B	Elective - 3: Plant Pathology	5	4

Course Objectives				
To acquire knowledge on pathogenesis and disease establishment in plants				
To learn the process of mode of dissemination and disease development				
To recognize the effect of Microbe infection on host physiology				
To comprehend the various different types of disease control mechanism				
To familiarize the concepts in plant immunity and various defence mechanism in plants				

UNIT I (15 Hours)

Concept of plant disease - definitions of disease, disease cycle and pathogenicity. General symptoms and Classification of plant diseases. History of Plant Pathology with special references to Indian work.

UNIT II (15 Hours)

Pathogenesis- pathogens and their mode of dissemination, pre-penetration, penetration and post penetration changes. Role of Chemical Weapons (Enzymes, Toxins and Growth regulators) in disease development.

UNIT III (15 Hours)

Effect of infection on physiology of host viz. photosynthesis, respiration, carbohydrate metabolism, nitrogen metabolism, phenols, shikimic acid pathway, importance of phenol oxidation in plant diseases.

UNIT IV (15 Hours)

Plant diseases: causal organisms, symptoms, disease cycle and control measures for the following diseases: White rust of Crucifers, Bacterial blight of paddy, Yellow vein Mosaic of Bhindi, covered smut of Barley, Spike disease in Sandal. Integrated Disease Management (IDM) -Plant diseases control: Cultural, physical, chemical and biological methods.

UNIT V (15 Hours)

General concepts on plant immunity: morphological, structural defence mechanisms and biochemical defence mechanisms, pre-existing defence mechanisms. Phytoalexins, defence through induced synthesis of proteins and enzymes. Molecular Basis of Defence Mechanism: Signal Transduction, Recognition of the pathogen by the host, transmission of the alarm signal to the host defence providers.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

1. Singh, R.S. (2018). *Introduction to Principles of Plant Pathology*, (4th Ed.). Scientific International.
2. Mehrotra, R.S., & Aggarwal, A. (2017). *Plant Pathology*. McGraw Hill Publisher Co. Ltd.

Books for Reference

1. Sharma, P.D. (2001). *Microbiology and plant pathology*. Rastogi publications.
2. Rangasamy, G. (1998). *Diseases of crop plants in India*. Prentice- Hall of India.
3. Mukherjee, K.G., & Jayanti, B. (1986). *Plant diseases of India*. Tata MacGraw-Hill.
4. Harsfall, J.G., & Cowling, E.B. (1979). *Plant Disease, an Advanced Treatise*. Academic Press.

Websites and eLearning Sources

1. http://www.jnkvv.org/PDF/11042020102651plant_pathology.pdf
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3218475/#:~:text=Two%20layers%20of%20plant%20immune,perception%20of%20microbe%20general%20elicitors.>

CO No.	Course Outcomes	Cognitive Levels (K- Level)
	CO-Statements	
	On successful completion of this course, the students will be able to	
CO1	acquaint with the structure, vector relationship, biology and management of plant-pathogen interaction.	K1
CO2	introduce the subject of Plant Pathology, its concepts and principles.	K2
CO3	recognize the effect of Microbe infection on host physiology	K3
CO4	learn the various methods/techniques/instruments used in the study of plant diseases/pathogens.	K4
CO5	educate about the nature, prevalence, etiology, factors affecting disease development and control measures of crop diseases.	K5
CO6	gain knowledge the molecular interaction of defence mechanism.	K6

Relationship Matrix												
Semester	Course Code					Title of the Course					Hours	Credits
2	23PBO2ES03B					Elective - 3: Plant Pathology					5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	2	2	2	2	2	3	3	3	2	2	2.3	
CO2	2	3	2	2	2	3	2	2	2	3	2.3	
CO3	2	2	2	2	2	3	3	2	2	2	2.5	
CO4	2	2	2	2	2	3	3	3	2	2	2.2	
CO5	2	2	3	2	2	2	3	3	2	2	2.3	
CO6	2	3	2	2	2	3	2	2	2	3	2.3	
Mean Overall Score											2.3 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	23PSS2SE01	Skill Enhancement Course: Soft Skills	4	3

Course Objectives
To provide a focused training on soft skills for students in colleges for better job prospects
To communicate effectively and professionally
To help the students take active part in group dynamics
To familiarize students with numeracy skills for quick problem solving
To make the students appraise themselves and assess others

UNIT I: Effective Communication & Professional Communication (12 Hours)

Definition of communication, Barriers of Communication, Non-verbal Communication; Effective Communication - Conversation Techniques, Good manners and Etiquettes; Speech Preparations & Presentations; Professional Communication.

UNIT II: Resume Writing & Interview Skills (12 Hours)

Resume Writing: What is a résumé? Types of résumés, - Chronological, Functional and Mixed Resume, Purpose and Structure of a Resume, Model Resume.

Interview Skills: Types of Interviews, Preparation for an interview, Attire, Body Language, Common interview questions, Mock interviews & Practicum

UNIT III: Group Discussion & Personal effectiveness (12 Hours)

Basics of Group Discussion, Parameters of GD, Topics for Practice, Mock GD & Practicum & Team Building.

Personal Effectiveness: Self Discovery; Goal Setting with questionnaires & Exercises

UNIT IV: Numerical Ability (12 Hours)

Introducing concepts Average, Percentage; Profit and Loss, Simple Interest, Compound Interest; Time and Work, Pipes and Cisterns.

UNIT V: Test of Reasoning (12 Hours)

Introducing Verbal Reasoning: Series Completion, Analogy; Data Sufficiency, Assertion and Reasoning; and Logical Deduction. Non-Verbal Reasoning: Series; and Classification

Teaching Methodology	Chalk and talk, Lectures, Demonstrations, PPT.
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Book for Study

1. Melchias G., Balaiah, J. & Joy, J. L. (Eds). (2018). *Winner in the Making: A Primer on soft Skills*. Trichy, India: St. Joseph's College.

