



ANNAMALAI UNIVERSITY

Accredited with 'A' Grade by NAAC



FACULTY OF SCIENCE

DEPARTMENT OF ZOOLOGY

(UGC - SAP and DST - FIST Sponsored)

M.Sc. ZOOLOGY

Five Year Programme

Programme Code: SZOO 51



Regulations, Curriculum and Syllabus

2019

ANNAMALAI  **UNIVERSITY**

FACULTY OF SCIENCE

DEPARTMENT OF ZOOLOGY

M.Sc. ZOOLOGY FIVE YEAR PROGRAMME

PROGRAMME CODE: SZOO 51

These Regulations are common to all the students admitted to the Five-Year Master Programme in the Faculties of Science from the academic year 2019-2020 onwards.

1. Definitions and Nomenclature

1.1 University refers to Annamalai University.

1.2 Department means any of the academic departments and academic centers at the University.

1.3 Discipline refers to the specialization or branch of knowledge taught and researched in higher education. For example, Botany is a discipline in the Natural Sciences, while Economics is a discipline in Social Sciences.

1.4 Programme encompasses the combination of courses and/or requirements leading to a Degree. For example, M.A., M.Sc.

1.5 Course is an individual subject in a programme. Each course may consist of Lectures/Tutorials/Laboratory work/Seminar/Project work/Experiential learning/Report writing/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 Curriculum encompasses the totality of student experiences that occur during the educational process.

1.7 Syllabus is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 Academic Year refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 Semester is a half-year term that lasts for a minimum duration of 90 days.

1.10 Choice Based Credit System: A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.

1.11 Core Course is mandatory and an essential requirement to qualify for the Degree.

1.12 Elective Course is a course that a student can choose from a range of alternatives.

1.13 Value-added Courses are optional courses that complement the students' knowledge and skills and enhance their employability.

1.14 Credit refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.

1.15 Credit Hour refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular course.

- 1.16 Programme Outcomes (POs)** are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.
- 1.17 Programme Specific Outcomes (PSOs)** are statements that list what the graduate of a specific programme should be able to do at the end of the programme.
- 1.18 Learning Objectives** are statements that define the expected goal of a course in **Course Objectives** in terms of demonstrable skills or knowledge that will be acquired by a student.
- 1.19 Course Outcomes (COs)** are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.
- 1.20 Grade Point Average (GPA)** is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3
- 1.21 Cumulative Grade Point Average (CGPA)** is a measure of overall cumulative performance of a student over all the semesters. Calculation of CGPA is given in section 11.4.
- 1.22 Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2 Programme Offered and Eligibility Criteria:

The Department of Zoology offers M.Sc. Zoology Five Year Programme. A pass in H.S.E. (10+2 level) or equivalent thereto with a minimum of 40% under academic stream in the following subjects viz. Physics, Chemistry and Biology or Zoology and Botany.

- 2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for the above Programme.

3 Reservation Policy: Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4 Programme Duration

- 4.1 The Five Year Master's Programme consists of five academic years.
- 4.2 Each academic year is divided in to two semesters, the first being from July to November and the second from December to April.
- 4.3 Each semester will have 90 working days (18 weeks).

5. Programme Structure

- 5.1** The Five-Year Integrated Programme consists of Language Courses, Core Courses, Allied Courses, Elective Courses, Experiential Learning and Project. Students shall also participate in Extension Activities as part of their curriculum.

5.2 Language Courses

- 5.2.1 Each student shall take two languages of four courses each, one in each semester for the first two years of the programme.
- 5.2.2 Language-I shall be Tamil or another language such as Hindi or French.
- 5.2.3 Language-II shall be English.

5.3 Core courses

- 5.3.1 These are a set of compulsory courses essential for each programme.
- 5.3.2 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

5.4 Allied courses

- 5.4.1 Each student has to take Two allied courses and practical in the first and second year of the programme.
- 5.4.2 Student has to take Botany in First and Second semesters along with practical in the second semester.
- 5.4.3 Student has to take Chemistry in Third and Fourth semesters along with practical in the fourth semester

5.5 Elective courses

- 5.5.1 **Departmental Electives (DEs)** are the Electives that students can choose from a range of Electives offered within the Department.
- 5.5.2 **Interdepartmental Electives (IDEs)** are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties.

5.6 Soft Skills

- 5.6.1 Soft skills are intended to enable students to acquire attributes that enhance their performance and achieve their goals with complementing hard skills.
- 5.6.2 Soft skills include communication skills, computer skills, among others.

5.7 Value Education

- 5.7.1 All students shall take a course on Value Education that includes human values, sustainable development, gender equity, ethics and human right.
- 5.7.2 **Value Education is** categorized as **Non-Credit Compulsory Course**.

5.8 Experiential Learning

- 5.8.2 Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations, either within classroom, within the community, or within the work place-based learning outcome that are specifically focused on employability skills. .
- 5.8.3 In-plant training/field trips/internships/industrial visits (as applicable) fall under this category.

- 5.8.4 **Experiential learning is** categorized as **Non-Credit Compulsory Course**.

5.9 Extension Activities

- 5.9.2 It is mandatory for every student to participate in extension activities.
- 5.9.3 All the students shall enroll under NSS/NCC/YRC/RRC or any other Service organisation in the University.
- 5.9.4 Students shall put in a minimum attendance of 40 hours in a year duly certified by the Programme Coordinator.
- 5.9.5 Extension activities shall be conducted outside the class hours

5.9.6 Extension activities is categorized as **Non-Credit Compulsory Course**

5.10 Project

5.10.1 Each student shall undertake a Project and submit a dissertation as per guidelines in the final semester.

5.10.2 The Head of the Department shall assign a Research Supervisor to the student.

5.10.3 The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

5.10.4 Students who wish to undertake project work in recognized institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute.

5.11 Value added Courses (VACs)

5.11.1 Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

5.11.2 These courses impart employable and life skills.

5.11.3 Each VAC carries 2 credits with 30 hours of instruction. Classes for a VAC are conducted beyond the regular class hours and preferably in the VII Semester.

5.12 Online Courses

5.12.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.12.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

5.13 **Credit Distribution:** The credit distribution is organized as follows:

LIST OF COURSES	CREDITS
Semester I to VI	
Language - I (Tamil or any other Language)	12
Language – II (English)	12
Core Courses	83
Allied - I (1 st Year – SEM I & II)	10
Allied - II (2 ND Year – SEM III & IV)	10
Electives (DE)	09
Soft Skill (Computer Skill)	03
Environmental Studies (UGC mandated)	03
Value Education	02*

Experiential Learning	02*
Extension Activities	01*
Total Credits (Semester I to VI)	142
Semester VII to X	
Core Courses	70
Electives (DE)	06
Electives (IDE)	09
Project & Dissertation	06
Constitution of India	02*
Total Credits (Semester VII to X)	91
Total Credits (Semester I to X)	233

Note: ' * ' - Non -Credit Compulsory Course (Credit not counted)

5.14 Credit Assignment

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one hour duration per week over a semester

1 Tutorial period of one hour duration per week over a semester

1 Practical/Project period of two hours duration per week over a semester.

6 Attendance

6.1 Each Course teacher handling a course shall be responsible for the maintenance of Attendance and Assessment Record for candidates who have registered for the course.

6.2 The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course teacher.

6.3 The record shall be submitted to the Head of the Department and Dean once a month for monitoring the attendance and syllabus coverage.

6.4 At the end of the semester, the record shall be placed in safe custody for any future verification.

6.5 The Course teacher shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

6.6 Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to repeat the semester in the next year.

- 6.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

7 Mentor-Mentee System

- 7.1 To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the Course teacher who shall function as a Mentor throughout their period of study.
- 7.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.
- 7.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

8 Examinations

- 8.1 The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

8.2 There will be two CIA Tests and one ESE in each semester.

8.3 The Question Papers will be framed to test different levels of learning based on Bloom's taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

8.4 Continuous Internal Assessment Tests

8.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments and seminars. This requires an element of openness.

8.4.2 The students are to be informed in advance about the assessment procedures.

8.4.3 The question paper will be set by the respective course teacher using bloom taxonomy.

8.4.4 CIA Tests will be for one or two hours duration depending on the quantum of syllabus.

8.4.5 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

8.4.6 For the CIA Tests, the assessment will be done by the Course teacher .

8.5 End Semester Examinations (ESE)

8.5.1 The ESE for the first/third/fifth/seventh/ninth semester will be conducted in November and for the second/fourth/sixth/eighth/tenth semester in May.

8.5.2 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.

8.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course.

9 Evaluation

9.1 Marks Distribution

9.1.1 For each course, the Theory, Practical and project shall be evaluated for a

maximum of 100 marks.

9.1.2 For the theory courses and project, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will carry 40% and the ESE 60% of the marks.

9.2 Assessment of CIA Test

9.2.1 For the CIA Tests, the assessment will be done by the Course teacher

9.2.2 For the Theory Courses, the break-up of marks shall be as follows

	Marks
Test-I & Test-II	15
Seminar	5
Assignment	5
Total	25

9.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

	Marks
Test-I	15
Test-II	15
Record	10
Total	40

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by Internal examiners.

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a review of literature survey, experimentation/ field work, attendance etc.

9.4.4 The Project Report evaluation and viva-voce will be conducted by a committee constituted by the Head of the Department.

9.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

9.4.6 The marks shall be distributed as follows:

Continuous Internal Assessment (25 Marks)		End Semester Examination (75 Marks)	
Review – I	Review – II	Project/Dissertation Evaluation	Viva - Voce
10	10	50	25

9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal. Two CIA Tests shall be conducted by the Department(s) offering VAC.

9.5.2 The grades obtained in VACs will not be included for calculating the GPA/CGPA.

9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than **50%** marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.2 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

10. Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed.

11.3 **The GPA** is calculated by the formula

$$GPA = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$$

where, C_i is the Credit earned for the Course i in any semester;

G_i is the Grade Point obtained by the student for the Course i and

n is the number of Courses passed in that semester.

11.4 **CGPA** is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

$$CGPA = \frac{\sum_{i=1}^m \sum_{i=1}^n C_i G_i}{\sum_{i=1}^m \sum_{i=1}^n C_i}$$

where, C_i is the Credit earned for the Course i in any semester;
 G_i is the Grade Point obtained by the student for the Course i and
 n is the number of Courses passed in that semester.
 m is the number of semesters

11.5 Evaluation :

11.5.1 Performance of the student for each course will be rated as shown in the Table.

Range of Marks	Grade Points	Letter Grade
90 and above	10	S
80-89	9	A
70-79	8	B
60-69	7	C
55-59	6	D
50-54	5	E
Less than 50	0	RA
Withdrawn from the examination	0	W

11.5.2 A ten point rating scale is used for evaluation of the performance of the student to provide overall grade for the Master's Programme.

CGPA	CLASSIFICATION OF FINAL RESULT
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0.0 and above but below 5.0	Re-appear

11.6 **Classification of Results.** The successful candidates are classified as follows:

11.6.1 **For First Class with Distinction:** Candidates who have passed all the courses prescribed in the Programme in the first attempt with a CGPA of 8.25 and above within the programme duration. Candidates who have withdrawn from

the End Semester Examinations are still eligible for First Class with Distinction (See Section 12 for details).

- 11.6.2 **For First Class:** Candidates who have passed all the courses with a CGPA of 6.5 and above.
- 11.6.3 **For Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.
- 11.6.4 Candidates who obtain highest CGPA in all examinations at the first appearance itself are eligible for University Rank.
- 11.7 **Course-Wise Letter Grades**
 - 11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.
 - 11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.
 - 11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point.
 - 11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade sheet of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.
 - 11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

12. Provision for Withdrawal from the End Semester Examination

- 12.1 The letter grade W indicates that a candidate has withdrawn from the examination.
- 12.2 A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.
- 12.3 Permission for withdrawal from the examination shall be granted only once during the entire duration of the programme.
- 12.4 Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.
- 12.5 The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days notice, due consideration will be given under extraordinary circumstances.
- 12.6 Withdrawal will not be granted for arrear examinations of courses in previous semesters and for the final semester examinations.
- 12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.

- 12.8 Withdrawal shall not be taken in to account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.
13. **Academic misconduct:** Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitized on issues of academic integrity and ethics.
14. **Transitory Regulations:** Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.
15. Notwithstanding anything contained in the above pages as Rules and Regulations governing the Five Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.

CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SCHEME OF EXAMINATION

Course Code	Course Title	Hours/ Week			Credit	Marks		
		L	T	P		C	CIA	ESE
Semester - I								
19ITAMC11/ 19IHINC11	Language - I/Paper - I	3	0	0	3	25	75	100
19IENG12	Language - II /Paper - I	3	0	0	3	25	75	100
19IENSC13	Environmental Studies	3	0	0	3	25	75	100
19IZOOC14	Core 1: Invertebrata - I	4	0	0	4	25	75	100
19IBOTA01	Allied - I – Botany - I	4	0	0	4	25	75	100
19IZOOE1X	Elective 1: Department Elective	3	0	0	3	25	75	100
Total					20			600
Semester – II								
19ITAMC21 19IHINC21	Language - I Paper - II	3	0	0	3	25	75	100
19IENG22	Language - II Paper - II	3	0	0	3	25	75	100
19ICISC23	Soft skill - Computer Applications - I	3	0	0	3	25	75	100
19IZOOC24	Core 2: Invertebrata - II Tutorial/ Group Discussion	4	0	0	4	25	75	100
19IZOOP25	Core 3: Practical- I Pre-Lab Discussion (1 hour) Practical I (9 hours) (Covering 19IZOOC 14 & 24)	0	0	10	5	40	60	100
19IBOTA02	Allied - I- Botany - II	4	0	0	4	25	75	100
19IBOTP01	Allied practical - I : Botany Pre-Lab Discussion (1 hour) Practical (3 hours) (Covering 19BOTA 01 & 02)	0	0	4	2	40	60	100
Total					24			700
Semester -- III								
19ITAMC31/ 19IHINC31	Language - I Paper - III	3	0	0	3	25	75	100
19IENG32	Language - II Paper - III	3	0	0	3	25	75	100

19IZOOC33	Core 4: Chordata - I Tutorial/ Group Discussion	4	0	0	4	25	75	100
19IZOOP34	Core 5: Practical - II Pre-Lab Discussion (1 hour) Practical II (9 hours) (Covering 19IZOOC 33)	0	0	10	5	40	60	100
19ICHEA01	Allied - II - Chemistry - I	4	0	0	4	25	75	100
19IZOOE3X	Elective 2: Department Elective	3	0	0	3	25	75	100
	Total				22			600
	Semester - IV							
19ITAMC41/ 19IHINC41	Language –I Paper - IV	3	0	0	3	25	75	100
19IENGC42	Language -II Paper - IV	3	0	0	3	25	75	100
19IZOOC43	Core 6: Chordata - II Tutorial/ Group Discussion	4	0	0	4	25	75	100
19IZOOP44	Core 7: Practical- III Pre-Lab Discussion (1 hour) Practical III (9 hours) (Covering 19IZOOC 43)	0	0	10	5	40	60	100
19ICHEA02	Allied - II – Chemistry - II	4	0	0	4	25	75	100
19ICHEP01	Allied Practical – II: Chemistry Pre-Lab Discussion (1 hour) Practical II (3 hours) (Covering 19CHEA I & II)	0	0	4	2	40	60	100
19IZOOF40*	Extension activities	0	0	2	1*	40	60	100
	Total				21			600
	Semester - V							
19IZOOC51	Core 8: Cell Biology	5	0	0	5	25	75	100
19IZOOC52	Core 9: Principles of Genetics	5	0	0	5	25	75	100
19IZOOC53	Core 10: Comparative Animal Physiology	5	0	0	5	25	75	100
19IZOOC54	Core 11: Applied Zoology	5	0	0	5	25	75	100
19IZOOP55	Core 12: Practical - IV Pre-Lab Discussion (1 hour) Practical IV (11 hours) (Covering 19IZOOC 51, 52, 53 & 54)	0	0	12	6	40	60	100
19IZOOE5X	Elective 3: Department Elective	3	0	0	3	25	75	100
19IZOOV50*	Value Education	2	0	0	2*	25	75	100
	Total				30			600
	Semester - VI							
19IZOOC61	Core 13: Basic Embryology	5	0	0	5	25	75	100

19IZOOC62	Core 14: Evolution - I	5	0	0	5	25	75	100
19IZOOC63	Core 15: Ecology	5	0	0	5	25	75	100
19IZOOC64	Core 16: Animal Culture Techniques	5	0	0	5	25	75	100
19IZOOP65	Core 17: Practical - V Pre-Lab Discussion (1 hour) Practical V (11 hours) (Covering 19IZOOC 61, 62, 63 & 64)	0	0	12	6	40	60	100
19IZOOF60*	Experiential Learning	0	0	4	2*	40	60	100
	Total				26			500
	Semester - VII							
19IZOOC71	Core 18: Structure and functions of Invertebrates and Vertebrates	4	0	0	4	25	75	100
19IZOOC72	Core 19: Developmental Biology	4	0	0	4	25	75	100
19IZOOC73	Core 20: Cell and Molecular biology	4	0	0	4	25	75	100
19IZOOP74	Core 21: Practical - VI Pre lab Discussion (1 hour) Practical VI (11 hours) (Covering 19IZOOC 71, 72 & 73)	0	0	12	6	40	60	100
19IXXXXXX	Elective 4: Inter-department Elective	3	0	0	3	25	75	100
	Total				21			500
	Semester - VIII							
19IZOOC81	Core 22: Animal Physiology	4	0	0	4	25	75	100
19IZOOC82	Core 23: Genetics	4	0	0	4	25	75	100
19IZOOC83	Core 24: Immunology	4	0	0	4	25	75	100
19IZOOP84	Core 25: Practical - VII Pre lab Discussion (1 hour) Practical VII (11 hours) (Covering 19IZOOC 81, 82 & 83)	0	0	12	6	40	60	100
19IZOOE8X	Elective 5: Department Elective	3	0	0	3	25	75	100
19IXXXXXX	Elective 6: Inter-department Elective	3	0	0	3	25	75	100
	Total				24			600
	Semester - IX							
19IZOOC91	Core 26: Evolution - II	4	0	0	4	25	75	100
19IZOOC92	Core 27: Environment and Biodiversity conservation	4	0	0	4	25	75	100
19IZOOC93	Core 28: Animal Behaviour	4	0	0	4	25	75	100
19IZOOC94	Core 29: Biotechnology	4	0	0	4	25	75	100
19IZOOP95	Core 30: Practical - VIII Pre lab Discussion (1 hour) Practical VIII (11 hours) (Covering 19 IZOOC 91, 92, 93 & 94)	0	0	12	6	40	60	100

19IZOOE9X	Elective 7: Department Elective	3	0	0	3	25	75	100
19IXXXXXX	Elective 8: Inter- department Elective	3	0	0	3	25	75	100
19IPSC090*	Constitution of India	2	0	0	2*	25	75	100
	Total				30			800
	Semester - X							
19IZOOCX1	Core 31: Bio-chemistry	4	0	0	4	25	75	100
19IZOOCX2	Core 32: Endocrinology	4	0	0	4	25	75	100
19IZOOPX3	Core 33: Practical - IX Pre lab Discussion (1 hour) Practical IX (7 hours) (Covering 19IZOOC 101 & 102)	0	0	8	4	40	60	100
19IZOODX4	Project (Dissertation and Viva-Voce)	0	0	12	6	25	75	100
	Total				18			400
	Semesters I-X Total Credits				236			5900
	Value Added Courses							
	Online Courses (SWAYAM, MOOC, NPTEL)							

Note: ' * ' - Non -Credit Compulsory Course (Credit not counted)

L- Lectures; T – Tutorial; P- Practical; C- Credits; CIA- Continuous Internal Assessment; ESE- End-Semester Examination

Note:

1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available. The details of interdepartmental electives are given in the **"Handbook of Interdepartmental Electives-Five Year Programme"** and listed in the University website.
2. Students may opt for any Value-added Courses listed in the University website. The details of Value Added Courses are given in the **"Handbook of Value Added Courses"** and listed in the University website.
3. Guidance/Discussion on course specific **experimental learning** to Students will be provided wherever feasible to apply the knowledge, skills and attitude taught in the course, either within the classroom, within the community, or within the workplace, to learn by experience which would improve their employability skills.