Books for Reference

1. Aggarwal, R. S. (2010). *A Modern Approach to Verbal and Non-Verbal Reasoning*. S. Chand.
2. Covey, S. (2004). *7 Habits of Highly effective people*. Free Press.
3. Gerard, E. (1994). *The Skilled Helper* (5th Ed.). Brooks/Cole.
4. Khera, S. (2003). *You Can Win*. Macmillan Books.
5. Murphy, R. (1998). *Essential English Grammar*, (2nd Ed.). Cambridge University Press.
6. Sankaran, K., & Kumar, M. (2010). *Group Discussion and Public Speaking* (5th Ed.). M.I. Publications.
7. Trishna, K. S. (2012). *How to do well in GDs & Interviews?* (3rd Ed.). Pearson Education.
8. Yate, M. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting*

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	recall various soft skill sets	K1
CO2	understand personal effectiveness in any managerial positions	K2
CO3	apply verbal and non-verbal reasoning skills to solve problems	K3
CO4	differentiate problems at work and home; and design solutions to maintain work-life balance	K4
CO5	assess growth and sustainability and infuse creativity in employment that increases professional productivity	K5
CO6	construct plans and strategies to work for better human society	K6

Relationship Matrix											
Semester	Course Code			Title of the Course					Hours	Credits	
2	23PSS2SE01			Skill Enhancement Course: Soft Skills					4	3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	3	2	3	2.7
CO2	3	3	3	2	3	3	3	3	3	3	2.9
CO3	3	2	2	3	3	3	3	3	3	3	2.8
CO4	3	3	2	2	3	3	3	3	3	3	2.8
CO5	3	3	3	2	2	3	3	3	3	3	2.8
CO6	3	3	3	2	2	3	3	3	3	3	2.8
Mean Overall Score											2.8 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23PBO3CC05	Core Course - 5: Plant Systematics	5	5

Course Objectives
Understand plant diversity, classification, nomenclature, and evolutionary relationships through in-depth plant systematics study.
Proficiently use modern tools for plant identification, taxonomy, and phylogenetic analysis to contribute to plant systematics.
Critically analyze and synthesize scientific literature on plant systematics, applying knowledge to evolutionary biology and botanical classification.
Develop practical skills in fieldwork, herbarium techniques, and specimen curation for collecting and preserving plant specimens.
Conduct independent research projects applying systematic principles to address real-world challenges in biodiversity conservation, ecosystem management, and plant breeding.

UNIT I (15 Hours)

Overview of Plant Systematics - Phenetics (artificial, natural classification) and Cladistics (Phylogenetic systematics): terms and concepts, taxon selection, character analysis, cladogram construction, cladogram analysis - Angiosperm Phylogeny Group classification: principles of APG system, short version of APG I, APG II and APG III, detailed version of APG IV.

UNIT II (15 Hours)

Taxonomic hierarchy: principal ranks - species concept and infraspecific categories (subspecies, varieties and forms) - genus concept and infrageneric categories (subgenus, section and series) - family concept and infrafamily categories (subfamily, tribe and subtribe).

UNIT III (15 Hours)

Botanical nomenclature: ICN principles; scientific names; authorship; nomenclatural types; valid publication; priority of publication; conservation of names; retention and rejection; taxonomic revision; synonyms; names of hybrids and cultivated plants.

UNIT IV (15 Hours)

Plant identification: field inventory; herbarium techniques, Flora (e-flora), monographs; journals; taxonomic key. Systematic evidence: morphology; anatomy; palynology; embryology; cytology; phytochemistry.

UNIT V (15 Hours)

Molecular systematics: Plant genomes- nuclear, chloroplast and mitochondria. Molecular markers, generating molecular data, restriction site mapping, gene sequencing, analysis of molecular data, alignment of sequences, methods of phylogeny reconstruction.

Teaching Methodology	PPT, videos and practical demonstration.
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Books for Study

1. Michael, G., & Simpson. (2019). *Plant Systematics*, (3rd Ed.). Academic Press.
2. Crawford, D. J. (2003). *Plant Molecular Systematics*. Cambridge University Press.
3. Heywood, V. K., & Moore, D. M. (1984). *Current Concepts in Plant Taxonomy*. Academic Press.

Books for Reference

1. Grant, W. F. (1984). *Plant Biosystematics*. Academic Press Inc.
2. Harborne, J. B., & Turner, B. L. (1984). *Plant Chemosystematics*. Academic Press.
3. Hillis, D. M., Moritz, C., & Mable, B. K. (1996). *Molecular Systematics*. Sinauer Associates.

Websites and eLearning Sources

1. <https://www.kew.org/read-and-watch/apg-classification-consensus>
2. <https://unacademy.com/content/neet-ug/study-material/biology/what-is-the-taxonomic->

hierarchy/

3. <https://www.iapt-taxon.org/nomen/main.php>

4. <https://biomed.brown.edu/Courses/BIO48/26.Systematics.HTML>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recognize fundamental plant systematics principles and key terms.	K1
CO2	explain plant taxa evolutionary relationships with depth in systematics principles and methods.	K2
CO3	apply plant systematics knowledge to analyze literature critically and draw conclusions effectively.	K3
CO4	demonstrate proficiency in practical plant systematics skills, including fieldwork and specimen curation.	K4
CO5	execute independent plant systematics research, showcasing advanced problem-solving abilities	K5
CO6	evaluate ethical considerations in plant systematics, emphasizing responsible research practices.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours	Credits	
3	23PBO3CC05		Core Course - 5: Plant Systematics						5	5	
Course Outcomes	Programme Outcomes (POs)				Programme Specific Outcomes (PSOs)						Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	2	3	3	3	2	2	2.5
CO2	3	3	3	2	3	3	3	3	3	3	2.9
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	3	3	2	2	3	3	3	3	3	2.8
CO6	3	3	3	2	3	3	3	3	3	3	2.9
Mean Overall Score										2.83 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23PBO3CP04	Core Practical - 4: Plant Systematics	4	4

1. Exercise in key making.
2. Binomial identification using Flora.
3. Study and submission of digital description of the following families with reference to their South Indian representatives and minimum of one member each to be described, dissected and sketched to scale (classification based on APG IV, 2016):

BASAL ANGIOSPERM: Nymphaeales -Nymphaeaceae

MONOCOTS: Alismatales - Araceae, **Commelinales**-Commelinaceae, **Poales** - Cyperaceae

EUDICOTS: Ranunculales - Menispermaceae

ROSIDS: Malpighiales - Passifloraceae, **Sapindales** - Meliaceae, **Brassicales** - Cleomaceae

SUPERASTERIDS: Santalales - Loranthaceae, **Caryophyllales** - Caryophyllaceae, Aizoaceae

ASTERIDS: Solanales - Convolvulaceae, **Lamiales** - Scrophulariaceae, Acanthaceae, Verbenaceae

4. Exercise in the important Articles of the Code.
5. Cladogram construction and analysis.
6. Submission of herbaria of any five plant species.
7. Field Visit report.

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23PBO3CC06	Core Course - 6: Biochemistry	5	5

Course Objectives
To make students understand the structure and function of carbohydrates
To understand the role of lipids and its metabolism
To make the students to understand the amino acids
To apply knowledge about the protein and its metabolism.
To know the various biochemical techniques and its industrial application

UNIT I (15 Hours)

Carbohydrates: Homoglycans: chemical structure and functions of starch, glycogen, cellulose, dextrin and inulin. Heteroglycan: chemical structure and functions of agar, alginic acid (sea weed polysaccharide), glycosaminoglycans, proteoglycanas, glycoproteins and pectins. Glycocalyxoligo saccharide. Over view of metabolism of carbohydrate.

UNIT II (15 Hours)

Lipids and Biomembranes: Triglycerides, phosphoglycerols, derived lipids- steroids, prostaglandins, spingolipids, leukotrienes and lipopoly saccharides. Structure of membrane model, lipid bilayer. Structure of membrane proteins and membrane receptors: adrenalin receptors, acetylcholine receptors and insulin receptors. Over view of metabolism of lipids.

UNIT III (15 Hours)

Amino acids and peptides: Amino acids: general structure and classification. Glutathione: structure, metabolism and function. Biology of cyclosporin. Metabolism of phenylalanine and tyrosine; glycine, cysteine and methionine. Over view of metabolism of vitamins.

UNIT IV (15 Hours)

Proteins: The peptide bond and primary structure. Secondary structure, domain, motif and backbone folding. Tertiary structure and stabilizing forces in collagen. Quaternary structure of haemoglobin and its regulatory features. Protein sequencing strategies - chemical and enzymatic. Ramachandran plot.

UNIT V (15 Hours)

Enzymes: Principles of catalysis, activation barrier and energy changes in reaction profile, initial velocity and principles of enzyme kinetics: Michaelis- Menten Equation, K_M and V_{Max} measurements - LB blot; active site organization; and role of cofactors/vitamins. Enzyme regulation: pH, temperature and substrate concentration. Inhibitions and regulation of glutamine synthetase. Industrial applications of enzymes.

Teaching Methodology	PPT, videos and practical demonstration.
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Books for Study

1. Lubert, S. (2005). *Biochemistry*. W.H. Freeman & Co.
2. Nelson, D. L., Lehninger, A. L. & Cox, M. M. (2008). *Lehninger, Principles of Biochemistry*, (5th Ed.). Publisher: W. H. Freeman and Company.
3. Voet, D., & Voet, J.G (2011). *Biochemistry*, (14th Ed.). Publisher: John Wiley & Sons.

Books for Reference

1. Caret. *et al.* (1993). *Inorganic, Organic and Biological Chemistry*. WMC Brown.
2. Jeremy, M. B., John, L. T., & Lubert, S. (2010). *Biochemistry*, (17th Ed.). 74Publisher: W. H. Freeman.

Websites and eLearning Sources

1. <https://www.medicalnewstoday.com/articles/161547#chemistry>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2642958/>
3. [https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_\(Jakubowski_and_Flatt\)/01%3A_Unit_I-Structure_and_Catalysis/03%3A_Amino_Acids_](https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(Jakubowski_and_Flatt)/01%3A_Unit_I-Structure_and_Catalysis/03%3A_Amino_Acids_)

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the classification and structural organization of proteins.	K1
CO2	apply knowledge about the enzyme kinetics and its regulatory process.	K2
CO3	apply basic principles of chemistry to biological systems.	K3
CO4	infer the metabolism of amino acids and its regulation.	K4
CO5	design biochemical techniques to carry out experiments.	K5
CO6	understand the industrial importance of industrial enzymes.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course						Hours	Credits	
3	23PBO3CC06		Core Course - 6: Biochemistry						5	5	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	1	2	3	2	2	3	2.3
CO2	1	3	2	2	2	3	3	1	2	3	2.1
CO3	2	2	3	2	3	2	3	3	2	1	2.3
CO4	3	1	3	3	1	2	2	2	3	2	2.2
CO5	1	3	2	2	2	2	3	1	2	3	2.1
CO6	3	1	3	3	1	2	2	2	3	2	2.2
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23PBO3CP05	Core Practical - 5:Biochemistry	4	4

Experiments

1. Estimation of glycogen / total polysaccharides
2. Estimation of hexosamine
3. Determination of total proteins (Bradford's / Lowry's)
4. Study of Enzyme Kinetics (experiments with acid phosphatase)
5. Effect of temperature on enzyme activity.
6. Effect of [S] on enzyme activity; measurement of V_{max} and K_m .
7. Estimation of Ascorbic acid (Calorimetric /volumetric)
8. Estimation of Phenolics (Folin -Ciocalteu)
9. Estimation of Tannins (Folin-Denis / Vanillin hydrochloride)
10. Estimation of cholesterol
11. Thin Layer Chromatography
12. Native-PAGE

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23PBO3CC07	Core Course - 7: Pharmacognosy	3	3

Course Objectives
To acquire the knowledge about understanding of Principle and Treatment methods of various Traditional system of medicines.
To learn the identification, pharmacological importance and processing of medicinal plants based on their classification and characterization.
To analyze the suitable conservation method for medicinal plants using modern biotechnology tools to ensure the sustainable utilization.
To evaluate the medicinal plants based drug efficacy and its various applications for different ailments
To create new drug formulations using phytochemical compounds for the healthy life of society.

UNIT I (9 Hours)

Traditional and alternative system of medicine-Principle, practice, short history and merits of herbal medicine- Siddha, Ayurveda, Homeopathy, Chinese medicine, Unani, Naturopathy, Aromatherapy and acupuncture. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants.