DEPARTMENT ELECTIVE COURSES (DE)

Course Code	Title	L	T	P	C	CIA	ESE	Total Marks
Elective 1								
19IZOOE16	Medical Entomology	3		0	3	25	75	100
19IZOOE17	Bio-Physics	3		0	3	25	75	100
Elective 2								
19IZOOE36	Aquaculture	3		0	3	25	75	100
19IZOOE37	Pisciculture	3		0	3	25	75	100
Elective 3								
19IZOOE57	Bio-informatics	3		0	3	25	75	100
19IZOOE58	Medical Laboratory techniques	3		0	3	25	75	100
Elective 5								
19IZOOE85	Entomology	3		0	3	25	75	100
19IZOOE86	Public Health and Hygiene	3		0	3	25	75	100
Elective- 7								
19IZOOE96	Fisheries & Aquaculture	3		0	3	25	75	100
19IZOOE97	Toxicology	3		0	3	25	75	100

Allied Courses offered to Other Science Department in I and II Semesters

Course Code	Title	L	T	P	C	CIA	ESE	Total Marks
I Semester								
Allied – I 19IZOOA15	Allied Zoology - I Animal Diversity – I	4		0	4	25	75	100
II Semester								
Allied - II 19IZOOA25	Allied Zoology - II Animal Diversity- II	4		0	4	25	75	100
19IZOOP01	Allied practical - I Pre lab Discussion (1 hour) Practical (3 hours) (Covering IZOOA-15 & IZOOA 25)			4	2	40	60	100

ANNAMALAI UNIVERSITY
Department of Zoology
[Question Paper Pattern - INTERNAL TESTS I & II (CIA)]
(Based on Revised Bloom's Taxonomy)

Programme: M.Sc. : Five Year Integrated

Semester: All

Time: 2 Hrs

Max.Marks:50

Part-A (Level-K1)
(Answer ALL of the questions)

Marks: (6x2=12)

1. Define /Choose/ Relate.....
2. What / Why / How?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Match the following i - a ii - b iii - c iv - d v -
6. Match the following i - a ii - b iii - c iv - d v -

Part-B (Level-K2)
(Answer any THREE of the questions)

Marks: (3x5=15)

7. Explain.....
8. Describe.....
9. Select.....
10. Compare

Part-C (Level-K3/ Level-K4)
(Answer any TWO of the questions)

Marks: (2x7=14)

11. Apply....
12. Calculate....
13. Categorize...

Part-D (Level-K5/ Level-K6)
(Answer any ONE of the questions)

Marks: (1x9=9)

14. Discuss....
15. Summarize....

ANNAMALAI UNIVERSITY
[End Semester Examinations]
(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: I/II
Time: 3 Hrs

Semester:
Max.Marks:100

Part-A (Level-K1) _____ **Marks: (15x2=30)**
(Answer ALL of the questions)

1. Define.....
2. What?
3. Choose/Relate.....
4. How?
5. Why?
6. Find.....
7. Spell out.....
8. Multiple Choices a. b. c. d.
9. Multiple Choices a. b. c. d.
10. Multiple Choices a. b. c. d.
11. Multiple Choices a. b. c. d.
12. Match the following i - a ii - b iii - c iv - d v -
13. Match the following i - a ii - b iii - c iv - d v -
14. Match the following i - a ii - b iii - c iv - d v -
15. Match the following i - a ii - b iii - c iv - d v -

Part-B (Level-K2) _____ **Marks: (5x5=25)**
(Answer any FIVE of the questions)

16. Explain.....
17. Describe.....
18. Select.....
19. Classify....
20. Compare....
21. Interpret...

Part-C (Level-K3/ Level-K4) _____ **Marks: (5x7=35)**
(Answer any FIVE of the questions)

22. Apply....
23. Show.....
24. Solve....
25. Calculate....
26. Categorize...
27. Distinguish....
28. Test for.....

Part-D (Level-K5) _____ **Marks: (1x10=10)**
(Answer any ONE of the questions)

29. Discuss....
30. Summarize....

ANNAMALAI UNIVERSITY
[End Semester Examinations]
(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: III
Time: 3 Hrs

Semester:
Max.Marks:100
Marks: (10x2=20)

Part-A (Level-K1)
(Answer ALL of the questions)

1. Define.....
2. What?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Multiple Choices a. b. c. d.
6. Multiple Choices a. b. c. d.
7. Match the following i - a ii- b iii- civ - d v -
8. Match the following i - a ii- b iii- civ - d v -
9. Match the following i - a ii- b iii- civ - d v -
10. Match the following i - a ii- b iii- c iv - d v -

Part-B (Level-K2) **Marks: (5x3=15)**
(Answer any FIVE of the questions)

11. Explain.....
12. Describe.....
13. Select.....
14. Classify....
15. Compare....
16. Outline

Part-C (Level-K3/Level-K4) **Marks: (9x5=45)**
(Answer any NINE of the questions)

17. Apply....
18. Prepare....
19. Show.....
20. Solve....
21. Illustrate.....
22. Sketch....
23. Infer....
24. Categorize...
25. Analyze...
26. Distinguish...
27. Take part in...

Part-D (Level-K5/Level-K6) **Marks: (2x10=20)**
(Answer any TWO of the questions)

28. Discuss....
29. Summarize....
30. Design....

ANNAMALAI UNIVERSITY
[End Semester Examinations]
(Based on Revised Bloom's Taxonomy)

Programme: M.Sc.,; Five Year Integrated PG Year: IV Semester:

Time: 3 Hrs

Max.Marks:100

Part-A (Level-K1/ Level-K2) Marks: (10x2=20)
(Answer ALL of the questions)

1. Define.....
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii- b iii- c iv -d v -
5. Match the following i - a ii- b iii- c iv -d v -
6. Explain.....
7. Select.....
8. Describe.....
9. Classify....
10. Elucidate....

Part-B (Level-K3/ Level-K4) Marks: (8x5=40)
(Answer any EIGHT of the questions)

11. Prepare.....
12. Solve.....
13. Apply.....
14. Show.....
15. Categorize...
16. Analyze...
17. Distinguish....
18. Infer....
19. Compare....
20. Compute

Part-C (Level-K5) Marks: (3x10=30)
(Answer any THREE of the questions)

21. Discuss...
22. Summarize....
23. Evaluate.....
24. Disprove....

Part-D (Level-K6) *Marks: (1x10=10)
(Answer any ONE of the questions)

25. Design....
26. Develop...

i. .

ANNAMALAI UNIVERSITY

All PG in the Faculties of Arts / Sci. / M. Sci. / Ind. Lan. / Edn. / Fine Arts. [2019-20]

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year:V Semester:

Time: 3 Hrs

Max.Marks:100

Part-A (Level-K1/ Level-K2) **Marks: (10x2=20)**

(Answer ALL of the questions)

1. Define.....
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii- b iii- c iv -d v -
5. Match the following i - a ii- b iii- c iv -d v -
6. Explain.....
7. Select.....
8. Describe.....
9. Classify....
10. Elucidate....

Part-B (Level-K3/ Level-K4) **Marks: (6x5=30)**

(Answer any SIX of the questions)

11. Apply.....
12. Show.....
13. Prepare
14. Make use of....
15. Categorize...
16. Analyze...
17. Distinguish....
18. Simplify.....

Part-C (Level-K5) **Marks: (3x10=30)**

(Answer any THREE of the questions)

19. Discuss...
20. Recommend with
21. Evaluate.....
22. Justify....
23. Optimize...

Part-D (Level-K6) ***Marks: (2x10=20)**

(Answer any TWO of the questions)

24. Design....
25. Formulate ...
26. Modify

ANNAMALAI UNIVERSITY													
All PG in the Faculties of Arts / Sci. / M. Sci. / Ind. Lan. / Edn. / Fine Arts. [2019-20]													
[End Semester Examinations]													
Bloom's Taxonomy - Questions Conforming to Levels K1 to K6													
I Year(Five Year PG)				II Year (Five Year PG)				III Year(Five Year PG)					
Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks		
K1	A	15 x 2	30	K1	A	15 x 2	30	K1	A	10 x 2	20		
K2	B	5 x 5	25	K2	B	5 x 5	25	K2	B	5 x 3	15		
K3	C	3 x 7	21	K3	C	3 x 7	21	K3	C	5 x 5	25		
K4		2 x 7	14	K4		2 x 7	14	K4		4 x 5	20		
K5	D	1 x 10	10	K5	D	1 x 10	10	K5	D	1 x 10	10		
			100				100	K6		1 x 10	10		
											100		

IV Year (Five Year PG) I Year (Two/Three year PG)/				V Year (Five Year PG) II/III Year (Two/Three Year PG) /			
Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks
K1	A	5 x 2	10	K1	A	5 x 2	10
K2		5 x 2	10	K2		5 x 2	10
K3	B	4 x5	20	K3	B	2 x 5	10
K4		4 x5	20	K4		4 x 5	20
K5	C	3 x 10	30	K5	C	3 x10	30
K6	D	1 x 10	10	K6	D	2x 10	20
			100				100

Notes:

(i) All QPs of both internal and ESE shall contain four sections of A,B,C & D with the prescribed levels of 'K_i's'.

(ii) Part - A has no choice.

(iii) Open Choice is followed for Parts B, C and D.

(iv) No choice for MBA Programme in Part D as to the Case Study question is concerned.

(v) Actions verbs are appended for reading/reference and as guidelines for adherence.

PROGRAMME OUTCOMES (POs)

At the end of the programme, the student will be able to

PO1:	Domain knowledge: Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline.
PO2:	Resource Utilisation. Cultivate the skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge-base and stay abreast of recent developments.
PO3:	Analytical and Technical Skills: Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.
PO4:	Critical thinking and Problem solving: Identify and critically analyse pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions.
PO5:	Project Management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational skills and the ability to manage time and resources.
PO6:	Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.
PO7:	Effective Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.
PO8:	Environment and Society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
PO9:	Ethics: Commitment to professional ethics and responsibilities.
PO10:	Life-long learning: Ability to engage in life-long learning in the context of the rapid developments in the discipline.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

After the successful completion of the M.Sc. Zoology (5 year) Degree Programme, the graduates will be able to:

PSO1	To ensure that the candidate after successfully completing the master's degree in Zoology is well versed in subjects related to the programme and are able to impart knowledge to the concerned sections of the society.
PSO2	To acquire skills in utilizing the fundamental knowledge gained in various fields of biological sciences in teaching learning activities.
PSO3	To analyze biological problems professionally with a scientific temperament and research attitude and also to think logically in a scientific way to solve biological issues that they may come across.
PSO4	To critically evaluate and interpret biological data and to acquire skills in modern tools and techniques in biological field to take up jobs in teaching/research/clinical/Biotechnology/animal husbandry and environment related establishments.
PSO5	To analyze environmental issues and contribute to words environmental protection, bio-sustainability and biodiversity and also to apply the scientific knowledge in guiding the society in maintaining public health and hygiene and thereby avoiding spreading of diseases.

FIRST YEAR

Semester	19ITAMC11: Part-I Language நவீனஇலக்கியமும்நாடகமும்	L	T	P	C
I		3	0	0	3

Learning Objective (LO): கற்றலின்நோக்கம்

LO1	தமிழில்தோன்றியநவீனஇலக்கியங்கள்குறித்துஅறிமுகம்செய்தல்.
LO2	நவீனஇலக்கியங்கள்குறித்தவரையறை - தோற்றப்பின்னணி
LO3	நவீனஇலக்கியவகைகள் - உரைநடை - புதுக்கவிதை - செய்தித்தாள்
LO4	நாடகம்போன்றவற்றின்வரலாற்றைவிளக்குதல்.

Course Outcomes (CO): கற்றல்வெளிப்பாடு

At the end of the course, the student will be able to

CO1	நவீனஇலக்கியங்கள்நாடகஇலக்கியங்கள்குறித்தஅறிதலைப் பெறுவததோடுதமிழ்இலக்கியங்களில்நீட்சியைப்புரிந்துகொள்வர்
CO2	தற்காலஇலக்கியங்கள்எவ்வாறுசமூகத்தைஎடுத்துக்காட்டுகின்றன என்பதைவிளங்கிகொள்வர்
CO3	நவீனஇலக்கியங்களின்வழிவாழ்வியல்கருத்துக்களைஅறிந்து வாழ்க்கையில்பின்பற்றுவார்கள்

அலகு - 1 சிறுகதை

- | | |
|-------------------------|-----------------------|
| 1. புதுமைப்பித்தன் | - பால்வண்ணம்பிள்ளை |
| 2. கி.ராஜநாராயணன் | - கதவு |
| 3. கு.அழகிரிசாமி | - ராஜாவந்திருக்கிறார் |
| 4. கண்மணிகுணசேகரன் | - உயிர்த்தண்ணீர் |
| 5. மேலாண்மைபொன்னுச்சாமி | - தேசியமயில் |

அலகு - 2 புதுக்கவிதை

- | | |
|----------------------|-----------------------------------|
| 1. பாரதியார் | - புதுமைப்பெண் |
| 2. பாரதிதாசன் | - தமிழ்உணவு |
| 3. உவமைக்கவிஞர்சுரதா | - தமிழில்பெயரிடுங்கள் (துறைமுகம்) |

4. தேவதேவன் - புகட்டல்
(அமுதம்மாத்திரமேவெளிப்பட்டது)
5. அறிவுமதி - நட்புக்காலம் (முதல் 20-
கவிதைகள்மட்டும்)
6. மித்ரா - ஹைகூளந்தோழி
(முதல் 20- கவிதைகள்மட்டும்)

அலகு - 3 புதினம்

1. டி.செல்வராசு - பொய்க்கால்குதிரை

அலகு - 4 நாடகம்

1. இன்குலாப் - ஓளவை

அலகு - 5 இக்காலஇலக்கியவரலாறு

ஐரோப்பியர்வருகை - நவீனஇலக்கியங்கள்அறிமுகம் - புதுக்கவிதை - சிறுகதை
- புதினம்ஆகியவற்றின்தோற்றமும்வளர்ச்சியும் - இலக்கியமுன்னோடிகள் -
செய்தித்தாள்வருகை - நாடகம் - தோற்றமும்வளர்ச்சியும்.

(மாணவர்கள்அறிந்துகொள்வதற்குமட்டும் - தேர்வுக்கானபகுதிஅல்ல)

இலக்கியங்களையும்அவைதொடர்பானஇலக்கியவரலாற்றையும்இணைத்துப்
படித்தல்.

நவீனஇலக்கியங்கள்சமூகத்தைப்படம்பிடித்துக்காட்டுவதைசமூகக்கண்ணோட்
டத்தோடுஅறிதல்.

நவீனஇலக்கியவடிவங்களின்வளர்ச்சிவாழ்வியலுக்குப்பயன்படும்முறையை
விளக்குதல்.

பாடநூல்கள்

1. புதுமைப்பித்தன் - பால்வண்ணம்பிள்ளை
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
ஐந்தாம்பதிப்பு - 2015
2. கி.ராஜநாராயணன் - கதவு
அன்னம்வெளியீடு,
தஞ்சாவூர், ஏழாம்பதிப்பு - 2015
3. கு.அழகிரிசாமி - ராஜாவந்திருக்கிறார்
காலச்சுவடுபதிப்பகம், நாகர்கோயில்
முதற்பதிப்பு -2012
4. கண்மணிகுணசேகரன் - உயிர்த்தண்ணீர்
தாமரைச்செல்விபதிப்பகம்
சென்னை, முதற்பதிப்பு- 1997

5. மேலாண்மைபொன்னுச்சாமி - தேசியமயில்
வானதிபதிப்பகம், சென்னை
முதற்பதிப்பு - 1997
6. பாரதியார் - பாரதியார்கவிதைகள்
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு - 2014
இரண்டாம்பதிப்பு- செப்டம்பர்- 2017
7. பாரதிதாசன் - பாரதிதாசன்கவிதைகள்
மணிவாசகர்பதிப்பகம், சென்னை
ஏழாம்பதிப்பு -2016
8. உவமைக்கவிஞர்சுரதா - துறைமுகம்
சுவாதிபதிப்பகம்,
அம்பத்தூர், சென்னை, முதற்பதிப்பு 2010
9. தேவதேவன் - அமுதம்மாத்திரமேவெளிப்பட்டது
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு - 2016
10. அறிவுமதி - நட்புக்காலம்
கவிதாபதிப்பகம், சென்னை
எட்டாம்பதிப்பு-2005
11. மித்ரா - மித்ராகவிதைகள்
சாரல்வெளியீடு, சென்னை
முதற்பதிப்பு, 1990
12. டி.செல்வராசு - பொய்க்கால்குதிரை
நியூசெஞ்சரிபுக்ஹவுஸ், சென்னை
முதற்பதிப்பு - 2014
13. இன்குலாப் - ஓளவை
அகரம்பதிப்பகம், தஞ்சாவூர்
ஐந்தாம்பதிப்பு - 2015
14. ச.வே.சுப்பிரமணியன் -தமிழ்இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம்
சென்னை, ஏழாம்பதிப்பு- 2015
15. சோ.நா. கந்தசாமி -தமிழ்இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம்
சென்னை, முதற்பதிப்பு- 2004

பார்வைநூல்கள் :

1. வல்லிகண்ணன் - புதுக்கவிதையின்தோற்றமும்வளர்ச்சியும்
பாரிநிலையம், சென்னை-108
முதற்பதிப்பு- 2008
2. க. கைலாசபதி - தமிழ்நாவல்இலக்கியம்
குமரன்பதிப்பகம்
வடபழனிசென்னை
முதற்பதிப்பு- 1968, மறுபதிப்பு 2010
3. கார்த்திகேசசிவதம்பி - தமிழில்சிறுகதைதோற்றமும்
வளர்ச்சியும், நியூசெஞ்சரி, புத்தகநிலையம்,
சென்னை- 98, முதற்பதிப்பு- 2013
4. ஆறு. அழகப்பன் - தமிழ்நாடகத்தோற்றமும்வளர்ச்சியும்
பாரிநிலையம், சென்னை, மு.ப. 2011
5. சு. சக்திவேல் - இருபதாம்நூற்றாண்டுத்தமிழ்உரைநடை
மணிவாசகர்பதிப்பகம், சிதம்பரம்-2010

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2	0	0	0	0	0	0	0	0	0	3	2	3	3	3
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	2	2	3	3
CO3	3	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	3

*1-Low *2-Medium *3-Strong

Semester	19IHINC11: Part-I Language Hindi-I	L		P	C
I		3		0	3

Learning Objective (LO):

LO1	To know the Hindi terms for various professions.
LO2	To gain knowledge of poem and prose
LO3	To help the student to learn the importance of the moral, spiritual and human values
LO4	To study short stories and imbibe morals
LO5	To know about national leaders

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic structure of poems.
CO2	Knowledge on various common Hindi words.
CO3	Describe the basic concepts of moral stories.
CO4	Apply the concepts in life.
CO5	Analyze the difference between prose and poem.

Unit - I: Introduction

Mathruvandana (poem), peshwar, chalo bazaar chalo, ahimsa kivijay

Unit - II: Poem, Prose

Balwanbano, Gandhiji keasheram me chor,

Unit - III: vani ka theer, Bharth, daku se mahatma.

Unit - IV: chandhini, samaykipabandhi, vitamin.

Unit - V: Rajiv Gandhi, titiali (poem), Bangalore.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations. Understanding on Hindi drama basis and concepts and nibandh.