UNIT II (9 Hours)

Classification of crude drugs - alphabetical, taxonomical, morphological, chemical, pharmacological (therapeutic). Medicinal plants - Mass Cultivation methods for sustainable utilization, Collection and processing of herbal raw material for drugs Preparation-Post Harvesting care, Drying, Dressing, Packing and Storage. Conservation and mass propagation of important medicinal plants through *In vitro* propagation methods.

UNIT III (9 Hours)

Medicinally useful plant parts: Root - *Hemidesmus indicus*, *Withania somnifera* and *Rauvolfia serpentina*; Rhizome - *Zingiber officinalis*, *Acorus calamus* and *Curcuma longa*; Stem- *Tinospora cordifolia*, *Santalum album*; Bark - *Terminalia arjuna*, *Cinnamomum verum* and *Saraca asoca*; Leaf - *Adhatoda vasica*, *Ocimum sanctum* and *Cynodon dactylon*; Flowers - *Crocus sativus*, *Syzygium aromaticum* and *Leucus aspera*; Fruits - *Phyllanthus emblica*, *Piper longum* and *Terminalia chebula*; Seeds - *Azadirachta indica*, *Trigonella foenum-graecum* and *Ricinus communis*.

UNIT IV (9 Hours)

Herbal preparation methods - bolus, capsules, compresses, creams, decoctions, extracts, infusions, herbal tea, ointments, massage oils, medicinal vinegar, poultice & plasters, powders, salves, syrups, tinctures, tonic, maceration and baths and bathing remedies and dry extract (pills or capsules). Application of herbal formulations for the treatment of certain diseases- Jaundice, Fever, Cardiac, Infertility, Diabetics, Blood pressure, Skin care and Respiratory diseases.

UNIT V (9 Hours)

Pharmaceutical plant products- alkaloids, glycosides, terpenoids, tannins, flavonoids, lipids, proteins. Nutraceuticals, cosmeceuticals, pharmaceuticals - fibre, sutures, surgical dressings, adaptogens, rasayana. Drug adulteration and methods of evaluation-physical, chemical and microscopic. NMPB, CDRI, CIMAP, CIPLA; WHO regulation and Guidelines for quality control and trade of herbal medicine.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

- Green, J. (2000). *Herbal Medicine-Maker's Handbook*. Crossing Press.
- Kokate, C.K., Purohit, A.P., & Gokahale. (2006). *Pharmacognosy*. NiraliPrakashan.
- Somasundara, S. (1997). *Maruththuva Thavaraiyal*. Ilangovan Padhippagam.
- Farooqui, A. A., & Sreeramu, B.S. (2004). *Cultivation of Medicinal and Aromatic crops*.

Universities Press.

5. Pulok, K. M. (2019). *Quality control and evaluation of Herbal Drugs*.

Books for Reference

1. Evans. (2009). *Pharmacognosy*. Elsevier Publications. Edinburgh.
2. Weiss., & Fritz, R. (2000). *Herbal Medicine*, (2nd Ed.). Thieme Medical Publishers

Websites and eLearning Sources

1. <http://www.gallowglass.org/jadwiga/herbs/preparations.html>
2. <http://shawnacohen.tripod.com/thetribaltraditions/id51.html>
3. <http://www.vasundharaorissa.org/Research%20Reports/Globalisation>
4. http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the Principle and Treatment methods of various Traditional system of medicines.	K1
CO2	identify pharmacological importance and processing of medicinal plants based on their classification and characterization.	K2
CO3	conserve medicinal plants using modern biotechnology tools to ensure the sustainable utilization.	K3
CO4	evaluate the medicinal plants based drug efficacy and its various applications for different ailments	K4
CO5	create new drug formulations using phytochemical compounds for the healthy life of society.	K5
CO6	know the regulation and Guidelines for quality control and trade of herbal medicine	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
3	23PBO3CC07		Core Course - 7: Pharmacognosy							3	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	1	3	3	3	1	2	2	2.3
CO2	2	2	3	1	2	1	3	3	2	3	2.2
CO3	3	3	3	2	3	2	3	3	2	3	2.7
CO4	3	1	3	2	3	2	3	1	2	2	2.2
CO5	2	3	2	2	3	1	1	2	3	2	2.1
CO6	2	2	3	1	2	1	3	3	2	3	2.2
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	23SBS3CC01	Common Core: Intellectual Property Rights	5	4

Course Objectives
To understand the concept and procedure of IPR.
To know the status of IPR in India.
To evaluate the difference between patent, copy right and trademark.
To analyse the benefits of patent, copy right and trademark.
To prepare applications for patent, copy right and GI.

UNIT I (15 Hours)

Intellectual Property Rights - Introduction, Concept and Theories, Kinds of Intellectual Property Rights, Need for intellectual property right, Advantages and Disadvantages of IPR. International Regime Relating to IPR - TRIPS, WIPO, WTO, GATTs. IPR in India genesis and development.

UNIT II (15 Hours)

Patent - introduction, Patent acts and its amendments. Patentable and Non patentable inventions. Process and product patent, double patent, patent of addition. Patent application process - Searching a patent, Drafting of a patent, filling of a patent, Types of patent applications-national, regional and international, patent document: specification and claims. Infringement.

UNIT III (15 Hours)

Copy right - concepts and principles. Historical background and development of copyright law - Copy right act, Berne Convention, Universal Copyright Convention, WIPO Phonograms and Performances treaty. Conditions for grant of copyright. Copyright in Literary, Dramatic and musical works, sound recording, cinematograph films and computer programme. Right of Broadcasting and performers. Copyright Board - Power and functioning.

UNIT IV (15 Hours)

Trademark - introduction, examples of well-known trademark. Historical development of the concept of trademark and trademark law-National and International. Kinds of trademarks. Procedure for registration of trademark. Infringement of trademark.

UNIT V (15 Hours)

Geographical Indication - introduction, types. GI laws. Indian GI act. Traditional knowledge and IPR. Public health and Intellectual Property Rights - case study. New plant varieties protection laws - need and benefits. Patenting of microorganism. IPR and Climate change. Patents and Biotechnology.

Teaching Methodology	PPT, videos and practical demonstration
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Book for Study

1. Venkataraman M. (2015). *An introduction to Intellectual property rights*. Create space Independent Pub. North Charleston.

Books for Reference

1. Gopalakrishnan N. S., & Agitha, T.G. (2009). *Principles of Intellectual Property*. Eastern Book Company.
2. Ramakrishna, B., & Kumar, A.H.S. (2017). *Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers*. Notion Press.
3. Boyle, J., & Jenkins, J. (2018). *Intellectual Property: Law & the Information Society- Cases and Materials*. Create space Independent Pub. North Charleston.
4. Reddy, D. S. V. (2019). *Intellectual Property Rights - Law and Practice*. Asia LawHouse.

Websites and eLearning Sources

1. <https://ipindia.gov.in/>
2. <https://www.annauniv.edu/ipr/files/downloadable/Overview%20of%20IPR.pdf>
3. <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC110356/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the concept and procedure of IPR.	K1
CO2	know the status of IPR in India.	K2
CO3	evaluate the difference between patent, copy right and trademark.	K3
CO4	analyse the benefits of patent, copy right and trademark.	K4
CO5	prepare applications for patent, copy right and GI.	K5
CO6	know the plant varieties protection laws.	K6

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
3	23SBS3CC01	Common Core: Intellectual Property Rights								5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	1	2	2	2	2	2	2.2
CO2	2	3	2	2	1	2	2	2	2	3	2.1
CO3	2	2	3	2	2	2	2	2	2	3	2.2
CO4	2	2	2	3	2	2	2	2	2	3	2.2
CO5	2	2	2	2	3	1	2	2	2	2	2.2
CO6	2	3	2	2	1	2	2	2	2	3	2.2
Mean Overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4CC08	Core Course - 8: Research Methodology	5	5

Course Objectives
To obtain knowledge on basic concepts in Research and in Biostatistics.
To acquire knowledge on sampling techniques, evaluate literature, collection of data and thesis writing.
To analyze the significance of databases and Citation Index.
To acquire skill in writing research articles and formatting the papers.
To solve and statistically analyse the data of variables

UNIT I (15 Hours)
Research - types, objectives and approaches. Hypothesis: definition, characteristics, types, significance. Methods of collecting data: primary and Secondary- merits and demerits, Code of research ethics. Literature collection: Books, Research articles and e-resources.

UNIT II (15 Hours)
Structure of thesis & research article. Journals in Life Sciences, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Software. Manuscript for publication and proof correction. Structure and components of research proposal, National and International funding sources.

UNIT III (15 Hours)
Bibliometrics: definition and relevance; Bibliometrics databases, h-index, SNIP, Page Rank, Impact Factor and evaluation. The use of bibliometrics in research: Citation Research, Science Citation Index. The Institute for Scientific Information (ISI), Thomson Reuter's Webmetric and ORCID. Tailored Research and Retraction. Indian Patent Act.

UNIT IV (15 Hours)
Biostatistics: Introduction. Census method, Sample -types; Sampling techniques. Classification of data; Frequency Distribution: Discrete, Continuous and Cumulative Frequency Distributions. Tabulation of data; Diagrammatic and graphical representation of data: Bar Charts: Simple, Multiple & Sub divided, Histogram, Frequency polygon, Ogive curve, Pie diagram. Measures of Central values: Mean, Median and Mode. Measures of Dispersions: Range, Mean deviation and Standard deviation.

UNIT V (15 Hours)
Skewness. Probability: Binomial, Poisson and Normal distributions. Correlation: types, methods. Regression analysis, Large sample(Z), small sample testing: Test of Significance; t-test, chi-square and F test. ANOVA - one and two way, Duncan Multiple Range Test. Principles of experimental design - randomization, replication, local control, size and shape of the plot, CRD & RBD.

Teaching Methodology	PPT, videos and practical demonstration.
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Books for Study

1. Kothari, C. R. (2014). *Research Methodology-Methods & Techniques*. Wishwa Prakashan.
2. Misra, R. P. (2000). *Research Methodology - A Handbook*. Concept Pub. Company.
3. Pillai., & Bagavathi. (2008). *Statistics*. S. Chand & Company Ltd.

Books for Reference

1. Gupta, S.P. (1990). *Statistical Methods*. Sultan Chand & Sons.
2. Rao, N.G. (1983). *Statistics for Agricultural Science*. Oxford & IBH.
3. Gupta, S.C. (2013). *Fundamentals of statistics*. Himalaya Publishers.

Websites and eLearning Sources

1. <https://monad.edu.in/img/media/uploads/objectives,types%20and%20features%20research.pdf>
2. https://iaeme.com/MasterAdmin/Journal_uploads/IJLIS/VOLUME_7_ISSUE_3/IJLIS_07_03_002.pdf
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_extension_trainees/ln_biostat_hew.pdf

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand and comprehend the basics in research methodology and applying them in research/ project work.	K1
CO2	demonstrate the ability to choose methods appropriate to research objectives.	K2
CO3	develop advanced critical thinking skills and Demonstrate enhanced writing skills	K3
CO4	help them to select an appropriate research design	K4
CO5	enable them to collect the data, edit it properly and analyse it accordingly. Thus, it will facilitate students' prosperity in higher education.	K5
CO6	apply various statistical tools in teaching and research.	K6

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
4	23PBO4CC08	Core Course - 8: Research Methodology								5	5
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	2	2	3	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	2	2	3	2	1	3	2	3	2	1	2.1
CO6	3	2	3	2	2	3	2	2	3	2	2.4
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4CC09	Core Course - 9: Genetic Engineering and Biotechnology	5	5

Course Objectives
To define the principles and application of intellectual property rights.
To understand the principles of genetic engineering.
To learn the types and application of cloning vectors.
To study and analyze different types of gene transfer methods.
To design protocol for plant tissue culture.

UNIT I (15 Hours)

Agrobacterium mediated gene transfer and Crown gall; **Nucleases:** Exonucleases and Endonucleases, **Restriction Enzymes:** (Type I - V), RNases and Eukaryotic (cDNA). **Methylases:** CpG Methylase, Dam Methylase, Dcm Methylase; Polymerases: DNA Pol I, Klenow Fragments, Reverse Transcriptase, Taq & Pfu Polymerases. **Ligases:** T4 DNA Ligase, E. coli DNA Ligase, T4 RNA Ligase **Topoisomerases:** Type I (A, B) & Type II (A, B) End Modifying Enzymes: Terminal Transferase, T4 Polynucleotide Kinase, Alkaline. Phosphatases. Linkers and Homopolymers.