Text Books

1. Adharshahindi reader I-DBHPSabha-Chennai.17.
2. ParichyaDBHPS ,Trichi 17.

Supplementary Reading

1. Naveen Hindi Patamala: Part - I, D.B.H.P. Sabha, Chennai - 600 017.
2. Hindi prachar vahini.1, DHBS, sabha Chennai 17.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	0	2	3	2	2	3	2	3	3	3	3	3	0	0	0
CO2	3	0	2	0	3	0	2	3	0	3	0	0	0	0	0
CO3	3	2	0	0	2	3	0	2	3	0	0	0	2	0	0
CO4	3	3	3	3	3	0	3	3	2	2	2	0	0	2	0
CO5	0	0	2	3	3	3	3	0	2	2	2	0	0	0	3

Semester	19IENGC12:	L	T	P	C
I	ENGLISH THROUGH LITERATURE I: PROSE	3	0	0	3

Learning Objective (LO):

LO1	Develop the Language ability of the students
LO2	Enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing
LO3	Make the students proficient in the four language skills
LO4	Make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice.
LO5	Develop their inquiry skills.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Obtain competency in communication, both in written and oral skills
CO2	Acquire fluency in English language
CO3	Become knowledgeable about construction of sentence structures
CO4	Develop English vocabulary to use the English language effectively
CO5	Exhibit proficiency in the four communication skills

Unit I

Stephen Leacock "With the Photographer"
Winston S. Churchill "Examinations"
Grammar: Parts of Speech: Nouns, Verbs, Adjectives, and Adverbs

Unit II

G.B. Shaw "Spoken English and Broken English"
M.K. Gandhi "Voluntary Poverty"
Grammar: Articles

Unit III

Robert Lynd "On Forgetting"
Virginia Woolf "Professions for Woman"
Grammar: Pronouns

Unit IV

A. G. Gardiner
R.K. Narayan
Grammar:

“On Umbrella Morals”
“A Snake in the Grass”
Prepositions

Unit V

Martin Luther King (Jr.)
George Orwell
Grammar:

“I Have a Dream”
“The Sporting Spirit”
Conjunctions & Interjections

Text Book:

1. Ayyappa Raja, S T. Deivasigamani. N. Saravana Prabhakar, B .Karthikeyan. (2010). *English through Literature: Prose*, Manibharathi Publishers, Chidambharam.
2. David Green (2012). *Contemporary English Grammar: Structures and Composition*, Macmillan.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	0	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO2	0	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO3	3	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	3
CO4	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO5	2	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2

*1-Low *2-Medium *3-Strong

Semester	19IENSC13: ENVIRONMENTAL STUDIES	L	T	P	C
I		3	0	0	3

Learning Objective (LO):

LO1	To make the student aware of World Environmental System
LO2	To make the student aware of the fundamental Concepts and Principles of Ecosystem and energy flow

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Evaluate the present condition of environmental pollution
CO2	Understand the nature of the atmosphere
CO3	Aware of causes of pollution and precautionary measure

UNIT - I: ENVIRONMENTAL SYSTEM

- (1.1) The Services provided by the Environmental System
- (1.2) Ecosystems: Food Chains, Food Webs, Ecological Pyramids
- (1.3) Biochemical Cycles: Hydrological Cycle, Carbon Cycle

UNIT – II: ENVIRONMENTAL DAMAGE –POLLUTION

Sources and impact of

- (2.1) Air Pollution
- (2.2) Water Pollution
- (2.3) Land Pollution
- (2.4) Municipal Solid Waste (2.5) Noise Pollution

UNIT – III: RESOURCE DEPLETION

- (3.1) Importance of Forests: Causes and Consequences of Deforestations
- (3.2) Bio Diversity: Meaning and Importance – Reasons and Consequences of Biodiversity Decline
- (3.3) Consequences of overdrawing Water Resources.

UNIT – IV: GLOBAL CLIMATE CHANGE

- (4.1) The Science of Climate Change The Green House Effect (4.2) Sources and Impact of Climate Change (4.3) Coping with Climate Change

UNIT – V: SUSTAINABLE DEVELOPMENT

- (5.1) Concept and Definition of Sustainable Development (Brundtland Commission Definition)
- (5.2) Poverty, Population Growth and Environmental Damage
- (5.3) Policies for Sustainable Development

❖ **CURRENT STREAM OF THOUGHTS**

For Knowledge Purpose and not for Examinations

Current issues in environmental eco system Effects, Climate Change and Global Warming.

TEXT BOOKS

1. Erach Bharucha, (2004). *Environmental Studies*, UGC, New Delhi.
2. Richard Wright and Dorothy F. Boorse, (2010). *Environmental Science: Toward a Sustainable Future*, Prentice-Hall, New Delhi, India.

SUPPLEMENTARY READINGS

1. Kumarasamy, K., A. Alagappa Moses and M. Vasanthy, (2004). *Environmental Studies*, Bharathidasan University Publications, Trichy.
2. Rajamannar, V. (2004). *Environmental Studies*, EVR College Publications, Trichy.
3. Kalavathy, S. (Ed), (2004). *Environmental Studies*, Bishop Heber College Publication, Trichy.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	0	3	0	0	0	0	3	2	2	3	0	0	0	0	3	2	3
CO2	0	3	0	0	0	0	2	2	2	3	0	0	0	0	3	2	3
CO3	0	3	0	0	0	0	2	2	2	3	0	0	0	0	3	2	3

***1-Low *2-Medium *3-Strong**

Semester	19IZOOC14: INVERTEBRATA- I	L	T	P	C
I		4	0	0	4

Learning Objective (LO):

LO1	To learn lower invertebrate diversity
LO2	To learn the classification of lower invertebrate upto orders
LO3	To learn the morphological features, physiology and reproduction in invertebrates

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the diverse forms of lower invertebrates
CO2	Identify common protozoans
CO3	Identify common coelenterates and ctenophore
CO4	Understand common parasitic platyhelminthes and nematodes and also Classify lower invertebrate up to orders based on morphological characters

Unit – 1: Non- chordates

Principles of classification – salient features and classification up to orders in non-chordates. Structural organization in different classes of non- chordates.

Unit – 2: Protozoa

Protozoa – salient features and classifications up to orders: Type study - Amoeba and Paramecium - Locomotion, osmoregulation, nutrition and reproduction.

Unit – 3: Porifera

Porifera – salient features and classifications up to orders: Type study – *Leucosolenia* and Sycon Sponge, Origin of metazoa – metamerism and symmetry.

Unit - 4: Coelenterata and Ctenophora

Coelenterata – salient features and classifications up to orders: Type study- *Obelia* and *Aurelia*- alternation of generation – Polymorphism in Hydrozoa.

Ctenophora - salient features and classifications up to orders: Type study – *Pleurobranchia* and *Ctenoplana* and affinities.

Unit–5: Platyhelminthes and Nematelminthes

Platyhelminthes – salient features and classification up to orders: Type study - Tapeworm – reproduction and parasitic adaptations.

Nematoda – salient features and classifications up to orders: Type study – *Ascaris*.

Current Streams of Thought (Not for final exam): Advances in invertebrate - Invertebrate symbiosis – social behavior of invertebrates – Reproduction strategies - invertebrate behavior .

PRACTICAL

1. Examination of *Paramecium*, *Amoeba*, *Euglena*
2. Study of specimens: *Sycon*, *Hylonema* and *Spongilla*
3. Study of Specimens: *Hydra*, *Obelia*, *Aurelia*, *Sea Anemone*, *Gargonia*.
4. Study of Specimens: *Fasciola* and *Taenia*
5. Study of Slides and specimen of *Ascaris*

TEXT BOOKS

1. Arumugam, N., T. Murugan, B. Ramanathan and M.G Ragnathan. (2019). *A Text Book of Invertebrates*, Saras Publications, Nagercoil, Tamil Nadu.
2. Ekambaranatha Ayyar .M., (1973). *A Manual of Zoology – Part I, Invertebrata*. S. Viswanathan Printers and Publishers Pvt., Ltd., Madras.
3. Jordon, E.L. and P.S Verma, (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi
4. Adam Sedgwick, (1960). *A student's text book of Zoology, Vol. I & III*, General Book Depot, Allahabad.
5. Hyman, L.H. (1951). *The Invertebrates, Vol. I*, McGraw Hill Book Co., New York.
6. Kotpal.R.L., (2017). *Modern Text book of Zoology-Invertebrata, (Animal Diversity- I)*. Rastogi Publications, New Delhi.

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume -1 – Invertebrata*. Saras Publication, Nagercoil, Tamil Nadu
- 2) Fatik Baran. (2012). *Invertebrate Zoology*. Prentice Hall of India Pvt. Ltd., New Delhi.
- 3) Barrington E.J.W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
- 4) Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates*. **Oxford University Press**, USA.
- 5) Clarkson E.N.K. (2011). *Invertebrate Palaeontology and Evolution*. Wiley India Pvt. Ltd., New Delhi

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	1	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

SEMESTER	19IBOTA01: ALLIED – I: BOTANY I: PLANT DIVERSITY, ANATOMY AND EMBRYOLOGY	L	T	P	C
I		4	0	0	4

Learning Objective (LO):

LO1	To acquire basic knowledge in Plant Science
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Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the structure and reproduction of bacteria
CO2	Appreciate the diverse Algae & Fungi groups and their characteristic features
CO3	Comprehend the structure and reproductions of Bryophytes, Pteridophytes and Gymnosperms
CO4	Understand the anatomy of vascular plants
CO5	Understand the structure and types of embryo of seed plants

Unit – 1

General account of bacteria – ultrastructure, nutrition and nutritional types, reproduction- asexual and parasexual. Economic importance

Viruses: Structure- ultrastructure of TMV, bacteriophage, reproduction of viruses.

Unit – 2

Structure, Reproduction and Life history of *Nostoc*, *Oedogonium*, *Ectocarpus* and *Polysiphonia*, *Albugo*, *Pencillium* and *Agaricus*.

Unit – 3

Structure, reproduction and life history of *Funaria*, *Lycopodium* and *Cycas*.

Unit – 4

Anatomy – simple and complex tissues, Internal structure of dicot root, stem and leaf - monocot stem and leaf. Normal secondary thickenings of dicot stem.

Unit – 5

Embryology – Microsporogenesis – male gametophyte, Megasporogenesis (*Polygonum* Type) – types of ovule, double fertilization, Types of endosperms.

Practicals:

1. To make suitable micropreparations, describe and identify the specimens of Algae, Fungi, Bacteria, Viruses, Bryophytes, Pteridophytes and Gymnosperms prescribed in theory syllabus.
2. Study of Anatomical features of leaf, stem and root of dicots and monocots
3. Study of different types of anther, LS of ovule.

Text Books:

1. Bhojwani, S.S and Bhatnagar, S.P. (2015). *Embryology of Angiosperms*. Vikas Publications PVT Ltd., New Delhi.
2. Pandey, S.N. (2009). *Plant Anatomy*. S. Chand & Company, New Delhi
3. Sambamoorthy, A.V.S.S. (2005). *A Textbook of Algae*. I.K.International, Pvt. Ltd., New Delhi.
4. Sharma,O.P. (2007). *Textbook of Algae*. Tata McGraw Hill Publications Pvt. Ltd, New Delhi.
5. Vashista, B.R. (2014). *Textbook of Fungi*. S. Chand & Company, New Delhi
6. Vashista, B.R., A.K.Sinha and Adarsh Kumar. (2011). *Botany for Degree students- Bryophyta*. S.Chand & Company, New Delhi.
7. Vashista, B.R. (2015). *Textbook of Pteridophyta*. S. Chand & Company, New Delhi.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO2	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO3	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO4	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO5	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0

Semester	19ITAMC21: பக்திஇலக்கியமும்சிற்றிலக்கியமும்	L	T	P	C
II		3	0	0	3

Learning Objective (LO): கற்றலின்நோக்கம்

LO1	தமிழ்ப்பக்திஇலக்கியங்களையும்சிற்றிலக்கியங்களையும் அறிமுகம்செய்தல்.
LO2	பக்திஇலக்கியத்தின்செல்வாக்கு - தோற்றம்வளர்ச்சி - பாகுபாடு
LO3	தமிழின்தனித்தன்மையைஉணர்த்தியபாங்குபோன்றவற்றை வரலாற்றுடன் விளக்குதல்.

Course Outcomes (CO): கற்றல்வெளிப்பாடு

At the end of the course, the student will be able to

CO1	பக்திஇலக்கியங்களால்தமிழ்மொழிஅடைந்த சிறப்புத்தன்மையான நெகிழ்வுத்தன்மைஅறிந்திருப்பர்.
CO2	பக்திஇலக்கியங்களில்சுறப்பட்டதத்துவங்களின்வழிவாழ்வியல் நெறிமுறைகளைப்பின்பற்றுவர்.
CO3	பக்திஇலக்கியங்களில்சுறப்பட்டக்கருத்துக்களைசமூக மற்றும்உலக அமைதியைநிலைநாட்டப்பயன்படுத்துவர்.

அலகு- 1 பக்திஇலக்கியம்

- | | |
|---------------------|--|
| 1. திருஞானசம்பந்தர் | - திருநள்ளாறு - பச்சைப்பதிகம் (முதல் 5 பாடல்கள்) |
| 2. திருமூலர் | - திருமந்திரம் (உடம்பினை முன்னை, யாவர்க்குமாம், ஒன்றேகுலமும், உள்ளம் பெருங்கோயில், ஆர்க்கும்எனத் தொடங்கும்பாடல்கள்) அறிவுநிலை (5 பாடல்கள்) |
| 3. சிவவாக்கியர் | |

அலகு - 2 பக்திஇலக்கியம்

- | | |
|-------------|---|
| 1. ஆண்டாள் | - திருப்பாவை (முதல் 5 பாடல்கள்) |
| 2. வள்ளலார் | - திருவருட்பா - பிள்ளைச்சிறு விண்ணப்பம் |

அலகு - 3 பக்திஇலக்கியம்

1. தேம்பாவணி - குழவிகள்வதைப்படலம்
2. சீறாப்புராணம் - மானுக்குப்பிணைநின்றபடலம்

அலகு - 4 சிற்றிலக்கியம்

1. குற்றாலக்குறவஞ்சி - மலைவளம் (வானரங்கள்... பாடல் முதல்)
2. முக்கூடற்பள்ளு - நாட்டுவளம்

அலகு - 5 இலக்கியவரலாறு

- பக்திசிற்றிலக்கியவரலாறு - இடைக்காலத்தமிழகச்சூழல் -
சைவவைணசமயங்களின்செல்வாக்கு - சமணபௌத்தசமயஇலக்கியங்கள் -
கிறித்துவஇசுலாம்இலக்கியங்கள் -
நாயக்கர்காலச்சிற்றிலக்கியங்கள்தோற்றபின்னணி - சிற்றிலக்கியவகை.

(மாணவர்கள் அறிந்துகொள்வதற்குமட்டும் - தேர்வுக்கானபகுதி அல்ல)

இலக்கியங்களையும் அவைதொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப்படித்தல். பக்தி இலக்கிய வளர்ச்சியில் தமிழ்ப்பனுவல்களில் ஏற்பட்ட வளர்ச்சியைச்சுட்டிக்காட்டுதல். மனிதமனத்தைபண்படுத்தவும், சமூக அமைதியை நிலைநாட்டவும், உலக நல்லிணக்கம் காணவும் பக்தி இலக்கியம் பயன்படுமாற்றை விளக்குதல்.

பாடநூல்கள்:

1. ச.வே.சுப்பிரமணியன்(ப.ஆ)- பன்னிருதிருமுறைகள்
மணிவாசகர்பதிப்பகம், சென்னை
மூன்றாம்பதிப்பு - 2010
2. ச.வே.சுப்பிரமணியன் (ப.ஆ) நாலாயிரத்திவ்யபிரபந்தங்கள்
முல்லைநிலையம்
சென்னை-17
முதற்பதிப்பு - 2000, இரண்டாம்
பதிப்பு 1996
3. சித்தர்பாடல்கள்
மணிவாசகர்பதிப்பகம், சென்னை
இரண்டாம்பதிப்பு - 1996
4. வள்ளலார் திருவருட்பா,
அண்ணாமலைப் பல்கலைக்கழகப்
பதிப்பு அண்ணாமலைநகர்
5. வீரமாமுனிவர் தேம்பாவணி
பாரிநிலையம்,
சென்னை - 8
முதற்பதிப்பு - 2010
6. உமறுப்புலவர் சீராப்புராணம்
நேஷனல்பதிப்பகம்
சென்னை

முதற்பதிப்பு – 2004

7. திரிகூடராசப்பக்கவிராயர் - குற்றாலக்குறவஞ்சி
பாவைபதிப்பகம்
சென்னை
இரண்டாம்பதிப்பு – 2014
8. - முக்கூடற்பள்ளு
பாரிநிலையம்
சென்னை -108 , மறுபதிப்பு – 2015

பார்வைநூல்கள்

1. ந.வீ.செயராமன் சிற்றிலக்கியச்செல்வம்
மணிவாசகர்பதிப்பகம், சென்னை.
முதற்பதிப்பு- 1968.
2. ந.வீ. செயராமன் பள்ளுஇலக்கியம்
மணிவாசகர்பதிப்பகம், சென்னை.
முதற்பதிப்பு- 1980.
3. கோ.கேசவன் - பள்ளுஇலக்கியம்ஒருசமூகவியல்
பார்வை அன்னம்வெளியீடு, தஞ்சாவூர்
- 1981.
முதற்பதிப்பு - 1981
4. ச.வே.சுப்பிரமணியன் - தமிழ்இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம், சென்னை.
ஏழாம்பதிப்பு - 2010
5. சோ.நா.கந்தசாமி - தமிழ்இலக்கியவரலாறு
மணிவாசகர்பதிப்பகம், சென்னை.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2	0	0	0	0	0	0	0	0	0	3	2	3	3	3
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	2	2	3	3
CO3	3	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	3

*1-Low *2-Medium *3-Strong

Semester	19IHINC21: Part-I Language Hindi-II	L	T	P	C
II		3		0	3

Learning Objective (LO):

LO1	To know the life of National leaders.
LO2	To introduce the Gandhiji's thought.
LO3	To understand the concepts of teaching and learning from Dr.Sarvapalli Radhakrishnan's life.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic structure of poem and prose.
CO2	Classify and compare various poems.
CO3	Describe the basic concepts of moral stories.
CO4	Apply the teachings of various national leaders.
CO5	Understand the spirit of spirituality.

Unit - I: Introduction

man ki shakti dena, prathighnapalan, hamaraRajchinga, adhbhudmaya.

Unit - II: Poem ,Prose

sarvapalliradhakrishnan, amedkar, mahaveer, sadakkeniyam, sanghi ka phal (poem).

Unit - III: Stories.

Tyog ka such,bhavansabkaekhai,chirjivan ka jharna, , lob ka parinam.

Unit - IV: dadhakimoorkatha, kuthekipoonchandebardhana.

Unit - V: bakri do ghav kha gayi, ,Dhankimagima,

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Naveen Hindi Patamala: Part - II D.B.H.P. Sabha, Chennai - 600 017.
2. Manohar Kahaniyam , Part – II D.B.H.P. Sabha, Chennai - 600 017.