UNIT II (15 Hours)

Features of Cloning vectors: ideal cloning vehicles: Natural vectors (E. coli and *Agrobacterium* based), *in vitro* vectors (pBR), ssrDNA vectors (M13) and shuttle vectors. Human Artificial Chromosomes (HACs). Expression of cloned genes - problems and solution. Cloning strategies - cDNA libraries and genomic libraries.

UNIT III (15 Hours)

Metagenomics. Engineered microbes - bioremediation of oil spills: oil-eating super bugs (*B. megatarium*, *P. putida* & *A. borkumensis*); Bt crops, golden rice technology, plantibodies and edible vaccines. Strategies for crop improvement: engineering for resistance against herbicides and diseases. Antisense RNA technology, CRISPR

UNIT IV (15 Hours)

Technology protection systems (GURT) - terminator gene technology. Biosafety aspects of GMOs and GM foods. Principles of biosafety; potential risks; environmental impacts; safety of food and animal feed derived from GM crops; and patterns of gene flow. Issues concerning release of Bt-brinjal. Essentials of IPRs and patents.

UNIT V (15 Hours)

Synthetic biology-scope and importance. Artificial DNA and synthetic genome. Contribution of JC Venter. Minimal genome, expanded gene pool. Creation of synthetic and commercially available products. Potentials and applications; ethical issues of synthetic organisms.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

1. Old, R.N. & Primrose, S. B. (2004). *Principles of Gene Manipulation*. Blackwell Sci.
2. Watson, J.D., Gilman, M., Witkowski, J., & Zoller, M. (1992). *Recombinant DNA*, (12th Ed.). WH Freeman Co.

Books for Reference

1. Presidential Commission for the Study of Bioethical Issues. (2010). (www.bioethics.gov)
2. ETC Group. (2010). *Extreme Genetic Engg - an introduction to synthetic biology*.
3. Young, E. & Alper, H, (2010). *Synthetic Biology: A Review. Journal of Biomedicine and Biotechnology*.

Websites and eLearning Sources

1. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/agrobacterium>
2. <https://www.frontiersin.org/articles/10.3389/fmicb.2021.766364/full>

3. <https://www.genome.gov/about-genomics/policy-issues/Synthetic-Biology>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	understand the basics of gene cloning, role of enzymes and vectors for genetic engineering	K1
CO2	understand the basics of Gene transfer methods	K2
CO3	learn the techniques and safety measures of genetic engineering, genome mapping and gene therapy	K3
CO4	understand Totipotency and cytodifferentiation	K4
CO5	learn the concepts of callus culture, cell suspension culture, micropropagation, organogenesis, somatic embryogenesis and protoplast culture	K5
CO6	gain knowledge about synthetic genome.	K6

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
4	23PBO4CC09	Core Course - 9: Genetic Engineering and Biotechnology								5	5
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	3	2	3	2	2.5
CO2	2	3	2	3	2	2	3	2	2	3	2.4
CO3	2	2	3	2	3	3	3	2	3	1	2.4
CO4	3	3	3	3	1	3	3	3	3	1	2.6
CO5	2	2	2	2	3	2	2	2	2	3	2.2
CO6	2	2	3	2	3	3	3	2	3	1	2.4
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4CC10	Core Course - 10: Cell and Molecular Biology	5	4

Course Objectives
To understand the organization of cells.
To acquire knowledge on the structure and organization of various cell organelles
To learn cell cycle and methods of cell division
To apply the knowledge acquired to study the molecular mechanisms.
To analyse the principles of gene regulation.

UNIT I (15 Hours)

Phases and control system of cell cycle, Cell cycle checkpoints - DNA damage, centrosome duplication, spindle assembly. Cyclins and Cyclin-dependent kinases, apoptosis. Cytoskeleton structure and functions: actin filaments (microfilaments), microtubules, and intermediate filaments.

UNIT II (15 Hours)

Cell communication: general principles, Signaling molecules and their receptors. Receptors: Cell surface receptors - ion-channel linked receptors, G-protein coupled receptors, and Tyrosine-kinase linked receptors (RTK), Programmed cell death.

UNIT III (15 Hours)

Transcription: RNA polymerases and their role. Transcription signals - promoters and terminators. Detailed account of transcription in *E. coli* and eukaryotes. Differences between the prokaryotic and the eukaryotic transcription, Post transcriptional modifications of mRNA (5'CAP formation, poly adenylation, spliciosome assembly, splicing editing). Organization of mRNA, RNA editing, mRNA export.

UNIT IV (15 Hours)

Translation: Genetic code - introduction, important features of the genetic code, exceptions to the standard code. Mechanism of translation in prokaryotes and eukaryotes. Differences between prokaryotic and eukaryotic protein synthesis. Protein sorting and translocation: Post-translational modification of proteins, Protein folding-self-assembly and role of chaperones.

UNIT V (15 Hours)

Gene regulation: Operon model - Inducible and repressible systems. Attenuation, positive and negative regulation. *lac* and *trp* operons of *E. coli*. Regulation of eukaryotic gene expression. Gene families and hormonal control in eukaryotes. Gene silencing: transcriptional and post transcriptional gene silencing.

Teaching Methodology	PPT, videos and practical demonstration.
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Book for Study

1. Malacinski, G.M. (2015). Essentials of Molecular Biology. Jones and Bartlett.

Books for Reference

1. Cooper, M. (2000). *The Cell-a molecular biology approach*, (2nd Ed.). Sinauer Associates.
2. Berk, A., Chris, Kaiser, Lodish, H., Amon, A., Ploegh, H., Bretscher, A., Krieger, M., & Kelsey, Martin, C. (2016). *Molecular Cell Biology*. WH Freeman & Co.
3. Watson, JD. *et al.* (2004). *Molecular biology of the gene*. Pearson education.
4. Gardner. *et al.* (2004). *Principles of genetics*. John Wiley & Sons Inc.
5. Veer Bala Rastogi. (2016). *Principles of Molecular Biology*. Medtech publishers.