Supplementary Reading

1. Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2. Hindipracharbodhini-DHBS, Chennai 17

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	0	2	3	2	2	3	2	3	3	3	3	3	0	0	0
CO2	3	0	2	0	3	0	2	2	0	3	0	0	0	0	0
CO3	3	2	0	0	2	3	0	2	3	0	0	0	2	0	0
CO4	3	3	3	3	3	0	3	0	2	2	2	0	0	2	0
CO5	0	0	2	3	3	3	3	2	2	2	2	0	0	0	3

Semester	19IENGC22: English Through Literature II: Poetry	L	T	P	C
II		3	0	0	3

Learning Objective (LO):

LO1	Develop the ability of the learner to comprehend and appreciate poems in English
LO2	Enhance the competence of the learner in using the English language
LO3	Improve the interest of the learner in human values and perceptions
LO4	Enable students to study and analyze the use of language in poetry
LO5	Provide learners with the theoretical and practical understanding of grammar

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Become competent in communication, both in written and oral skills
CO2	Gain fluency in English language
CO3	Attain knowledge about construction of sentence structures
CO4	Acquire the vocabulary to use the English language effectively
CO5	Acquire the aesthetic sense for appreciating poetry

Unit I

William Shakespeare	“Sonnet 116”
William Blake	“Lamb”
Robert Burns	“A Red, Red Rose”
Grammar	Finite & Non-finite verbs

Unit II

PB Shelley	“To Wordsworth”
John Keats	“Sonnet to Sleep”
Thomas Hardy	“Neutral Tones”
Grammar	Strong and Weak Verbs, Auxiliaries and Modals

Unit III

Robert Frost	“Stopping By Woods on a Snowy Evening”
Wilfred Owen	“Anthem for Doomed Youth”

Emily Dickinson "A Narrow Fellow in the Grass"
 Grammar Transitive, Intransitive Verbs, Active and Passive Voice

Unit IV

Sri Aurobindo "The Tiger and the Deer"
 AK Ramanujan "Obituary"
 Sarojini Naidu "Queen's Rival"
 Grammar Concord

Unit V

Roger Mc Gough "My Bus Conductor"
 Maya Angelou "Still I Rise"
 Langston Hughes "The Negro Speaks of Rivers"
 Grammar Tenses and their forms

TEXT BOOKS

1. Jack.Hydes, (1985). *Touched With Fire*. Cambridge UP, London.
2. C. D Narasimhaiah, (2006). *An Anthology of Common Wealth Literature*. Macmillan, New Delhi.

SUPPLEMENTARY READING

1. Thomas, C.T., (2006). *Twentieth Century Verse: An Anglo-American Anthology*. Macmillan, New Delhi.
2. Henry Louis, and Y. Nellie McKay. (2004). *The Norton Anthology of African American Literature*. W.W. Norton & Co, New York.
3. Ramachandran, C.N. and Radha Achar. (1998). *Five Centuries of Poetry*. Laxmi, New Delhi.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO2	2	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO3	3	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2
CO4	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO5	2	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2

*1-Low *2-Medium *3-Strong

Semester	19ICISC023: COMPUTER APPLICATIONS - I	L	T	P	C
II		3	0	0	3

Learning Objective (LO):

LO1	To Study the Fundamentals Concepts of Computers and Operating Systems.
LO2	To get familiar with basics of the Internet Programming.
LO3	To acquire knowledge and skills for creation of web site considering both client and server side programming.
LO4	To explore different web extensions and web services standards and ability to develop responsive web applications.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Describe the usage of computers and why computers are essential components in business and society.
CO2	Solve common business problems using appropriate Information Technology applications and systems.
CO3	Identify categories of programs, system software and applications. Organize and work with files and folders and utilize the Internet Web resources and evaluate on-line e-business system.
CO4	Design a responsive web site using HTML5 and demonstrate Rich Internet Application.

Unit – 1: Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output devices, data storage devices, software, the definition, the role of software, House keeping.

Unit – 2: The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software. Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – 3: Introduction to internet, client sever basics, E-mail, Telnet and Archie, FTR – Gopher, Jug head and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – 4: Issues involved in web site management, addressing, designing web sites with front page.

Unit – 5: Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies, fundamental and use of hypertext, hypermedia, sound, images, animation, video. Using multimedia, multimedia interface, planning and development of multimedia projects.

Text Books:

1. Sanjay Saxena, (2015). *“A first course in computers”*, Vikas Publishing House, New Delhi.
2. Alexies Leon and Mathews Leon *“Internet in a nutshell”* Leon Press, Chennai and Vikas Publishing House, New Delhi.
3. Tay Vaughan (1999). *“Multimedia Making it work”*, Osborne, Tata McGraw Hill.

Reference Books:

1. Ron Mansfield, (1997), *“Windows 95 for Busy People”*, Osborne, McGraw Hill.
2. Krishnan, *“Computer fundamentals and Windows with Internet Technology”*, Scitech Publications Pvt. Ltd., Chennai, India.
3. Krishnan, *“Windows and MS-Office 2000 with database concepts”*, Scitech Publications Pvt. Ltd., Chennai, India.

Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3	0	1	3	2	0	2	0	2	3	0	0	3	1	0	3	0	2
CO2	3	2	3	0	0	0	0	3	0	2	0	0	0	0	0	3	1	0
CO3	0	0	3	0	3	0	1	0	0	0	0	0	2	3	0	0	0	1
CO4	3	2	0	3	2	1	0	3	0	0	0	0	3	9	0	3	3	0

Semester	19IZOOC24 INVERTEBRATA- II	L	T	P	C
II		4	0	0	4

Learning Objective (LO):

LO1	To learn higher invertebrate diversity
LO2	To learn the salient features of higher invertebrates
LO3	To learn the classification of higher invertebrate up to orders
LO4	To learn the various organ systems in higher invertebrates

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the diversity and significance of higher invertebrates
CO2	Identify higher invertebrates up to order based on morphological features
CO3	Understand the various salient features of annelids
CO4	Identify and explain onychopora and arthropods and also Identify and differentiate various echinoderms

Unit – 1: Annelida

Annelida- Salient features - Classification up to orders: Type study- Earthworm, Nereis, Leech – Coelom and excretory system –adaptive radiation in polychaetes.

Unit - 2: Onychopora

Onychopora – Salient features – Classification up to orders: Type study - *Peripatus* and affinities

Unit - 3: Arthropoda

Arthropoda – Salient features – Classification up to orders: Type study- *Palaemon* and Grasshopper; *Limulus* and its affinities.

Unit - 4: Mollusca

Mollusca- Salient features – classification up to orders: Type study- Fresh water Mussel and Sepia; Torsion in Mollusca, Foot in Mollusca, Shells in Mollusca.

Unit - 5: Echinodermata

Echinodermata – Salient features - classification up to orders - Type study – *Asterias* – Echinoderm larvae and significance.

PRACTICAL

1. Dissection of Cockroach- Internal organs and mounting of mouth parts.
2. Dissection of Prawn- digestive system and Nervous system and mounting of appendages.
3. Dissection of Earthworm – Internal organs.
4. Pila –dissection of internal organs.
5. Transverse sections of Leech and Earthworm (slides).
6. Mounts of Radula, Ctenidium.
7. Echinoderm – specimen study.
8. Spiders, Ticks and Mites-specimen study.
9. Minor phyla - specimen study.

TEXT BOOKS

1. Ekambaranatha Ayyar .M., (1973). *A Manual of Zoology – Part-I, Invertebrata*. S.Viswanathan (Printers and Publishers) Pvt. Ltd., Madras.
2. Jordon, E.L and P.S Verma (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
3. Adam Sedgwick, (1960). *A Students Text Book of Zoology*, Vol. I, II &III. General Book Depot, Allahabad.
4. Hyman, L.H. (1951). *The Invertebrates*, Vol I & II, McGraw Hill Book Co., London.
5. Kotpal.R.L., (2017). *Modern Text Book of Zoology, Invertebrata (Animal Diversity II)*. Rastogi Publications, New Delhi).

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume -1 – Invertebrata*. Saras Publication, Nagercoil, Tamil Nadu
- 2) Fatik Baran. (2012). *Invertebrate Zoology*. Prentice Hall of India Pvt. Ltd., New Delhi.
- 3) Barrington E.J.W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
- 4) Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates*. Oxford University Press, USA.
- 5) Clarkson E.N.K. (2011). *Invertebrate Palaeontology and Evolution*. Wiley India Pvt. Ltd.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	1	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	1	2	3	3	3	3	3	2	3	3	2

SEMESTER	19IBOTA02: ALLIED – I: BOTANY II: TAXONOMY, PHYSIOLOGY, ECOLOGY AND BIOTECHNOLOGY	L	T	P	C
II		4	0	0	4

Learning Objective (LO):

LO1	To understand the principles, classification and salient features of Angiosperm families.
LO2	To understand the physiology and ecology of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the Bentham and Hooker's Classification
CO2	Understand the characteristic features various angiosperm families
CO3	Comprehend the photosynthesis and respiration of plants
CO4	Appreciate the knowledge on ecological principles
CO5	Analyze various tissue culture methods and its applications

Unit – 1

Outline the classification of natural system- Bentham and Hooker, A detailed study of following families and their economic importance: *Annonaceae*, *Zygophyllaceae*, *Caesalpinia* and *Cucurbitaceae*

Unit – 2

A detailed study of following families and their economic importance: *Rubiaceae*, *Apocynaceae*, *Lamiaceae*, *Nyctaginaceae*, *Cannaceae* and *Poaceae*

Unit – 3 Physiology

Absorption of water, absorption of minerals, photosynthesis- photo system I and Photo system II, C₃ C₄ and CAM pathways. Respiration- Glycolysis, TCA cycle and electron transport system, Pentose phosphate pathway. Growth hormones- physiological effects of growth substance – Auxins, Gibberellins and Cytokinins.

Unit – 4 Ecosystem

Biotic and abiotic components – food chain – food web – energy flow. Plant Ecology: Factors affecting vegetation- abiotic and biotic. Morphological and anatomical adaptations in hydrophytes and *Xerophytes*.

Unit – 5 Plant Biotechnology

Enzymes (restriction enzymes, DNA Ligase)- cloning vectors (Plasmid, Cosmid, Tiplasmid). Production of rDNA. Production of transgenic plants. Tissue culture techniques (Aseptic conditions, MS media and callus induction)

Practicals:

1. Detailed study of families mentioned in the theory with one representative specimen from the local Flora
2. Simple experiments and experimental set up in Plant Physiology section of the syllabus.
3. Study of anatomical structure of Hydrophytes and Xerophytes

Text Books:

1. Devlin, R.M. (1996). Plant Physiology. PWS Publishers, Boston.
2. Dubey, R.C. (2009). A Textbook of Biotechnology. S. Chand & Company, New Delhi
3. Dutta, S.C. (2003). Systematic Botany. New Age International pvt. Ltd., New Delhi
4. Jain, V.K. (2009). Fundamentals of Plant Physiology. S. Chand & Company, New Delhi.
5. Pandey, B.P. (2009). Taxonomy of Angiosperms. S. Chand & Company, New Delhi
6. Sambamoorthy, A.V.S.S. (2005). Molecular Biology. Narosa Publishers, New Delhi.
7. Shukla R.S and R.S. Chandel. (1998). Plant Ecology. S. Chand &Co. Pvt. Ltd, New Delhi.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO2	3	3	0	0	0	0	0	0	0	3	3	3	3	0	2
CO3	3	3	0	0	0	0	0	0	0	3	3	3	3	0	0
CO4	3	3	2	0	0	0	0	0	2	3	3	3	3	2	0
CO5	3	3	2	0	0	0	0	0	2	3	3	3	3	0	0

Semester	19IBOTAP1: ALLIED PRACTICAL I: BOTANY	L	T	P	C
II		0	0	4	2

Learning Objective (LO):

LO1	To know about the microbes, Algae, Bryophytes, Pteridophytes and Gymnosperms.
LO2	To gain knowledge on the anatomy of leaf , stem and roots
LO3	To gain knowledge on the physiology of plants

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the microbes, Algae, Bryophytes, Pteridophytes and Gymnosperms
CO2	Analyze the anatomy of leaf , stem and roots
CO3	Analyze the physiological aspects of plants

Practicals:

1. To make suitable micropreparations, describe and identify the specimens of Algae, Fungi, Bacteria, Viruses, Bryophytes, Pteridophytes and Gymnosperms prescribed in theory syllabus.
2. Study of Anatomical features of leaf, stem and root of dicots and monocots
3. Study of different types of anther, LS of ovule.
4. Detailed study of families mentioned in the theory with one representative specimen from the local Flora
5. Simple experiments and experimental set up in Plant Physiology section of the syllabus.
6. Study of anatomical structure of Hydrophytes and Xerophytes

SECOND YEAR

Semester	19 ITAC31: அறஇலக்கியமும்காப்பியமும்	L	T	P	C
III		3	0	0	3

Learning Objective (LO): கற்றலின்நோக்கம்

LO1	தமிழில்தோன்றியஅறஇலக்கியங்களையும்காப்பியஇலக்கியங்களையும் அறிமுகம்செய்தல்.
LO2	அவற்றின்வகைகளைவரலாற்றுடன்விளக்குதல்
LO3	இலக்கியங்களையும்அவைதொடர்பானஇலக்கியவரலாற்றையும் இணைத்துப்படித்தல்

Course Outcomes (CO): கற்றல்வெளிப்பாடு

At the end of the course, the student will be able to

CO1	அறஇலக்கியங்கள்எப்படிமனதைநெறிப்படுத்தவும்சமூக நடத்தையையும்கற்றுத்தருகின்றதுஎன்பதைவிளக்குவர்.
CO2	அறஇலக்கியங்களில்கூறப்பட்டுள்ளஅறநெறிக்கருத்துக்களை வாழ்வியலில்கடைப்பிடிக்கமுயலுவர்
CO3	நல்லசமுதாயம்உருவாக்கஅறஇலக்கியங்களில்கூறப்பட்டுள்ள அறக்கருத்துக்களைஎடுத்துரைப்பர்.

அலகு - 1 அறஇலக்கியம்

1. திருக்குறள் - உழவு, ஒழுக்கமுடைமை, காலமறிதல், நட்பு, பிரிவாற்றாமை

அலகு - 2 அறஇலக்கியம்

1. நாலடியார் - பெரியாரைப்பிழையாமை
2. பழமொழிநானூறு - கல்வி

அலகு - 3 காப்பியம்

1. சிலப்பதிகாரம் - இந்திரவிழவுஊரெடுத்தகாதை
2. மணிமேகலை - ஆபுத்திரன்திறன் அறிவித்தகாதை

அலகு - 4 காப்பியம்

1. பெரியபுராணம் - அப்பூதிஅடிகள்புராணம்
2. கம்பராமாயணம் - வாலிவதைப்படலம்

அலகு - 5 இலக்கியவரலாறு

சங்கமருவியகால அறஇலக்கியங்கள் - திருக்குறளின்பெருமை -
அறஇலக்கியங்களின்வளர்ச்சி - காப்பியஇலக்கணம் - பகுப்புகள் -
காலந்தோறம்தோன்றியகாப்பியங்கள் - வரலாறு.

அலகு - 6 (மாணவர்கள் அறிந்துகொள்வதற்குமட்டும் - தேர்வுக்கானபகுதிஅல்ல)

அறஇலக்கியங்கள்மனதைநெறிப்படுத்துவதோடுசமூகநடத்தைகளையும்
கற்றுத்தருகின்றன.

அறஇலக்கியங்களின்தொடர்பால்மாணவர்கள்நல்லக்கருத்துகளைக்கற்றுக்கொள்
வதோடுவாழ்விலும்கடைபிடிக்கஎண்ணுதல்நல்லசமூகம்உருவாகும்.
சமூகத்திற்குஅறநெறிகளில் தேவையானவைஎடுத்துரைத்தல்.

பாடநூல்கள்:

1. பதிப்பாசிரியர் ச. மெய்யப்பன் - திருக்குறள்
மணிவாசகர்பதிப்பகம், சென்னை- 08.
இரண்டாம்பதிப்பு -2017
2. ச.வே.சுப்பிரமணியன் - நாலடியார், பழமொழிநானூறு
மணிவாசகர்பதிப்பகம், சென்னை- 08.
இரண்டாம்பதிப்பு -2012
3. இளங்கோவடிகள் - சிலப்பதிகாரம்
டாக்டர் உ.வே.சா. பதிப்பு
2, அருண்மடல்கடற்கலைசாலை
பெசன்ட்நகர், சென்னை
பதினொன்றாம்பதிப்பு -2008
4. சீத்தலைச்சாத்தனார் - மணிமேகலை
டாக்டர் உ.வே.சா. பதிப்பு
2, அருண்மடல்கடற்கலைசாலை
பெசன்ட்நகர், சென்னை
எட்டாம்பதிப்பு -2008
5. சேக்கிழார் - பெரியபுராணம்
முல்லைநிலையம், சென்னை
முதற்பதிப்பு -2010
6. கம்பர் - கம்பராமாயணம்
அண்ணாமலைப்பல்கலைக்கழகம்
வெளியீடு,
7. ச.வே.சுப்பிரமணியன் - தமிழ்இலக்கியவரலாறு

8. சோ.ந.கந்தசாமி

-

மணிவாசகர்பதிப்பகம், சென்னை.

முதற்பதிப்பு- 1999

தமிழ்இலக்கியவரலாறு

மணிவாசகர்பதிப்பகம், சென்னை.

முதற்பதிப்பு - 2004

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2	0	0	0	0	0	0	0	0	0	3	2	3	3	3
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	2	2	3	3
CO3	3	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	3

*1-Low *2-Medium *3-Strong

Semester	19IHINC31: Part-I Language Hindi-II	L	T	P	C
III		3	0	0	3

Learning Objective (LO):

LO1	To study various comedy stories.
LO2	To introduce Indian epics.
LO3	To understand the concepts of drama

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the basic structure of short stories.
CO2	Knowledge on Mahabharath.
CO3	Describe the basic concepts of human feelings.
CO4	Apply the concepts of comedy in stories.
CO5	Describe the effects of western culture.

Unit - I: Introduction, ekanki.

. Andher Nagari - Bharathendhoo Harishchandra

Unit - II: Mahabharath Ki EkSanj - Bharath BhoosahnAgrwal [Full]

Unit - III: Drama.

3.Ladai - SarveswarDayalSaxeena [Full]

Unit - IV: Stories,Tatava-vyanghya

Unit - V: Upstick Ki Muskhan - Vishnu Prabakar [Full]

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Andher Nagari - Bharathendhoo Harishchandra, Vinodh Pustak Mandir, Agra-2
2. Prathinidhi Ekanaki - Dr. Dashrath Oojaa, Jawahar Pustakalya, Mathura
3. Ekanaki Manach - Dr.V.P. Abhithap, Jawahar Pustakalya, Mathura
4. Ladai – Sarveswar Dayal Saxeena, Rajkamal Prakashan, New Delhi

Supplementary Reading

- 1.Hindi natakuthbhavaurvikas-dashrath ojha-rajpal and saons, New Delhi.7.
- 2.hindi natakaurrangmanch-pahachanaurparak-Dr. Indranathmadan, newdelhi.7.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	0	3	3	2	2	3	2	3	3	3	3	3	0	0	0
CO2	3	0	3	0	3	0	2	2	0	3	0	0	0	0	0
CO3	3	3	0	0	2	3	0	2	3	0	0	0	2	0	0
CO4	3	3	3	3	3	0	3	0	2	2	2	0	0	2	0
CO5	0	0	3	3	3	3	3	2	2	2	2	0	0	0	3

Semester	19IENGC32:	L	T	P	C
III	ENGLISH THROUGH LITERATURE III: DRAMA	3	0	0	3

Learning Objective (LO):

LO1	Enhance the conversational competence of the learners by introducing drama in English.
LO2	Make the students understand characteristics of the Elizabethan Age.
LO3	Make them appreciate Shakespearean drama.
LO4	Make them learn the key elements of sentence structures
LO5	Make the students master the mechanics of writing

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Obtain a literary acumen to answer MCQs of NET/SET examinations and other competitive examination
CO2	Appreciate conversational English
CO3	Recognize the dramatic elements of Shakespearean dramas
CO4	Use punctuations and capitals effectively in their composition
CO5	Recognize the elements of the spoken discourses

Unit I

William Shakespeare
Grammar

The Tempest (Act I)
“Phrases and Clauses”

Unit II

William Shakespeare
Grammar

The Tempest (Act II)
“Simple, Compound, and Complex Sentences”

Unit III

William Shakespeare
Grammar

The Tempest (Act III)
“Transformation of Sentences”

Unit IV

William Shakespeare
Grammar

The Tempest (Act IV)
“Sequence of Tenses and Reported Speech”

Unit V

William Shakespeare

The Tempest (Act V)

Grammar

“Punctuation and Capitals”

Text Books:

1. Shakespeare, William. (2008). *The Tempest*, S. Chand & Co., New Delhi.
2. Green, David. (2010). *Contemporary English Grammar, Structures, and Composition*. MacMillan, Chennai.

Supplementary Reading:

1. Cahn, L Victor.(1996). *Shakespeare the Playwright: A Companion to the Complete Tragedies Histories, Comedies, and Romances*. Praeger, London.
2. Crystal, David.(2009). *Shakespeare's Words: A Glossary and Language Companion*. Penguin, London.
3. Greenbaum , Sidney, (2005). *Oxford English Grammar*. Oxford UP, London.
4. McCarthy.(2018). *Cambridge Grammar of English*. Cambridge UP, London.
5. Quirk, Randolph (2010). *A Comprehensive Grammar of the English Language*. Pearson, London.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO2	2	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO3	3	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2
CO4	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO5	2	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2

*1-Low *2-Medium *3-Strong

Semester	19IZOOC33: CHORDATA- I	L	T	P	C
III		4	0	0	4

Learning Objective (LO):

LO1	To learn the origin, salient features of lower chordate
LO2	To learn the classification of lower chordates
LO3	To learn the structural organization of lower chordates
LO4	To learn the classification of agnatha
LO5	To study the general characters, behaviour and classification of fishes

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the diversity of lower chordates
CO2	Learn the salient features and classification of lower chordates
CO3	Know the structural organization of protochordata and vertebrata
CO4	Understand origin of chordate and general characters of agnatha

Unit – 1: Protochordata

General characters and phylogeny of Hemichordata, Urochordata, Cephalochordata and their larval forms; Significance of protochordates, Type study: Balanoglossus, Herdmania and Amphioxus.

Unit – 2: Origin of Chordate

Theories of origin of Chordates – Dipleurula concept– Echinoderm theory of chordates – Origin of Hemichordata, Urochordata and Cephalochordata – Barringtons hypothesis.

Unit – 3: Vertebrate

General characters of vertebrates and classification up to orders. Structural organization in vertebrates – notochord – pharynx with pouches - slits – Nervous system – Vertebral column.

Unit – 4: Agnatha

General characters of Agnatha and classification of cyclostomes up to orders – Type study'- *Petromyzon*. Affinities and phylogenetic status of Cyclostomata.

Unit - 5: Pisces

General Characters of Chondrichthyes and Osteichthyes. Pisces and Classification up to orders. Comparison between Chondrichthyes and Osteichthyes. Types of Fishes, scales and accessory respiratory organs of fishes. Migration in fishes, osmoregulation and parental care.

Unit - 6: Current Streams of Thought (Not for final exam) : Advances in chordate Zoology – Phylogenetic relationships – Medical uses – as food – Defense mechanisms – Life cycles – animal behavior – Animal diversity

PRACTICAL

1. Protochordata
 - a) (Specimens and Slides): *Balanoglossus*, *Herdmania*, *Branchiostoma*, Colonial *Urochordata*. *Ascidian*
 - b) Sections of *Balanoglossus* through proboscis and branchiogenital regions
 - c) Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions.
2. Agnatha (Specimens), *Petromyzon*, *Myxine*
3. Fishes (Specimens): *Etroplus*, *Tilapia*, *Pristis*, *Torpedo*, *Chimaera*, *Notopterus*, *Mystus*, *Heteropneustes*, *Labeo*, *Exocoetus*, *Echeneis*, *Anguilla*, *Tetrodon*, *Diodon*, *Anabas*, Flat Fish.
4. Dissection: Fish digestive system and Reproductive system.

TEXT BOOKS

1. Ekambaranatha Ayyar. M., (1973). *A Manual of Zoology Part – II: Chordata*. S. Vishvanathan Printers and Publishers, Pvt. Ltd., Madras.
2. Jordan. E.L. and P.S Verma, (2017). *Chordate Zoology and Elements of Animal Physiology*, S. Chand & Co., Ltd., New Delhi.
3. Young, J.N. (2004). *The Life of Vertebrates*. Oxford at the Clarendon Press, London.
4. Adam Sedgwick, (1960). *A Student Text Book of Zoology Vol.III*. General Book Depot, Allahabad.
5. Hyman, L.H. (1974). *Comparative Vertebrate Anatomy*. University of Chicago Press, New York, Chicago.
6. Edwin H Colbert, (1969). *Evolution of Vertebrate*. Wiley Eastern University Press, Ansari Road, New Delhi.
7. Hall, B.K. and B.Hallgrimson. (2014). *Strickbergers Evolution*, Jones and Bartlett Publishers Ltd., New Delhi.

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume -2 – Chordata*. Saras Publication, Nagercoil, Tamil Nadu.
- 2) Saxena R.K. and Sumitra Saxena. (2016). *Comparative Anatomy of Vertebrates*. Viva Books New Delhi.
- 3) Kent, G.C. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill, UK.
- 4) Edwin H. Colbert, Michael Morales and Eli C. MinKoff. (2011). *Colbert's Evolution of the Vertebrates*. Wiley USA
- 5) Kenneth Kardong. 2018. *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill. UK

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3

Semester	19ICHEA01: ALLIED – II: CHEMISTRY I	L	T	P	C
III		4	0	0	4

Learning Objective (LO):

LO1	To enable the students to have knowledge about the basics aspects of chemistry
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Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Students gain knowledge on Basic Chemistry.
CO2	The students will gain knowledge about the organic compounds, acid base equilibria and chemical kinetics
CO3	Students gain knowledge on photochemistry and its laws

Unit–I: Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene -Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophile & electrophilic), elimination, condensation and polymerization - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect.

Unit–II: Chemistry of Some Useful Organic Compounds

Structure and uses of the following: Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF_2Cl_2 . Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III: Acid-Base Equilibria

Bronsted definition, Lewis definition, K_a K_b , $\text{p}K_a$ and $\text{p}K_b$ for Bronsted acids and bases. Relative strengths of Bronsted acids and bases. pH Buffer solution. Henderson's equation. Theory of acid-base indicators.

Unit–IV: Coordination Chemistry

Definition of terms-classification of ligands-chelation- Nomenclature of coordination compounds. Effective Atomic Number and its application to $\text{Ni}(\text{CO})_4$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Role of metal ions in biological systems such as Haemoglobin, Vitamin B12.

Unit–V: Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photosensitisation.

Text Books:

1. Veeraiyan, V. (2006). *Textbook of Ancillary Chemistry*, High mount Publishing house. Chennai.
2. Huheey, (2005). *Inorganic Chemistry*, Addison Wesley, USA.
3. Soni P.L. and Others (2006). *Textbook of Organic chemistry*, S. Chand and Co., New Delhi.
4. Soni P.L. and Others, (2006). *Textbook of Inorganic Chemistry*, S. Chand and Co., New Delhi.
5. Puri B.R., Sharma and Pathania, (2006). *Textbook of Physical Chemistry*, Vishal Publishing Co. Punjab.
6. Dara S.S., (2006). *Text book of Environmental Chemistry and Pollution Control*. S. Chand and Co., New Delhi.
7. Vaithyanathan, S. and Others, (2006). *Textbook of Ancillary Chemistry*, Priya Publications, Chennai.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO3	3	3	2	3	1	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19 ITAMC41:	L	T	P	C
IV	சங்கிலக்கியமும்செம்மொழிவரலாறும்	3	0	0	3

Learning Objective (LO): கற்றலின்நோக்கம்

LO1	உலகச்செம்மொழியின்வரலாற்றைக்கூறுதல்.
LO2	தமிழ்ச்செம்மொழியின்தனிச்சிறப்புக்களையும் செம்மொழிஇலக்கியங்களையும்விவரித்தல்
LO3	சங்கிலக்கியங்களின்தனித்தன்மைகளைவரலாற்றுடன்விளக்குதல் .
LO4	சங்கிலக்கியங்களின்தனித்தன்மைகளைவரலாற்றுடன்விளக்குதல் .
LO5	Talk about their health problems.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	பண்டையத்தமிழ்மரபுகளையும்சமூக அமைப்புகளையும்விளக்குவர்.
CO2	தமிழ்மொழியின்தனித்துவத்தைச்செம்மொழியின் இயல்புகள்மற்றும் சங்கிலக்கியங்களின் துணைக்கொண்டு விளக்குவர்.
CO3	இலக்கணஇலக்கியவகைமைகளை அறிந்துதன்னைப்படைபாளராக உருவாக்கமுயலுவர்.

அலகு - 1 அகிலக்கியங்கள்

1. குறுந்தொகை - 125, 129, 177, 302, 397 (நெய்தல்)
2. நற்றிணை - 206, 217, 304, 334, 382 (குறிஞ்சி)
3. ஐங்குறுநூறு - 17, 18, 71, 75, 96,(மருதம்)
4. அகநானூறு - 147, 303, 370 (பாலை)
5. கலித்தொகை - 104, 105(முல்லை)

அலகு - 2 புறஇலக்கியங்கள்

1. புறநானூறு -பெண்பாற்புலவர்கள் 76, 83, 133, 146, 178, 188, 227, 261, 264, 278

அலகு - 3 பத்துப்பாட்டு

1. நெடுநெல்வாடை

அலகு - 4 சங்கஇலக்கியவரலாறு

தொல்காப்பியம் - சங்ககாலம் - முற்சங்கங்கள் - பாட்டும்தொகையும் - தொகுப்புமுறை - தனித்தன்மைகள்.

அலகு - 5 பயன்பாட்டுத்தமிழும்செம்மொழிவரலாறும்

மொழிவிளக்கம் - மொழிக்குடும்பங்கள் - உலகச்செம்மொழிகள் - இந்தியச்செம்மொழிகள் - செம்மொழித்தகுதிகள் - வரையறைகள் - வாழும்செம்மொழித்தமிழ் - தமிழின்தொன்மை - தமிழின்சிறப்புக்கள் - தமிழ்ச்செம்மொழிநூல்கள் - தமிழ்செம்மொழிஅறிந்தேற்பு - பரிதிமாற்கலைஞர்முதல்தற்காலஅறிஞர்கள்வரை (அறிஞர்கள் - அமைப்புகள் - நிறுவனங்கள் - இயக்கங்கள்தொடர்முயற்சிகள் - அறப்பேராட்டங்கள் - உலகத்தமிழ்ச்செம்மொழிமாநாடு, கோவை-2010)

(மாணவர்கள்அறிந்துகொள்வதற்குமட்டும் - தேர்வுக்கானபகுதிஅல்ல)

பண்டையதமிழ்மரபுகளையும்சமூகஅமைப்புகளையும்விளக்குதல், தமிழ்மொழியில்தனித்துவத்தையும்செம்மொழிஇயல்புகளையும்சங்கஇலக்கியங்களின்துணைக்கொண்டுவிளக்குதல்.

சங்கப்பனுவல்களில்பொதுமைத்தன்மையையும்அவற்றின்சிறப்பியல்புகளையும் விளக்குதல்.

பாடநூல்கள் :

1. ச.வே.சுப்பிரமணியன் (ப.ஆ)- குறுந்தொகை, நற்றினை, ஐங்குறுநூறு, “ அகநானூறு, கலித்தொகை, மணிவாசகர்பதிப்பகம், சென்னை இரண்டாம்பதிப்பு -2011
2. ச.வே.சுப்பிரமணியன் (ப.ஆ)- புறநானூறு, மணிவாசகர்பதிப்பகம், சென்னை இரண்டாம்பதிப்பு -2011
3. ச.வே.சுப்பிரமணியன்(ப.ஆ)- பத்துப்பாட்டு (நெடுநெல்வாடை) மணிவாசகர்பதிப்பகம், சென்னை

4. தெ.பொ.மீனாட்சிசுந்தரம் - இரண்டாம்பதிப்பு -2011
சங்கமொழிவரலாறு
நியூசெஞ்சரி, புத்தகநிலையம்
முதற்பதிப்பு -2018
5. மணவைமுஸ்தபா - செம்மொழிஉள்ளும்புறமும்
சீதைபதிப்பகம், சென்னை
முதற்பதிப்பு -2010
6. ச.வே.சுப்பிரமணியன் - சங்கஇலக்கியம்
மணிவாசகர்பதிப்பகம், சென்னை
இரண்டாம்பதிப்பு -2011
7. மு.வரதராசன் - தமிழ்இலக்கியவரலாறு,
சாகித்தியஅகாதெமிவெளியீடு,
புதுதில்லி
மூன்றாம்பதிப்பு- 2015

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	3	2	0	0	0	0	0	0	0	0	0	3	2	3	3	3
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	2	2	3	3
CO3	3	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	3

*1-Low *2-Medium *3-Strong

Semester	19IHINC41: Part-I Language Hindi-II	L	T	P	C
IV		3	0	0	3

Learning Objective (LO):

LO1	To learn the important poems of famous Hindi poets.
LO2	To imbibe the knowledge of writing in Premchand stories.
LO3	To understand the relation between poems and stories.
LO4	To gain knowledge on stories of Beeshma Sahini

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the concepts of Hindi poems.
CO2	Knowledge on stories of Premchand.
CO3	Describe the basic concepts of Hindi stories.
CO4	Apply the concepts of writings of Jai sankar Prasad.
CO5	Understand the writing style of Beeshma Sahini.

Unit - I: Introduction, Poem

Kabeer - 1 To 10 Dohas Tulasi - 1 To 10 Dohas.

Unit - II: Rahim - 1 To 10 Dohas

Unit – III: Edgaah - Premchand. Madhuva - Jayashankar Prasad.

Unit - IV: stories,
Chief Ki Daavat – Beeshma Sahini

Unit - V: 7. HANUMAN JI ADHALATH ME - HARISHAKNA PARSAYE

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. PADHYA MANJARI - DR. T.NIRMALA & DR.S.MOHAN Rajkamal Prakashan, New Delhi
2. Premchand Kipradhnikahaniya,Rajkamal Prakshan, New Delhi.7.
3. Kahani: nayikahani: namvirsingh,Rajkamal Prakashan, New Delhi.

4. Bihari-ompraksh.vaniprakshan, New Delhi 110002.

Supplementary Reading

1. Nayikahani: prakrutiaurpaat:surendrachowdari.
2. Naveen ekanki , D.B.H.P. SABHA, Madras17.
3. Bihari ki kavya sruti:jayapraksh.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	0	3	3	2	2	3	2	3	3	3	3	3	0	0	0
CO2	3	0	3	0	3	0	2	2	0	3	0	0	0	0	0
CO3	3	3	0	0	2	3	0	2	3	0	0	0	2	0	0
CO4	3	3	3	3	3	0	3	0	2	2	2	0	0	2	0
CO5	0	0	3	3	3	3	3	2	2	2	2	0	0	0	3

Semester	19IENGC42: ENGLISH THROUGH LITERATURE IV: SHORT STORY	L	T	P	C
IV		3	0	0	3

Learning Objective (LO):

LO1	Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing
LO2	Enable the students to know about the origin and development of short story
LO3	Write objectively, avoiding vagueness, prejudice, and exaggeration
LO4	Enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc
LO5	Discover an author's purpose, and draw conclusions about certain events, evaluating cause and effect, and understanding point of view

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Use more vocabularies while writing
CO2	Ensure about the history and development
CO3	Develop a flow in writing
CO4	Come up with new ideas while reading stories from different perspectives
CO5	Write in a style appropriate for communicative purposes

Unit I

- | | |
|-------------|------------------------|
| 1. O' Henry | "The Gift of The Magi" |
| 2. Ken Liu | "The Paper Menagerie" |
| Grammar | Synonyms and Antonyms |

Unit II

- | | |
|----------------------|----------------------|
| 1. Flora Annie Steel | "Valiant Vicky" |
| 2. Oscar Wilde | "Happy Prince" |
| Grammar | Words often confused |

Unit III

- | | |
|-------------------|-----------------------|
| 1. R. K. Narayan | "The Martyr's Corner" |
| 2. Mahasweta Devi | "Draupati" |

Grammar

Paragraph-Writing

Unit IV

1. Leo Tolstoy

“How much Land Does a Man Need?”

2. Somerset Maugham

“The Verger”

Grammar

Letter-Writing

Unit V

1. Langston Hughes

“On the Road”

2. Premchand

“Bakthi Marg”

Grammar

Precis-Writing

TEXT BOOKS

1. Srinivasa Iyengar, K.R. (1996). *Indian Writing in English*. : Sterling Pub., New Delhi.
2. Michael Swan, (2016). *Practical English Usage*, Oxford University Press, New Delhi.

SUPPLEMENTARY READING:

1. Frank Robert Palmer, (1975). *Grammar: (by) Frank Palmer*. Penguin Books, New Delhi.
2. Browns, Julie, ed., (1997). *Ethnicity and the American Short Story*, Garland, New York.
3. Patea, Viorica. (2012). *Short Story Theories: A Twenty-First-Century Perspective*. Amsterdam [etc.]: Rodopi.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO2	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	3
CO3	3	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2
CO4	3	0	0	3	0	0	3	3	0	3	0	0	3	3	0	0	0
CO5	2	0	0	2	0	0	2	2	0	2	0	0	2	2	0	0	2

*1-Low *2-Medium *3-Strong

Semester	19IZOOC43 CHORDATA- II	L	T	P	C
IV		4	0	0	4

Learning Objective (LO):

LO1	To learn general characters and classification of higher chordates up to order
LO2	To learn various types of snakes
LO3	To learn various flying adaptations in birds and also flightless birds
LO4	To learn various types of mammals and zoogeography

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify different types of higher chordates based on their morphology
CO2	Differentiate poisonous and non poisonous snakes and other reptiles
CO3	Understand flying adaptations in birds
CO4	Understand origin, ancestry and adaptive radiation among mammals and also differentiate the anatomical features of various internal organs

UNIT - 1 : Amphibia

Origin and evolution of amphibian, general characters and classification up to order – type study – Frog. Adaptive features of Urodela - Salamander and Ichthyophis. Parental care in amphibian.

UNIT - 2: Reptilia.

Origin and evolution of reptiles, general characters and classification up to order. Type study – Calotes. Extinct reptiles, Poisonous snakes in India, identification of poisonous and non-poisonous snakes – biting mechanism.

UNIT - 3: Birds

Origin, salient features and classification up to order. Type study – Pigeon. Principles, mechanism and flight adaptation in birds – flightless birds, adaptive radiation – bird migration - Archaeopteryx - a connecting link.

UNIT - 4: Mammals

Origin, ancestry of mammals, salient features and classification up to order. Type study- Rabbit. Aquatic mammals – flying mammals – adaptive radiation in mammals. Dentition in mammals.

UNIT - 5: Comparative anatomy

Comparative anatomy of vertebrates – integuments, lungs, heart, kidney, testis and ovary.

PRACTICAL

1. Amphibia: Amblystoma/Pipa-Pipa, Necturus, Bufo, Hyla, Alytes, Salamandra- Specimen study.
2. Reptiles:
 - i. Specimens: Krait, Hydrina, Hemidactylus, Varanus, Uromastix, Chamaeleon, Draco, Lycodon, Tomopterus, Vipera, Naja, Turtle, Phrynosoma, Crocodylus.
 - ii. Key for Identification of Poisonous and Non – Poisonous snakes.
3. Aves: Study of six common birds from different orders. Types of beaks and claws.
4. Mammals:

Specimens: Raccoon, Bat (Insectivorous and Frugivorous) Scaly anteater, Loris, Otter
5. Dissection of Frog: Digestive system and reproductive system – Demonstration
6. Dissection of Calotes: Digestive system and reproductive system– Demonstration

TEXT BOOKS

1. Ekambaranatha Ayyar M,. (1973). *A Manual of Zoology Part-II: Chordata*. S.Vishvanathan Printers and Publishers , Pvt. Ltd., Madras.
2. Jordan. E.L. and P.S Verma, (2017). *Chordate Zoology and Elements of Animal Physiology*, S. Chand & Co., Ltd., New Delhi.
3. Young, J.N. (2004). *The Life of Vertebrates*. Oxford at the Clarendon Press, London.
4. Adam Sedgwick, (1960). *A Student Text Book of Zoology Vol.III*. General Book Depot. Allahabad.
5. Hyman, L.H. (1974). *Comparative Vertebrate anatomy*. University of Chicago Press, New York, Chicago.
6. Edwin H Colbert, (1969). *Evolution of Vertebrate*. Wiley Eastern University press, Ansari Road, New Delhi.
7. Hall, B.K. and B.Hallgrimson. (2014). *Strickbergers Evolution*, Jones and Bartlett Publishers Ltd., New Delhi.