Websites and eLearning Sources

1. <https://www.ncbi.nlm.nih.gov/books/NBK26824/>
2. <https://www.rrcs.org/Downloads/Cell%20Communication%20Slides.pdf>
3. <https://rwu.pressbooks.pub/bio103/chapter/regulation-of-gene-expression/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	describe the evolution, diversity and replication of cells;	K1
CO2	explain the role of compartmentalization and signalling in cellular biology;	K2
CO3	interpret and explain key experiments in the history of cell biology;	K3
CO4	evaluate and apply knowledge of modern techniques in cellular biology.	K4
CO5	describe genes structure, chromosomes and proteins	K5
CO6	comprehend various gene regulatory mechanisms.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23PBO4CC10		Core Course - 10: Cell and Molecular Biology							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	2	2	2	2	2.2
CO2	3	1	2	2	3	3	2	2	2	2	2.2
CO3	2	2	2	2	2	2	2	2	1	2	1.9
CO4	2	1	3	2	2	2	3	2	2	3	2.1
CO5	2	2	2	3	2	2	2	2	1	2	2.0
CO6	2	1	3	2	2	2	3	2	2	3	2.1
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4CP06	Core Practical - 6: Research Methodology, Genetic Engineering and Biotechnology	4	3

Research Methodology

1. Sampling
2. Collection of data
3. Classification of data
4. Diagrammatic representation of data
5. Measures of central value
6. Measures of dispersion
7. Test of significance
8. Bibliometrics
9. H-Index

Genetic Engineering and Biotechnology

1. Callus induction and regeneration.
2. Clonal propagation.
3. Embryo culture
4. Electrophoretic separation of DNA, protein and restriction digestion.
5. Preparation of synthetic seeds.

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4ES04A	Elective - 4: Organic Farming	5	4

Course Objectives				
To enable students to gain knowledge on the scope and significances of organic farming.				
To impart practical insights sustainable agriculture, green manuring, recycling and composting.				
To understand the physical and chemical properties of soil.				
To know about the sustainable agriculture.				
To know about the importance of biofertilizers in organic farming.				

UNIT I (15 Hours)
Concepts and scope of organic farming, Requirements for organic farming, Farm components for an organic farm. Conversion to organic farming- Process, green card systems and subsidies. A fundamental of Livestock farming, kitchen waste and, Poultry management.

UNIT II (15 Hours)
Types of Farming, Concept of different cropping systems in relation to Organic Farming (Inter cropping), nutrient uptake and balanced nutrient supply, organic manure, green and liquid manure, biofertilizers and their method of use, Compost: decomposition, manure - Types vermicompost: Scope and importance, use of vermi castings in organic farming, Potentials and constraints for vermiculture in India.

UNIT III (15 Hours)
Soil formation, types of soil according to composition, methods of increasing soil productivity and fertility, Cultivation of crops with organic inputs: field crops and leguminous crops. Plant protection measures: integrated pest and disease management, biopesticides, treatment methods, importance of neem in organic agriculture.

UNIT IV (15 Hours)
Organic crop production methods- sugarcane, mango, ginger, medicinal and ornamental crops. Green labels, Bio-fuel crops. Integrated Nutrient Management (INM) and Integrated Plant Nutrient Supply System (IPNS). Organic produce quality considerations, certification, accreditation process, marketing and Economics.

UNIT V (15 Hours)
National and international status of organic farming. Agencies and institutions related to organic farming. Organic Food Quality and Human Health. Entrepreneurship Development- Concept, characteristics and approaches. Income generation activities: Apiculture, Mushroom production, Organic milk production.

Teaching Methodology	PPT, videos and practical demonstration
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Books for Study

1. Palaniappan, S.P., & Annadurai, K. (2007). *Organic Farming - Theory and Practice*. Scientific Publishers.
2. Lakshmi, Narasaiah, M. (2010). *Agriculture and Water Management*. Discovery publishing House.

Books for Reference

1. Gupta, P.K. (2012). *Vermicomposting for sustainable Agriculture*. Agrobios.
2. Kumar, N. (2010). *Introduction to Horticulture*. Oxford & Ibh Publishing Co. Pvt. Ltd.
3. Kristensen, P., Taji, A., & Reganold, J. (2006). *Organic Agriculture: A Global Perspective*. CSIRO Press, Victoria.

Websites and eLearning Sources

1. <https://www.dec.ny.gov/chemical/8480.html>
2. <https://www.fao.org/3/y5104e/y5104e05.htm>
3. <https://www.gasum.com/en/our-operations/biogas-production/how-is-biogas-produced/>

4. <https://www.legit.ng/1128248-economic-importance-earthworm-vermiculture.html>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	apply techniques for synthesizing green manure and develop strategies to increase crop yield.	K1
CO2	analyze and decipher the significance of biofertilizers in soil fertility.	K2
CO3	develop new strategies to enhance soil fertility, crop yields with minimum cost and sustainable utilization of various biodegradable wastes.	K3
CO4	practice and maintain soil fertility and plant productivity.	K4
CO5	plan a proper pest management strategy for various crops.	K5
CO6	gain knowledge to develop into an entrepreneurial skills.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23PBO4ES04A		Elective - 4: Organic Farming							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	3	2	2	3	1	2	3	2.3
CO2	1	2	3	2	2	3	2	3	2	2	2.2
CO3	1	2	3	2	2	3	3	2	2	3	2.3
CO4	3	2	2	3	1	3	3	1	2	3	2.3
CO5	2	3	2	1	3	1	2	2	3	3	2.2
CO6	1	2	3	2	2	3	3	2	2	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4ES04B	Elective - 4: Genetics	5	4

Course Objectives
To acquire knowledge on objectives of Mendelian laws.
To outline the process of evolution and various theories pertaining to biological evolution.
To learn about the population genetics.
To solving problems with relevance to the principles and applications of genetics.
To acquire the basic knowledge on genomics and proteomics.

UNIT I (15 Hours)
Mendel and his work: Laws of inheritance. Back cross and Test cross. Gene interaction and Modified Mendelian ratios. Quantitative inheritance and multiple alleles. Problem solving in genetics.

UNIT II (15 Hours)
Linkage and crossing over, 3-point cross and gene mapping methods. DNA is the genetic material: Griffith's experiment, Avery et al., and Hershey and Chase experiment; RNA as genetic material - Experiment of Fraenkel and Singer.