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume -2 – Chordata*. Saras Publication.
- 2) Saxena R.K. and Sumitra Saxena. (2016). *Comparative Anatomy of Vertebrates*. Viva Books, New Delhi.
- 3) Kent. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill India.
- 4) Edwin H. Colbert, Michael Morales and Eli C. MinKoff. (2011). *Colbert's Evolution of the Vertebrates*. Wiley.
- 5) Kenneth Kardong, (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill India.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	2	3	3	3	3
CO2	2	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	2	3	1	3	3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	1	3	2	3	3	3	3	3	3	3	3

Semester	19ICHEA02: ALLIED – II: CHEMISTRY II	L	T	P	C
IV		4	0	0	4

Learning Objective (LO):

LO1	To develop knowledge in electrochemistry and industrial chemistry
LO2	To understand Quantitative Analysis and separation techniques.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the quality of water samples
CO2	Appreciate , describe and adopt suitable separation techniques.
CO3	Identify compounds using spectral techniques.

Unit – I : Chemistry of Natural Products

Terpenoids: Structure and uses – Camphor, vetivones.
Alkaloids – Structure and uses, papavarine, cocaine
Structures and important biological properties

Unit – II : Electrochemistry

Galvanic cells – emf - standard electrode potential - reference electrodes - electrochemical series and its applications-glass electrode and pH determination - Electroplating process -Nickel and Chrome plating - Different types of cells - primary cell, secondary cell. Fuel cells. Corrosion and methods of prevention.

Unit – III : Industrial Chemistry

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

Unit-IV : Analytical Chemistry-I

Introduction to Quantitative Analysis and separation techniques - Principle of volumetric and gravimetric analysis-Estimation of hardness by EDTA method. Estimation of Ni, Ba and Cu by gravimetric methods. Electrogravimetry – theory of electrogravimetric analysis – determination of copper (by constant current procedure) - Separation techniques - extraction - distillation – crystallization.

Unit – V : Analytical Chemistry-II

Colorimetric methods, Beer's law and its validity, estimation of fluoride ion by photocolormeter, flame photometry and atomic absorption spectroscopy- NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons,

position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

Textbooks

1. Veeraiyan, V. (2006). *Text book of Ancillary Chemistry*, Highmount Publishing house, Chennai.
2. Vaithyanathan, S. (2006). *Textbook of Ancillary Chemistry*, Priya Publications, Chennai.
3. Soni. P. L, (2006). *Text book of Organic chemistry*, Sultan Chand &Company, New Delhi.
4. Puri, Sharma and Pathania, (2006). *Text book of Physical Chemistry*, Vishal Publishing Co., Jalandar.
5. Dara. S.S, (2006). *Text book of Environmental chemistry and Pollution Control-* S. Chand and Co., New Delhi.
6. Day. R.A and Underwood.A.L. (1999). *Quantitative Analysis*, Prentice Hall, New Delhi.
7. Kemp.W, (1989). *Organic spectroscopy*, Palgrave, USA
8. Silverstein R.M and F.X.Webster (1998). *Spectrometric identification of organic compounds*, John Wiley, New York..
9. Jag Mohan, (2000). *Organic spectroscopy (Principles & Applications)*, Narosa Publishing house, India.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	0	0	0	0	3	0	0	0	0	0	0	0	0
CO2	3	0	3	0	0	0	0	3	0	3	0	0	0	0	0
CO3	3	0	0	3	0	0	0	0	3	0	0	0	0	0	0
CO4	3	3	0	0	3	3	3	0	0	0	0	0	0	3	2

SEMESTER	19ICHEP01: ALLIED PRACTICAL II: CHEMISTRY	L	T	P	C
IV		0	0	4	2

Learning Objective (LO):

LO1	TO DEVELOP KNOWLEDGE IN VOLUMETRIC TITRATIONS.
LO2	TO UNDERSTAND REACTIONS INVOLVED IN COMPLEXOMETRIC TITRATIONS.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	ESTIMATE COMMERCIAL CAUSTIC SODA FOR CARBONATE AND HYDROXIDE CONTENT.
CO2	ESTIMATION OF METAL IONS USING EDTA AND EBT AS INDICATOR
CO3	Attain knowledge about construction of sentence structures

Titrimetric Analysis

1. Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution
2. Standardization of given sodium hydroxide solution using potassium hydrogenphthalate.
3. Estimation of commercial caustic soda for carbonate and hydroxide content.
4. Titration involving KMnO_4 and standard sodium oxalate.
5. Estimation of Mg^{2+} using EDTA and EBT as indicator.
6. Estimation of Zn^{2+} using EDTA and EBT as indicator.

Text Book:

1. Vogel A. I., (2002). Textbook of Quantitative Inorganic Analysis, Pearson India Publishers, New Delhi.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	0	0	0	0	0	3	0	0	3	0	0	0	0
CO2	3	0	3	0	0	0	0	0	3	0	3	0	0	0	0

THIRD YEAR

Semester	19IZOOC51: CELL BIOLOGY	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To learn the structural organization of cell
LO2	To learn the mechanism of endoplasmic reticulum and ribosomes
LO3	To learn the structural organization of golgi apparatus and lysosome
LO4	To learn the relation between nucleus and chromosomes
LO5	To learn mechanism of cell division

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Acquire knowledge on the basic of structure and functions of cells
CO2	Differentiate various cell organelles and their role
CO3	Identify nucleus and chromosomes
CO4	Identify various stages of cell divisions

Unit - 1: Cell theory, Cellular organization and Cell Membrane

Discovery of cell, cell theory – protoplasm theory, organismal theory - Structural organization of prokaryote and Eukaryote - Virus - bacteria - Plasma membrane – Ultra structure models and functions

Unit - 2: Endoplasmic Reticulum and Ribosomes.

Endoplasmic reticulum: morphology – ultra structure – types of endoplasmic reticulum - rough and smooth surfaced endoplasmic reticulum - Chemical composition and Functions.

Ribosomes: 70s ribosomes – 80s ribosome – ribosome structure – ribosomal RNA, ribosomal protein – polyribosome – functions of ribosomes.

Unit – 3: Golgi apparatus and Lysosome

Golgi apparatus: Morphology, ultra structure – origin and function – golgi complex and secretion.

Lysosomes: Lysosomal structure – lysosomal enzymes – polymorphism in lysosome - primary lysosome - secondary lysosome – Functions of lysosome.

Unit - 4: Nucleus and Chromosomes

Nucleus: Structure of interphase nucleus – Functions – nuclear envelope
Chromosomes: structure, types and function of chromatin and chromosomes,
Nucleolus: Structure – types and functions of nucleolus.

Unit - 5: Cell Division

Mitosis: Process of mitosis – Karyokinesis - General events in interphase, Prophase, metaphase, anaphase and telophase.

Meiosis: Process of meiosis – first meiotic division – Second meiotic division, synaptonemal complex – significance of meiosis.

Current Streams of Thought (Not for final exam): Recent discoveries and Nobel prize in cellular and molecular research. Model of DNA damage. Cell death and regeneration.

PRACTICAL

1. Light and compound microscopes – observation, principles and functions
2. Micrometry: a) Stage micrometer b) Ocular micrometer and c) Camera Lucida
3. Eukaryotic cell types – slides (Columnar Epithelial cell, Buccal Epithelial cell, Liver, Pancreas and muscle)
4. Observation of mitosis from onion root tip - squash
5. Observation of meiotic cell division stages from permanent slides
6. Blood smear of human – identification of drum stick chromosome (neutrophil)
7. Identification of Barr body -Human Buccal smear

TEXT BOOKS:

1. Powar, C.B., (2012). *Cell Biology*, Himalaya Publishing house, Mumbai.
2. Verma, P. S and V. K Agarwal (2001). *Concept of cell Biology*, S. Chand & Co., New Delhi.
3. Rastogi .S.C., (2014). *Cell Biology*. New Age International (P) Limited, New Delhi
4. Wilson, G.B and John H. Morrison, EWP, (1996), *Cytology*, Ed., New Delhi

REFERENCE BOOKS

1. Verma P.S. and V.K. Agarwal. (2016). *Cell Biology*. S Chand & Co., New Delhi.
2. Geoffrey M. Cooper and Robert E. Hausman. (2013). *The Cell: A Molecular Approach*. Sinauer Associates Inc., USA.
3. Arnold Berk, Chris A. Kaiser and Harvey Ledish.(2016). *Molecular Cell Biology*. WH Freeman, USA.
4. Malathi. (2012). *Essentials of Molecular Biology*. Pearson Education, India.
5. Bruce Alberts, Alexander D. Johnson and Julian Lewis. (2014). *Molecular Biology of the Cell*. W.W.Norton & Co., New York, USA.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	1	3	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	2	3

Semester	19IZOOC52: PRINCIPLES OF GENETICS	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To learn the fundamental concepts of genetics
LO2	To learn about human health related genetic problems
LO3	To learn polygenic inheritance, linkage and crossing over
LO4	To understand genetics of Sex determination and sex linked inheritance
LO5	To study extranuclear inheritance, gene structure and mutation

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Interpret phenotypic expressions based on genotype
CO2	Understand and interpret genetically linked diseases, Polygenic inheritance and crossing over
CO3	Perform blood grouping and test metabolic disorders and Interpret genetics of sex determination and inheritance
CO4	Work in clinical laboratories and take up researches

Unit - 1: Mendelism, Interaction of Genes and Multiple Alleles

Mendel's Laws of inheritance - Monohybrid – Dihybrid cross - Back Cross -Test Cross.

Interaction of Genes: Dominant Epistasis – Recessive Epistasis - Complementary - Supplementary.

Multiple Alleles: Coat Colour in rabbit- ABO Blood Group in man- Rh factor.

Gene Expression: Atavism – Lethality - Penetrance - Expressivity – Pleiotropism

Unit - 2: Polygenic inheritance, Linkage and Crossing Over

Polygenic inheritance: Kernal colour in wheat – Skin Colour in man

Linkage: Classical Views – Kinds of linkage –Linkage groups- Experimental examples.

Crossing over: Kinds of crossing over – Mechanisms – Theories – Experimental example.

Unit – 3: Sex Determination and Sex – Linked Inheritance

Determination of Sex: Sex Determination in drosophila and man - Environmental Sex Determination – Gynandromorphs.

Sex linked inheritance in Drosophila and man – Y – linked gene – Sex influenced genes (Baldness in man) - sex limited genes (Sickle feathers in chicken)

Unit – 4: Extranuclear inheritance, Gene structure and mutation

Extrachromosomal inheritance: Maternal inheritance in Limnaea – Kappa Particles in *Paramecium*.

Fine Structure of Gene: Cistron – Recon – Muton.

Mutation: Mutagens – point mutation – chromosomal aberration – polyploidy

Unit - 5: Population Genetics and Human Genetics

Population Genetics: Hardy Weinberg Law - Gene Frequency – Genotypic frequency.

Human Genetics- Human Pedigree – Eugenics –Euthenics and Euphenics- Human Syndromes – (Downs, Edward, Patau, Klinefelter’s and Turner)

PRACTICAL

1. Mendelian Dihybrid cross – Illustrating with model (Peas/Beads)
2. Dominant Epistasis – illustrating with model
3. Polygenic inheritance – illustrating with human height
4. Blood Grouping in man
5. Identification of human finger prints
6. Identification of chromosomal disorder in human (Karyotyping).
7. Identification of sex and mutation in drosophila (eye colour)
8. Calculation of gene frequency & genotypic frequency

TEXT BOOKS

1. Snustad, D.P. and M. J. Simmons. (2017). *Principles of Genetics*, John Wiley & Sons Inc., India.
2. Veer Bala Rastogi. (2019). *A Text book of Cell Biology and Genetics*. Kedar Nath Ram Nath Publication, Meerut. U.P.
3. Gupta P.K. (2009). *Genetics*, Rastogi Publication Ltd., New Delhi
4. Verma P.S and Agarwal V.K. (2010). *Genetics*. S. Chand and Co., New Delhi.
5. Karvita B Ahluwalia. (2009). *Genetics*, New Age International (P) Ltd., New Delhi.

REFERENCE BOOKS

- 1) William S. Klug, Michael R. Cummings and Chariotte A. Spencer. (2016). *Genetics*. Pearson Education, New Delhi.
- 2) Peter Snustad.D and Michael J. Simmons. (2015). *Principles of Genetics*. John Wiley & Sons.
- 3) Gangane S.D. (2017). *Human Genetics*. Elsevier India.
- 4) Robert Tamarin. (2017). *Principles of Genetics*. McGraw Hill, USA.

5) James D. Watson, A. Baker Tania and P. Bell Stephen.(2017). *Molecular Biology of the Gene*. Pearson Education, New Delhi.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	1	3	3	2	3	3	3	3	3	3	3
CO4	3	2	3	3	1	3	3	3	3	3	3	3	2	3	3

Semester	19IZOOC53: COMPARATIVE ANIMAL PHYSIOLOGY	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To learn nutritional requirements and metabolism
LO2	To understand respiratory system
LO3	To learn blood vascular system
LO4	To learn physiology of respiration, excretion and neuronal functions
LO5	To learn about the physiology of muscle, receptors and neurons

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand basic biochemical molecules and their roles
CO2	Appreciate the nutritional requirements and the roles of nutrition in physiology
CO3	Learn the functioning and roles of respiratory and circulatory system
CO4	Analyse the physiology of excretion and osmoregulation

Unit - 1: Digestion and Absorption

Mode of nutrition – autotrophs – heterotrophs – Intracellular digestion – Extracellular digestion - Digestion in invertebrates – Digestion in vertebrates: Digestion in mammals - digestion in the mouth - stomach – intestine – absorption – structure of villi – absorption of food (water and fat soluble vitamins – electrolyte, calcium and iron absorption).

Unit - 2: Respiration

Respiratory organs – integumentary respiration - branchial respiration – external and internal gills – tracheal respiration - lungs - ventilation lungs - mammalian lungs – mechanism of breathing – exchange of gases in lungs – oxygen and carbon dioxide – Bohr's effect - Respiratory pigments - haemoglobin – chlorocruorin – haemocyanin – haemerythrin

Unit - 3: Circulation

Types of body fluids in animals – general properties and functions of blood – composition of blood – blood electrolytes, formed elements – red blood cells – white blood cells – platelets – blood groups and transfusion – coagulation of blood -

components of circulatory system – artery – vein – capillary – tubular heart - pulsating heart – ampullar heart – neurogenic heart – myogenic heart - open and closed type of circulation - structure and functions of mammalian heart

Unit - 4: Excretion and Osmoregulation

Organs of excretion in animal groups – nitrogenous wastes – ammonia – urea – uric acid – ammonotelic animals – ureotelic animals – uricotelic animals – excretory organs – archinephron – pronephron – mesonephron – opisthonephron – metanephros - structure and functions of mammalian kidney – osmoregulation in invertebrates and vertebrates.

Unit - 5: Muscle, Receptors and Neuron

Structure and functions of vertebrate muscle – skeletal muscle – smooth muscle – cardiac muscle – invertebrate muscle - synchronous and asynchronous, flight muscle; Receptors – chemoreceptor – mechanoreceptor – phonoreceptor - acoustic receptive organ in insects – photoreceptor, bioluminescence - structure and functions of neuron in invertebrates and vertebrates.;

PRACTICAL:

1. Pattern of osmotic response of Crab in two different media
2. Effect of chemical substance on respiratory metabolism of fish
3. Comparative study of vertebrate and insect eyes.
4. Ciliary mode of feeding in freshwater mussel
5. Effect of pH and amount of substrate activity of salivary amylase
6. Study of ciliary and amoeboid movements
7. Test for Nitrogenous waste products in cockroach and birds
8. Test for ammonia, urea and uric acid.

TEXT BOOKS:

1. Prosser.C.L., (1984). *Comparative animal physiology*. W.B.Sanders & Co.,
2. David Randall, Warren Burggren and Kathleen French. (2001). *Eckert Animal Physiology and adaptation*. W.H. Freeman and company, USA
3. Hoar.W.S., (1987). *General and comparative animal physiology*. Prentice Hall of India Ltd., New Delhi
4. Schiemdt-Nielsen.K., (2002). *Animal Physiology: adaptation and environment*. Combridge University Press, London.
5. Prosser.C.L., (1991). *Comparative animal physiology, Part A: Environment and Metabolic Physiology*. John Wiley & Sons, Inc., New York

REFERENCE BOOKS

- 1) Arumugam N. (2014). *Animal Physiology*. Saras, Nagercoil, Tamil Nadu.
- 2) Mohan P. Arora. (2018). *Animal Physiology*. Himalaya Publishing House Pvt. Ltd., Mumbai.
- 3) Tomar B.S. and Neera Singh. (2016). *Animal Physiology*. Pragati Prakashan, Meerut, UP.
- 4) Sobti R.C. (2011). *Animal Physiology*. Narosa Publishing House, New Delhi.
- 5) Sandeep Saxena. (2012). *Animal Physiology*. Oxford University Press, UK.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	2	3	3	3	1	3	2	2	3	3	3	3	2	3	3

Semester	19IZOOC54: APPLIED ZOOLOGY	L	T	P	C
V		5	0	0	5

Learning Objective (LO):

LO1	To learn the methodology and significance of reproductive technologies
LO2	To learn the basic of bioinformatics
LO3	To learn the importance of aquaculture and vermicomposting
LO4	To learn the Common practices in poultry science and dairy science

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Perform basic computer operation and bio-informatics technologies
CO2	Get top opportunity in fertility clinics and technicians
CO3	Start entrepreneurial activities
CO4	Start poultry farming and dairy operations

UNIT - 1: Bioinformatics

Historical perspective on computer and their applications in biology - Introduction to programming - the internet and the biologists - data bases and information retrieval - genome information.

UNIT - 2: Reproductive Technologies

Gametes technology - collection and preservation of economically important invertebrates and vertebrates, sperm function tests, semen analyses - embryo sexing - methods and principles.

UNIT - 3: Aquaculture

Types of culture - general culture techniques - pond culture - polyculture. Integrated fish farming; farm construction and management; Induced breeding - hypophysation technique. Culture of ornamental fishes.

UNIT - 4: Poultry Science

Introduction to poultry science – Important breeds of poultry – Desi – Chittagong and Leghorn – Layer house and Broiler house – Marketing of egg and Byproducts of poultry – Common diseases of poultry – Raniket, Coccidiosis and Coryza, Vaccination programme.

UNIT - 5: Dairy Science

Dairy farming – Definition – Scope – Dairy breeds of India – Exotic cow breeds – Jersey and Red Sindhi – Indian Breeds – Kangayam – Buffalo – Murrah – Milk – Composition – Nutritive value and Pasteurization of milk.

PRACTICAL

1. Study about biological databases
2. Study about Genome informations
3. Histology of gametes (Testis and ovary)
4. Semen analysis
5. Hypophysation techniques - location and removal of Pituitary; Pituitary extract, Preparation and Preservation – Demonstration
6. Culture method of ornamental fishes
7. Charts – Important breads of poultry
8. Charts – Dairy breads of India
9. Charts – Exotic cow breads

TEXT BOOKS

1. Kumar H.D., (2000). *A text book of biotechnology*, East-West Press Pvt. Ltd., New Delhi
2. Dubey, R.C., (2014). *A text book of biotechnology*. S. Chand and Co. Ltd., New Delhi
3. Krishnan, N. (2018). *Computer fundamentals and windows with internet technology*. Scitech publications pvt. Ltd., Chennai.
4. Primrose, S. B. and R. M. Twyman, (2003). *Principles of genome analysis and Genomics*. Black well science.
5. Banerjee, G.C., (2008). *A text book of Animal husbandry*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi

REFERENCE BOOKS

- 1) Arthur M. Lesk. (2014). *Introduction to Bioinformatics*. Oxford University Press, India.
- 2) Pevsner, J. (2017). *Bioinformatics and Functional Genomics*. Wiley India.
- 3) Gideon Waddell. (2018). *Poultry Science*. Larsen and Keller Education.
- 4) Chauhan H.V.S. and S. Roy. (2018). *Poultry Diseases, Diagnosis and Treatment*. New Age International Pvt. Ltd., New Delhi.
- 5) Christian Snider. (2016). *Dairy Farming: Animal Husbandry and Welfare*. Syrawood Publishing House.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	1	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	3	3	2	3	1	3	2	3	3	3	3	2	3	3	3

Semester	19IXXXV50: VALUE EDUCATION	L	T	P	C
V		2	0	0	2

Learning Objective (LO):

LO1	To focuses on Value Educations among the young minds.
LO2	To nurture the rational ethics among the students community.
LO3	To understand the importance of Human Freedom as responsibility.
LO4	To taught about Lifestyle, Equality and Fraternity.
LO5	To include the ethical values to the students and develop the ethical culture.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	The students may lead a life in ethical way and also able to take ethical based rational decision in their life.
CO2	Better understanding of moral consciousness of day to day life.
CO3	Acquire the knowledge about morality and freedom.
CO4	Understand the social ethics, its dimensions and its importance.
CO5	Know the ethical issues of present society.

UNIT – I

Value education – Meaning – Nature and Purpose
Importance of Value Education

UNIT – II

Basic Features of Rational Ethics- Moral consciousness and conscience
Love – the ultimate moral norm

UNIT – III

Morality and Freedom - Human Freedom and Moral Responsibility- God, Religion and Morality
Sanction for Moral Life.

UNIT – IV

Social Ethics: Value of life and human beings
Liberty. Equality and Fraternity

UNIT – V

Ethical Issues Today: Religious Ethics- Family Ethics- Political Ethics - Business Ethics- Ethics and Culture.

TEXT BOOKS

1. Herold Titus, 1964. *Ethics for Today*. Eurasia Publishing House, New Delhi.
2. Madan, G.R., 1966. *Indian Social Problems*, Allied Publishers, New Delhi.

SUPPLEMENTARY READINGS

1. Sharma, R.N., 1968. *Principles of Sociology*, Educational Publishers, Meerut.
2. Willam, K., 1999. *Ethics*, Prentice Hall of India, Delhi.
3. Arumugam, N., 2012. *Value based Education*, Saras, Madras.

Outcome Mapping

CO/PO	PO												PSO					
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
CO1	3					1					2				1			2
CO2		3		1		1		2		2		2		1				
CO3		2			2					1				2				2
CO4	1		2			1						1			2		3	
CO5	3			3			2		1		3		3		2			2

Semester	19IZOOC61: BASIC EMBRYOLOGY	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To learn the various concepts of developmental biology
LO2	To learn gametogenesis and process of fertilization
LO3	To learn cleavage, gastrulation and early embryonic developments
LO4	To learn the processes of embryogenesis, organ formation and differentiation
LO5	To learn metamorphosis and regeneration

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Assimilate knowledge on reproduction and development
CO2	Differentiate between spermatogenesis and oogenesis
CO3	Understand process of fertilization
CO4	Understand the whole process of embryogenesis and Interpret metamorphosis and regeneration

UNIT - 1: Basic concepts of Embryology

Historical thoughts, concepts and scope of embryology. Theories – germplasm theory, mosaic theory, regulative theory, gradient theory and Speman’s theory of organizers.

UNIT - 2: Gametogenesis

Reproductive organs – male and female reproductive system of frog, gametogenesis – spermatogenesis, oogenesis, perivitellinogenesis and vitellinogenesis.

UNIT - 3: Fertilization and early development

Fertilization – biological role of fertilization, basic requirements of fertilization, physiological aspects of fertilization – entry of sperm – activation of egg.

UNIT - 4: Cleavage, Gastrulation and Organogenesis

Cleavage laws, types of cleavage, planes of cleavage and patterns of cleavage. Cleavage in amphioxus. Gastrulation - major events in gastrulation, morphogenetic movements and physiology of gastrulation. Gastrulation in

amphioxus. Organogenesis - comparative account on the development of brain and eye in frog and chick - development of foetal membranes.

UNIT - 5: Metamorphosis and Regeneration

Metamorphosis - Types, hormonal control on metamorphosis, factors controlling metamorphosis in insects and amphibians. Regeneration - types and histological process – regeneration in amphibians.

PRACTICAL

1. Observation of different types of sperms – Amphibia, fish, frog, cock and man – slides/chart.
2. Observation of different types of eggs – Hen's egg, fish, frog, hen and rat- slides.
3. Observation of early development in Amphioxus – 2,4,8 and 16 celled stage – slides.
4. Observation of blastula, gastrula - Amphioxus – slides.
5. Observation of larval stage in invertebrates – radia, cercaria, zoea, mysis, bipinnaria, auricularia, dipleurula and ophiopluteus.
6. Observation of early development in frog tadpole – slides. Mouth open stage, external gill stage and opercular fold stage – slides.
7. Observation of developmental stages in chick – 20, 24, 33, 48, 72, and 96 – slides.

TEXT BOOKS

1. Verma, P.S. and V.K. Agarwal. (2017). *Chordate Embryology (Developmental Biology)*, S. Chand and Co., New Delhi.
2. Balinsky, B. I., (2012). *An Introduction to Embryology*, Saunders College Publishing Ltd., New Delhi.
3. Berrill, N.J. (1986). *Developmental Biology*, Tata McGraw Hill Publishing Co., New Delhi

REFERENCE BOOKS

- 1) Gilbert, S.F. (2013). *Development Biology*, Sinauer Associates Inc, Publishers, Sunderland, Massachusetts, USA.
- 2) Madhavan K.S. (2018). *Developmental Biology*. **Wave Books, USA.**
- 3) Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias. (2019). *Principles of Development*. Oxford University Press, USA.
- 4) Jain P.C. (2013). *Elements of Developmental Biology*. Vishal Publishing Co., Punjab.
- 5) Berry A.K. (2016). *An Introduction to Embryology*. Emkay Publications. New Delhi.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	1	3	3	2	3	3	3	2	3	3	3
CO3	3	3	3	2	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	2	3	3	3	2	3	3	2	3

Semester	19IZOOC62: EVOLUTION- I	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To learn the concepts of evolution
LO2	To learn the origin of life and geological time scale and theories of evolution
LO3	To learn the concepts of polymorphism, polyploidy and animal behaviors
LO4	To learn about mechanisms of evolution
LO5	To learn speciation and evolution of man

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand and appreciate the concept of organic evolution and origin of life
CO2	Differentiate between various theories of evolution
CO3	Interpret polymorphism and population genetics and explain the various animal behavior patterns
CO4	Understand the role of isolation in species formation and evolution and Get employment in zoological museums, zoological survey of India and paleontological institutes

UNIT - 1: Origin of Life

Introduction – Origin of life – Abiogenesis, Biogenesis, Time of origin, Urey and Miller Experiment. Evidence from Paleontology – Morphology and Comparative anatomy - Embryology - Physiological and Biochemical - Taxonomical – Geographical and Genetical Evidences.

UNIT - 2: Theories of Organic Evolution

Lamarckism – Salient feature - Use and Disuse theory and Neo Lamarckism – Experimental evidences - Darwinism – Natural selection theory – Struggle for Existence – Survival of the Fittest – Origin of the new species – sexual Selection theory - Artificial Selection theory – Theory of Pangenesis – HMS Beagle - Darwin's finches and Neo Darwinism

UNIT - 3: Mechanism of Evolution

Mutation Theory – Modern version of mutation theory – Classification of mutation – Gene mutation – Molecular basis of gene mutation – Induced mutations –

Chromosomal mutations – Evolutionary significance of mutation - Natural selection – Types of natural selection - Synthetic theory – Genetic Assimilation and Genetic Homeostasis – Non-adaptive traits

UNIT - 4: Polymorphism and Population genetics

Polymorphism – Types and origin of polymorphism - Variation – Sources of variations – Elemental forces of evolution – Polyploidy – types – origin and significance – Hardy-Weinberg Law – Genetic Drift – Salient features of genetic drift – Evolutionary significance of genetic drift

UNIT - 5: Speciation, Isolation and Evolution of man

Speciation – Types of speciation – Mechanism of speciation – Patterns of speciation – Factors influencing speciation – Isolating mechanisms – Patterns of evolution - Evolution of man – Fossils, types and significance - Living fossils – Continuous and discontinuous distribution of animals – Mimicry and Colouration – Adaptation and adaptive radiation.

Current Streams of Thought (Not for final exam):

Recent discoveries in Evolution – mechanism - the process of evolution - understanding phylogenies - ancient fossils and modern climate change.

PRACTICAL

1. Homologous organs, Analogous organs, vestigial organs
2. Fossils: Trilobite, nautilus, Ammonite
3. Animals of evolutionary importance: Peripatus, Limulus and Archaeopteryx
Darwin's finches
4. Mimicry: leaf insects, Stick insects, Monarch and Viceroy butterfly
5. Adaptive colouration: Chamaeleon, Lycodon

TEXT BOOKS

1. Colbert, E.H. (1969). *Evolution of vertebrates*, Wiley, New York.
2. Arumugam, N. (2016). *A text book of evolution* – Saras Publication. Nagercoil, Tamil Nadu.
3. Rastogi, V.B. (2018). *Organic evolution*, Kedar Nath Ram Nath Publishers, Meerut, UP.
4. Hall, B.K. and B.Hallgrimson. (2014). *Strickbergers Evolution*, Jones and Bartlett Publishers Ltd., New Delhi.
5. Gupta.P.K., N. (2008). *Cytology, genetics and Evolution*, Rastogi Publications, Meerut, UP.

REFERENCE BOOKS

- 1) Richard Swann Lull, (2012). *Organic Evolution*, Sagwan Press, UK.
- 2) Reena Mathur, B.S. Tomar and S.P. Singh, (2014). *Evolution and behavior*, Rastogi Publications, Meerut, UP.
- 3) Clarkson E.N.K. (2011). *Invertebrate Palaeontology and Evolution*. Wiley India Pvt. Ltd.
- 4) Edwin H. Colbert, Michael Morales and Eli C. MinKoff. (2011). *Colbert's Evolution of the Vertebrates*. Wiley India.

5) Kenneth V. Kardong.(2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill, USA.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	1	3	3	3	3	3	3	3	2	3	3
CO3	2	3	3	3	1	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3

Semester	19IZOOC63: ECOLOGY- I	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To analyse basic concepts in ecology
LO2	To learn the role of abiotic and biotic factors in an ecosystem
LO3	To learn the conservation of ecological resources
LO4	To learn ecological succession, population and ecological adaption
LO5	To learn biogeochemical cycles, significance of natural resources and wildlife management

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyse and appreciate the basic ecological concepts
CO2	Differentiate abiotic factors and biotic community
CO3	Critically evaluate the process of ecological adaptations and successions
CO4	Understand significance of natural resources and wildlife and their conservation

Unit - 1: Basic Concepts and Abiotic factors

Definition of ecology and subdivisions – autecology and synecology. Major abiotic factors and their ecological significance – Air: general composition and ecological significances of oxygen and carbondioxide; water: source, types, hydrological cycle, hydrocoles, mesocoles and xerocoles; Light: spectral distribution of solar light, zonation of water bodies based on penetration of light - biological effects of light and bioluminescence; Temperature: diurnal variations, thermal stratification of water bodies - Thermal adaptations (homeotherms, poikilotherms, hibernation, aestivation and thermal migration).

Unit – 2: Biotic Factors, Ecosystem and Biotic Community

Biotic environment: Types, mechanisms and significance of various interspecific relationships (mutualism, commensalism, antibiosis, parasitism, predation and competition).

Ecosystem: Principal steps, components and structure, trophic levels, food chain, food web and ecological pyramids. Structure and functions of pond and forest ecosystems. Energy flow in an ecosystem.

Community: Definition, characteristics and community stratification in terrestrial, fresh water and marine habits, ecotone, edge effect, habitat, ecological niche, ecotypes and ecological indicators.

Unit - 3: Ecological Succession, Population and Adaptations

Succession: Kinds, process and theories of succession. Patterns of succession – xerosere and hydrosere.

Population: characteristics of population, regulation of population (density independent and density dependent factors). Adaptations: fossorial, cursorial, arboreal, volant (flight) and desert adaptations.

Unit - 4: Biogeochemical Cycles, Natural Resources and Wild Life Management.

Carbon, nitrogen and phosphorous cycles. Renewable and non – renewable natural resources and their conservation. Causes of wild life depletion in India. Common endangered species in India. Necessity and modes of conservation. Major wild life sanctuaries, national parks and biosphere reserves in India and their significances.

Unit - 5: Major Ecological Issues

Environmental pollution: Major sources, causes, impacts and control measures of air, water, noise, radiation, thermal and land pollutions. Reasons, ecological consequences and remedial measures of green house effect, global warming, sea level rise, water scarcity and importance of water conservation.

Current Streams of Thought (Not for final exam) :

Recent trends in Ecology – Conservation and restoration ecology- Adaptability – Territoriality in small animals – Nobel Prize for Ecology and biodiversity conservation using modern techniques.

PRACTICAL

1. Estimation of dissolved oxygen
2. Estimation of dissolved CO₂
3. Determination of salinity
4. Determination of nitrites
5. Determination of TDS.
6. Identification of planktons
7. Quantitative estimation of planktons
8. Food chain
9. Adaptations: Fossorial, cursorial, volant and dessert adaptations
10. Inter specific interactions: Symbiosis, parasitism and predation.

TEXT BOOKS

1. Ananthkrishnan, T.N. and S. Viswanathan.(1996). *Principles of Animal Ecology*, Cornell University, USA.
2. Rastogi, V.B. and M.S. Jayaraj, (2001). *Animal Ecology and Distribution of Animals*, Kedar Nath Ram Nath. Meerut, UP.

3. Verma, P. S. and V. K. Agarwal. (1996). *Environmental Biology* (Principles of Ecology), S. Chand & Co Ltd., New Delhi.

REFERENCE BOOKS

- 1) Meetu Gupta. (2018). *Fundamentals of Environmental Biology*. I.K. International Publishing House, New Delhi.
- 2) Purohit S.S. (2014). *Ecology and Environmental Biology*. Agrobios, Rajasthan.
- 3) Manoj Kumar Sharma. (2013). *Environmental Biology*. Vayu Education of India, New Delhi.
- 4) Charles H. Ecleston. (2011). *Environmental Impact Assessment: A Guide to Best professional Practices*. CRC Press, USA.
- 5) Rana S.V.S. (2013). *Essentials of Ecology and Environmental Science*. Prentice Hall, India.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	3	3	1	3	3	3	3	2	3	3	3	3	2
CO2	3	3	3	3	1	3	3	3	3	3	3	2	3	3	3
CO3	3	2	3	3	1	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	2	3	3	2	3

Semester	19IZOOC64: ANIMAL CULTURE TECHNIQUES	L	T	P	C
VI		5	0	0	5

Learning Objective (LO):

LO1	To learn vermicomposting
LO2	To learn apiculture
LO3	To learn sericulture
LO4	To learn aquaculture
LO5	To learn Oyster culture

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Start entrepreneurial activities involving solid waste management and vermicomposting
CO2	Take up apiculture as a profession
CO3	Take up sericulture as a profession
CO4	Start aquaculture, oyster culture and also take up jobs in animal culture industry

Unit - 1: Vermicomposting

Method of composting - factors responsible for composting – vermicomposting – Composting earthworms, Indigenous and exotic - Applications of vermicompost- vermiwash.

Unit - 2: Apiculture

Types of honey bees - bee colony - structural adaptation social life in honey bees - types of bee hives and other accessories - apiary - uses of honey.

Unit - 3: Sericulture

Types of Silk worm - *Bombyx mori* - cultivation of mulberry plants - rearing of silkworms - silk production - composition - reeling of silk and uses of silk.

Unit - 4: Fish culture

Types of culture, types of ponds, general culture techniques - induced breeding - culture of edible fishes.

Unit – 5: Oyster culture

Seed production and collection – Feed and nutrition - edible oyster and pearl oyster – Predators and environmental factors affecting oyster culture.

Current Streams of Thought (Not for final exam): animal culture: Recent discoveries in animal cell culture – Nobel prize in tissue culture or cell cultural (or) medical research - recent achievement in animal culture.

PRACTICAL

1. Types of earthworms - Epigeic, Anaecic.
2. Pit method of vermicomposting. Spotter - Vermicompost, Vermiwash.
3. Mounting Legs, Sting, Mouth parts of honey bee.
4. Observation of life cycle of honey bee.
5. Study of beehive and its accessories.
6. Observation of Life cycle of silkworm.
7. Demonstration of silk gland.
8. Identification of carps - Catla, Rogu, Mrigal, Silver carp, Grass carp, Common carp.
9. Estimation of Hardness and Salinity.
10. Identification of brackish water prawns - *Penaeus monodon*, *Litopenaeus vannamei* and Fresh water Prawn – *Macrobrachium rosenbergii*.
11. Determination of Nitrite and Silicate in water.

TEXT BOOKS

1. Vasantaraj David.B and Kumaraswamy.T (2002). *Elements of Economic Entomology*. Popular Book Depot, Madras.
2. Pillay T.V.R. and M.N.Kutty. (2011). *Aquaculture Principles and Practices*, Wiley India Pvt Ltd.
3. Marry Christ Violet .A. (2014), *Vermitechnology*, MJP. Publisher, Chennai.

REFERENCE BOOKS

- 1) Manish Kumar Singh. (2014). *Handbook of vermicomposting: Requirements, Methods, Advantages and Applications*. Anchor Academic Publishing, Germany.
- 2) Kaliannan Durairaj, Arunachalam Manimekalan and Palaninaiker Senthilkumar. (2017). *Production of Marine Prawn Litopenaeus vannamei in pond culture system*. Lap Lambert Academic Publishing, Germany.
- 3) Chiranjib Chakraborty and A.K.Sadhu.(2013). *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. Daya Publishing House, New Delhi.
- 4) William E. Meehan. (2018). *Fish Culture: In Ponds and other Inland waters*. **Palala Press**, USA.
- 5) Francis Francis. (2019). *Fish Culture: A Practical guide to the Modern system of Breeding and Rearing Fish*. Hardpress Publishing.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	2	3	3
CO2	3	2	3	3	1	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	1	3	2	3	3	2	3	3	3	3	3
CO4	2	3	3	3	1	3	3	3	3	3	3	2	3	2	3

FOURTH YEAR

Semester	19IZOOC71: STRUCTURE AND FUNCTIONS OF INVERTEBRATES AND VERTEBRATES	L	T	P	C
VII		4	0	0	4

Learning Objective (LO)

LO1	To understand the structure and functions of invertebrates and vertebrates
LO2	To understand the organs of respiration and excretion and their functioning in invertebrates.
LO3	To analyses the nervous systems of various groups in invertebrates
LO4	To evaluate the larval forms of invertebrates to acquire knowledge on various organ system of vertebrates

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the morphological features and physiological features like Respiration, reproduction and nervous system of Invertebrates and Vertebrates
CO2	Understand the various salient features of higher Invertebrates and Vertebrates
CO3	Differentiate the patterns of functioning of various organ systems in invertebrates and vertebrates
CO4	Know the structural organization and functioning of various organs in invertebrates and vertebrates.