UNIT III (15 Hours)
Organization of eukaryotic and bacterial genomes- transformation, transduction (generalized and specialized), conjugation (F factor mediated, Hfr and Sexduction). Fine structure of the Gene: Cistron, muton and recon, Watson and Crick model of DNA helix, Semi-conservative replication mechanism of DNA: replication of linear and circular DNA, Replication of RNA genomes.

UNIT IV (15 Hours)
Molecular mechanisms of DNA repair (mismatch and proof reading, photo reactivation, excision, recombination and SOS repair). Mobile genetic elements- IS elements and transposons in maize and bacteria. Beneficial and harmful effects of mutations.

UNIT V (15 Hours)
Population genetics: gene frequency, gene pool, Hardy-Weinberg equilibrium. Gene frequencies- conservation and changes. Decline of human gene pool and eugenics. Genomics: Arabidopsis genome and rice genome. Gene therapy with reference to Haemophilia, Stem cells- Definition, types & sources.

Teaching Methodology	PPT, videos and practical demonstration.
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Books for Study

1. Malacinski, G.M. & Freifelder, D. (2008). *Essentials of Molecular Biology*, (4th Ed.). Jones & Bartlett.
2. Verma, P. S., & Agarwal, V.K. (2003). *Genetics*. S. Chand.

Books for Reference

1. Gardner, E. J., Simmons, M. J., Snustad, D. P. (1991). *Principles of Genetics*, (8th Ed.). John Wiley and Sons Inc.
2. Strickberger. (2005). *Genetics*, (3rd Ed). Prentice Hall of India Pvt. Ltd.
3. Snustad, D.P., & Michael, J. S. (2010). *Principles of Genetics*. John Wiley & Sons

Websites and eLearning Sources

1. <https://courses.lumenlearning.com/wm-biology1/chapter/reading-laws-of-inheritance-2/>
2. <https://www.genome.gov/>
3. <https://www.ncbi.nlm.nih.gov/books/NBK9900/>

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On the successful completion of this course, students will be able to	
CO1	understand the principles of linkage, crossing over and the hereditary mechanisms.	K1
CO2	examine the structure and functions of genetic materials.	K2
CO3	explain the organization of prokaryotic and eukaryotic genomes.	K3
CO4	justify and outline the mechanisms of DNA repair.	K4
CO5	compose the dynamics of genetic variation and data interpretation.	K5
CO6	interpret and analyse population genetics models.	K6

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
4	23PBO4ES04B		Elective - 4: Genetics							5	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	3	2	2	2.2
CO2	3	2	2	1	2	1	3	3	2	3	2.2
CO3	1	2	3	2	3	2	3	2	3	2	2.3
CO4	2	2	1	3	2	2	3	2	3	3	2.3
CO5	2	2	2	2	3	1	3	2	3	3	2.3
CO6	2	2	1	3	2	2	3	2	3	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	23PBO4CE01	Comprehensive Examination	-	2

Course Objectives
To acquire knowledge for attending competitive exams in biology.
To study the classification and the evolutionary significance of different plant groups.
To understand organisation, structure and function of various biomolecules.
To understand the mechanisms involved in plant physiology.
To understand components of biodiversity and ecosystem.

UNIT I

Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Ecology and Evolutionary trends. Levels of organization of tissues, organs & systems. Nodal anatomy, stomatal types; Shoot and root development; floral meristems and floral development, microsporogenesis, endosperm, embryo development and apomixis.

UNIT II

Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle, structure & function of cytoskeleton, signaling through G-protein coupled receptors, signal transduction pathways; DNA replication, repair and recombination, Protein synthesis and gene expression; Methods of genetic transfers - transformation, conjugation, transduction, germinal versus somatic mutants, Structural and numerical alterations of chromosomes

UNIT III

Light harvesting complexes; mechanisms of electron transport, CO₂ fixation-C₃, C₄ and CAM pathways. Nitrogen metabolism, plant hormones- physiological effects, phytochromes, photoperiodism, Plant response to biotic and abiotic stress. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins), Principles of catalysis, enzyme kinetics and enzyme regulation, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

UNIT IV

Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants; Concept of habitat and niche, Ecosystem structure; ecosystem function; energy flow and mineral cycling, biogeographical zones of India. Rare, endangered species. Conservation strategies. Environmental pollution; global environmental change

UNIT V

Cells and molecules involved in innate and adaptive immunity, antigens, inflammation, hypersensitivity and autoimmunity; Microbial fermentation, Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals. Bioremediation and phytoremediation, Biosensors, RFLP, RAPD and AFLP techniques; Measures of central tendency and dispersal, Levels of significance; Regression and Correlation; t-test.

Teaching Methodology	JosTEL.
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Books for Study

1. Pandey, P. B. (2014). *College Botany I: Including algae, fungi, lichens, bacteria, viruses, plant pathology, industrial microbiology and bryophyta*. Chand Publishing.
2. Kothari, C. R. (2014). *Research Methodology-Methods & Techniques*. Wishwa Prakashan.

Books for Reference

1. Berk, A., Chris, A. K., Lodish, H., Amon, H., Ploegh, H., Bretscher, A., Krieger, M., & Kelsey, Martin, C. (2016). *Molecular Cell Biology*. WH Freeman & Co. New York.
2. Sharma, P. D. (2010). *Ecology and Environment*, (8th Ed.). Rastogi Publications.

Course Outcomes		
CO No.	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	recollect the classification and the evolutionary significance of different plant groups.	K1
CO2	revisit the structure and functions of different organelles nucleic acids and proteins.	K2
CO3	regain the knowledge on the organization of prokaryotic and eukaryotic genomes.	K3
CO4	remind the biochemical processes in biological systems.	K4
CO5	recapture the dynamics of genetic variation and data interpretation.	K5
CO6	recall the ecosystems and population genetics models.	K6

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
4	23PBO4CE01	Comprehensive Examination								-	2
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	2	2	3	2	2	3	2	2	2.2
CO2	3	2	2	1	2	1	3	3	2	3	2.2
CO3	1	2	3	2	3	2	3	2	3	2	2.3
CO4	2	2	1	3	2	2	3	2	3	3	2.3
CO5	2	2	2	2	3	1	3	2	3	3	2.3
CO6	2	2	1	3	2	2	3	2	3	3	2.3
Mean Overall Score											2.3 (High)