UNIT - I: Respiration and Excretion of Invertebrates

Organs of respiration: gills, lungs and trachea – Respiratory pigments – Mechanism of respiration – Excretion – Organs of excretion: coelom, coelomoducts, nephridia and Malpighian tubules – Mechanisms of excretion – Excretion and osmoregulation.

UNIT - II : Nervous System of Invertebrates

Primitive nervous system: Coelenterata and Echinodermata – Advanced nervous system: Annelida, Arthropoda (crustacean and insecta) and Mollusca (cephalopoda) –Trends in neural evolution.

UNIT - III : Invertebrata larvae

Larval forms of free living invertebrates – Larval forms of parasites – Strategies and evolutionary significance of larval forms – Minor Phyla – Concept and significance – Organization and general characters.

UNIT - IV : Skin and Skeletal System of Vertebrates

General structure and functions of skin and its derivatives – glands, scales, horns, claws, hair, hooves, feather and hairs. Skeletal elements of the body – account of jaw suspensorium, vertebral column – limbs and girdles.

UNIT - V : Respiratory system and Nervous system of Vertebrates

Respiratory system – characters of respiratory tissue – Internal and external respiration – comparative account of respiratory organ. Nervous system – Anatomy of the brain and spinal cord in relation to their functions – Nerves - Cranial – peripheral and autonomous nervous system.

PRACTICAL

1. Dissections:

Dissection of Cockroach – Digestive and Nervous system, Dissection of Prawn - Nervous system and mounting of appendages.

Dissection of Fish – Nervous system, Respiratory system and Digestive system.

2. Observation and Classification of the following Specimens by giving reasons: Paramecium, Sycon, Obelia, *Taenia solium*, Neries, Prawn, Freshwater mussel, Amphioxus, Hyla, Calotes, Rat.
3. Study of Adaptations to the mode of life: Trypanosoma, Corals, Ascaris, Wuchereria
4. Biological Significance of the following forms: Peripatus, Sea anemone, Anabas, Arius, Exocoetus, Eel, Amblystoma, Woodpecker, Ant eater, Lingula, Sagitta and Phoronis.
5. Relate structure and function of the following forms: Taenia, Scolex, Nereis-Parapodium, Ctenoid and Quill feather of pigeon.

TEXT BOOKS

1. Arumugam, N., T. Murugan, B. Ramanathan and M.G Ragnathan. (2019). *A Text Book of Invertebrates*, Saras Publications, Nagercoil, Tamil Nadu.
2. Wells, H.G. (2018). *Text Book of Biology, Part 1: Vertebrata*, Createspace Publishing Company, USA.
3. Ekambaranatha Ayyar, M. (1973). *A Manual of Zoology – Part I, Invertebrata*. S.Viswanathan (Printers and Publishers) Pvt., Ltd. Madras.
4. Jordon, E. L. and P. S. Verma, (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
5. Ekambaranatha Ayyar, M. (1973). *A Manual of Zoology Part – II: Chordata*. S. Vishvanathan Printers and Publishers, Pvt. Ltd., Madras.

6. Jordan, E. L. and P. S. Verma, (2017). *Chordate Zoology and Elements of Animal Physiology*, S. Chand & Co., Ltd., New Delhi.
7. Saxena, R.K. and S. Saxena. (2015). *Comparative Anatomy of Vertebrates*, M.V.Learning, UK.

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume - 1 – Invertebrata*. Saras Publication, Nagercoil, Tamil Nadu.
- 2) Arumugam, N. (2014). *Animal diversity Volume - 2 – Chordata*. Saras Publication, Nagercoil, Tamil Nadu..
- 3) Barrington E. J. W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
- 4) Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates*. Oxford University Press, USA.
- 5) Kent. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill, New York, USA.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	2	3	3	2	3	3
CO3	2	3	3	3	1	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	2	3	3	3	3	3	3	2	3

Semester	19IZOOC72: DEVELOPMENTAL BIOLOGY	L	T	P	C
VII		4	0	0	4

Learning Objective (LO):

LO1	To understand the various concepts of development
LO2	To study gametogenesis and process of fertilization
LO3	To learn the processes of embryogenesis, organ formation and differentiation
LO4	To analyse the embryonic induction and teratogenesis
LO5	To critically explore assisted reproductive technologies for human welfare

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Acquire knowledge on reproduction and development
CO2	Understand process of fertilization
CO3	Understand the whole process of embryogenesis
CO4	Acquisition of skills in common methods and practices followed in developmental biology related laboratory activities and Take up jobs in fertility clinics and research labs

UNIT - I: Introduction to Embryology

Scope of embryology. Gametogenesis – spermatogenesis, oogenesis and egg membranes. Fertilization - mechanism of fertilization, capacitation, acrosomal reaction, cortical reaction and significance of fertilization. Cleavage – cleavage in frog and chick. Gastrulation – gastrulation in frog and chick. Fate map of amphibians, aves and mammals.

UNIT - II: Embryonic adaptations and Parthenogenesis.

Foetal membranes and their functions – Implantation – types and mechanism of implantation. placentation - placenta, structure, types and physiology of placenta. Parthenogenesis – types, mode of action of agents in artificial parthenogenesis – significance of parthenogenesis.

UNIT - III: Organogenesis and Differentiation

Organogenesis - development of brain, eye and heart of mammals (Rabbit). Differentiation, types, chemical basis, selective action of genes, changing pattern of protein synthesis and sequence of gene action in development – stem cells, role of microenvironments in differentiation.

UNIT - IV: Embryonic induction and Teratogenesis

Embryonic induction - types, embryonic induction in amphibians, reptiles, birds and mammals. Neural induction, gene activation, mechanism of neural induction and chemical basis of neural induction. Teratogenesis - genetic teratogenesis - in human beings and animals, teratogenic agents and mechanism of teratogenesis.

UNIT - V: Reproductive Technology for Human Welfare

Causes of impotency and sterility in the male – causes of sterility in the female – Treatment of sterility – Artificial insemination in human beings - Infertility in men and women.

PRACTICAL

1. Demonstration of male and female reproductive system in mammals (rat) - specimens
2. Dissection and mounting of chick blastoderm to identify different stages in chick development.
3. Observation of early development of frog – two celled stage, 4 celled stage, 8 celled stage and sixteen celled stage, blastula, gastrula and yolk plug stage.
4. Regeneration in amphibian – frog tadpole.
5. Observation of metamorphosis in insects.
6. Observation of different types of placenta – slides.
7. Analysis of excretory products – chick embryo.
8. Histology of mammalian testis and ovary – slides.
9. Observation of uterine cycles in mammals – slides.

TEXT BOOKS

1. Verma, P.S. and V.K. Agarwal. (2017). *Chordate Embryology (Developmental Biology)*, S. Chand and Co., New Delhi.
2. Arora, P. Mohan, (2014). *Embryology*, Himalaya publishing House, New Delhi.
3. Arumugam, N. (2014). *A Text Book of Embryology (Developmental Biology)*, Saras Publications, Nagercoil, Tamil Nadu.
4. Philip Grant (1977). *Biology of development systems*, University of Oregon
5. Berrill, N.J., and G. Karp. (1978). *Development Biology*, Tata McGraw Hill Publishing Co., Ltd, New Delhi
6. Balinsky, B.I. (2012). *An Introduction to embryology*, 4th Edition, Saunder's College Publishing Ltd, New York

REFERENCE BOOKS

- 1) Madhavan K. S. (2018). *Developmental Biology*. Arjun Publishing House.
- 2) Subhadra Devi, V. (2018). *Inderbir Singh's Human Embryology*, Jaypee Brothers Medical Publishers, New Delhi.
- 3) Berry A. K. (2016). *An Introduction to Embryology*. Emkay Publications, New Delhi.
- 4) Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias. (2015). *Principles of Development*. Oxford University Press, USA.
- 5) Jain P. C. (2013). *Elements of Developmental Biology*. Vishal Publishing Co., Punjab.

- 6) Carlson, B.M. (2014). *Pattens foundations of Embryology*, McGraw Hill
- 7) Sastry K. V. and Vinita Shukul. (2012). *Developmental Biology*. Rastogi Publication, Meerut, Uttar Pradesh..

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	2	3	3	3	3	3	3	2	3	3
CO3	2	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	2	3	1	3	3	2	3	3	2	3	3	3	2

Semester	19IZOOC73: CELL AND MOLECULAR BIOLOGY	L	T	P	C
VII		4	0	0	4

Learning Objective (LO):

LO1	To understand the molecular basis of cell structure and functions
LO2	To learn the structure and functions of various organization and cell membrane.
LO3	To learn bioenergetics and biogenesis
LO4	To learn structure and replication of DNA
LO5	To learn various molecular techniques

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Acquire knowledge on cellular structure and functions.
CO2	Understand the process of energetic and genesis in cells
CO3	Interpret the structural and functional significances of DNA and RNA
CO4	Take up jobs in molecular biology labs and clinical labs

UNIT - I: Cell structure and Cell membrane

Cell Structure: Introduction – Structural organization of prokaryotic and eukaryotic cells; structural differences of prokaryotic and eukaryotic cells.

Cell membrane: Ultra structure of plasma membrane – chemical composition of cell membrane, lipid bilayer – unit membrane concept – Fluid mosaic model; Functions of Plasma membrane; membrane transport - cell adhesion – cell recognition – antigen specificity – hormone receptors.

UNIT - II: Organelles of Endomembrane

Golgi apparatus & secretion: Ultra structure – chemical composition - origin of golgi complex - process and mechanism of secretion – Type of secretion – Function of Golgi apparatus.

Lysosome: Characteristics of lysosomal membrane and enzymes - Polymorphism of lysosome – functions of lysosome.

Endoplasmic reticulum and ribosomes: morphology and functions of endoplasmic reticulum - Structure of ribosomes and rRNAs - Organization of ribosomes – Role of ribosomes in protein synthesis.

UNIT - III: Organelles of Bioenergetics & Biogenesis

Organelles of Bioenergetics: Mitochondria - Ultra structure - respiratory chain complex; chemical composition and enzyme distribution – role in metabolism for cellular energetic - Anaerobic glycolysis, Pasteur effect - Krebs cycle – Formation of ATP. Chemical and conformation coupling hypothesis; shuttle system – Glycerophosphate and malate shuttle.

Organelle of Biogenesis: Chloroplast – Ultra structure - photochemical reaction in biogenesis - Light reaction and Dark reaction – Role of CO₂ and H₂O in photosynthesis – 'Z' scheme.

UNIT - IV: DNA Structure and Replication

Structure, Chemical composition - Types and their importance - Properties of DNA - Denaturation, Renaturation and Hybridization.

DNA replication: Prokaryotic and eukaryotic DNA replication – Semi - conservative replication mechanism, enzymes and necessary proteins origin, initiation, Termination – DNA polymerase, telomerase and mode of action – replication factors.

UNIT - V: RNAs Structure and Transcription

Structural features of RNAs: Structure of rRNA in prokaryotes and eukaryotes – structure of tRNA and anti-codon features – structure of mRNA in prokaryotes and eukaryotes.

Transcription and processing of RNA: Genetic code – Prokaryotic and eukaryotic transcription – RNA polymerases, general and specific transcription factors – regulatory elements – mechanism of transcription. Post transcriptional modifications. Translation – Prokaryotic and eukaryotic translation - translational machinery – mechanism of initiation, elongation and termination – regulation of translation. Post translational modifications.

Current Streams of Thought (Not for final exam) : Recent discoveries and Nobel prize in cellular and molecular research. Advanced research on assembly of ribosomes and ribosomal structure. Recent approach on purification and separation of nucleic acids; Analysis of protein interactions.

PRACTICAL

1. Light Microscope – components , use and principles
2. Mounting of polytene chromosomes from salivary gland of Chironomus larva
3. Squash preparation of different stages of meiosis in grasshopper testis
4. Squash Preparation of mitosis in onion root tips
5. Study of Micrometry: a) Camera lucida, b) Stage micrometer, c) Ocular micrometer
6. Determination of Nucleo – Cytoplasmic index
7. Identification of drumstick chromosome from human blood smear preparation
8. Identification of Barr body from buccal smear preparation
9. Histochemical Localization of DNA and RNA
10. Estimation of DNA and RNA of the samples.

TEXT BOOKS

1. De Robertis E.D.D and De. Robertis E.M.F. (2017). *Cell and Molecular Biology*. Lippincott Williams & Wilkins , USA.
2. Pollard, T.D., W.C.Earnshaw, J.L.Schwartz and G.Johnson. (2017). *Cell Biology*, Elsevier.
3. Gupta. P.K., (2003). *Cell and Molecular Biology*, Rastogi Publication, Meerut, India.
4. Lodish.H, Berk.A, Zipursky.SL, Matiudaira.P, Baltimore.D and Darnell J. (2000). *Molecular Biology of the cell*, W.H. Freeman and company, New York.
5. Lewin.B, (2000). *Gene VII*, Oxford University Press, London.
6. Verma P.S. and V.K. Agarwal, (2015). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, S. Chand and Company, New Delhi.

REFERENCE BOOKS

- 1) Verma P. S. and V. K. Agarwal. (2016). *Cell Biology*. S Chand & Co., New Delhi.
- 2) Geoffrey M. Cooper and Robert E. Hausman. (2013). *The Cell: A Molecular Approach*. Sinauer Associates Inc., USA.
- 3) Arnold Berk, Chris A.Kaiser and Harvey Ledish. (2016). *Molecular Cell Biology*. WH Freeman, USA.
- 4) Malathi, V. (2012). *Essentials of Biology*. Pearson Education, Chennai, India.
- 5) Bruce Alberts, Alexander D. Johnson and Julian Lewis. (2014). *Molecular Biology of the Cell*. W.W.Norton & Co., USA.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	2	3	3	3	2	3	3
CO3	3	2	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19IZOOC81: ANIMAL PHYSIOLOGY	L	T	P	C
VIII		4	0	0	4

Learning Objective (LO)

LO1	To learn the significance of food and physiology diagram
LO2	To understand the significance of excretory and osmoregulation system.
LO3	To study the functioning of cardiovascular system
LO4	To study respiratory and nervous systems including various receptors

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the normal physiological functions and necessity to maintain a healthy Life
CO2	Get an opportunity to understand various factors that could lead to altered physiological functions and thereby health problems
CO3	Perform various physiological experiments and observations
CO4	Take up jobs in clinical labs and research institutes

UNIT - I: Food and Digestion

Composition of food - classification of nutritive substances - comparative physiology of digestion - digestion in mammals - digestive enzymes – absorption - hormonal control of digestion – BMR – BMI.

UNIT - II: Excretion and Osmoregulation

Excretion - Nitrogenous wastes and their formation – Patterns of Excretion in different animal groups – Mammalian excretory system – structure and functions of vertebrate kidney - Mechanism of urine formation – Acid-base balance – electrolyte balance - Hormonal control of kidney function in mammal.

General concepts of osmoregulation – osmoregulation in invertebrates and vertebrates.

UNIT - III: Circulation

Major types of body fluids - circulation of body fluids and their regulations - Composition of blood – blood groups – clotting mechanism – buffer system of blood - Circulation of blood in vertebrates - Open and Closed systems – Arthropod heart – Chambered hearts and booster pumps. Structure of mammalian heart, origin, conduction and regulations of heart beat – cardiac cycle and ECG.

UNIT - IV: Respiration

Respiration in vertebrate – Respiratory organs and their ventilation – Integumentary respiration – bronchial respiration – lung respiration – mechanism of respiration in vertebrates – Regulation of breathing - Neural and chemical regulation – Transport of Oxygen - Respiratory pigments – Bohr's effect – Transport of CO₂ – Haldane's effect.

UNIT - V: Nervous system, Muscle and Sense organs

Nervous System: Structure of neuron - Transmission of nerve impulse – axonal transmission - theories of excitation - synaptic transmission – nervous system (central & Peripheral) - neuroendocrine system - hormones and their functions.

Muscle: Types and Structure - chemical composition – mechanism of muscle contraction.

Sense Organs: Mechanoreceptors – chemoreceptors - photoreceptors – phonoreceptors – equilibrium receptor - Bioluminescence.

Current Streams of Thought (Not for final exam) : Cell biology: Recent discoveries in cell physiology – Nobel prize in physiological (or) medical research – Advances research on need of oxygen for functions of cell; Sense and respond to cell to the Oxygen level; Cell adjustment with level of oxygen at high attitudes

PRACTICAL

1. Effect of enzyme concentration on the activity of salivary amylase
2. Effect of substrate concentration on the activity of salivary amylase
3. Effect of pH concentration on the activity of salivary amylase
4. Oxygen consumption of fish.- Unit metabolism
5. Effect of thyroxin on the respiratory metabolism of fish.
6. Counting of blood cells (RBC and WBC).
7. Quantitative estimation of haemoglobin.
8. Quantitative estimation of proteins.
9. Biochemical analysis of protein, Carbohydrates and Lipids (Qualitative).

TEXT BOOKS

1. Verma, P. S., B. S. Tyagi and V. K. Agarwal, (2015). *Animal Physiology*. S. Chand & Company Ltd, New Delhi.
2. Arumugam, N. and A. Mariakuttikan . (2017). *Animal Physiology*, Saras Publications, Nagercoil, Tamil Nadu.
3. Rastogi, S.C. (2016). *Essentials of Animal Physiology*, New Age International Publishers, New Delhi.
4. William S. Hoar, (1966). *General and Comparative Physiology*. Prentice Hall of India, New Delhi.
5. Wilson. A, (1979). *Principles of Animal Physiology*. Macmillan Publishing Co., Inc. New York.
6. Leon Goldstein, (1977). *Introduction to Comparative Physiology*. Holt, Rinehart and Winston, New York.

7. Prosser, L. and A. Brown, (1965). *Comparative Physiology*. Saunders Company, London.

REFERENCE BOOKS

- 1) Arumugam N. (2019). *Animal Physiology*. Saras publications. Nagercoil, Tamil nadu
- 2) Mohan P. Arora. (2018). *Animal Physiology*. Himalaya Publishing House Pvt. Ltd., New Delhi
- 3) Tomar B.S. and Neera Singh. (2016). *Animal Physiology*. Pragati Prakashan, Meerut, Uttar Pradesh .
- 4) Sobti R.C. (2011). *Animal Physiology*. Narosa Publishing House, New Delhi.
- 5) Sandeep Saxena. (2012). *Animal Physiology*. Oxford University Press, USA.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	1	3	3	2	3	3	3	3	3	3	2
CO2	3	2	3	3	1	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	1	2	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	1	3	3	3	2	3	3	3	3	3	3

Semester	19IZOOC82: GENETICS	L	T	P	C
VIII		4	0	0	4

Learning Objective (LO):

LO1	To learn the fundamental concepts of genetics
LO2	To study human health related genetic problems, quantitative traits and population genetics
LO3	To learn the structure of genes and their regulation
LO4	To acquire skills in chromosomal alterations, gene mutations and cancer.
LO5	To learn application of genetics concepts in microbial genetics and genetic engineering.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Interpret phenotypic expressions based on genotype
CO2	Understand and interpret genetically linked diseases
CO3	Perform blood group analysis and test metabolic disorders
CO4	Working clinical laboratories and take up researches

UNIT - I: Principles and Concepts of Gene and Gene mapping

Mendelian principles: Dominance, Segregation extension of principles: Gene Interactions, dominant epistasis, Pleiotrophy: Penetrance and expressivity. Linkage and crossing over – concept, theories and example - linkage maps (X chromosome) gene mapping in drosophila, Coincidence and Interference – multiple allele – ABO and Rh blood group in man.

UNIT - II: Quantitative, Population and Human Genetics

Polygenic inheritance: concept, mode of inheritance of skin colour in man – heritability and its measurements - normal karyotypes – Syndromes related to numerical variations of chromosomes – pedigree analysis – genetic counseling, Hardy-Weinberg law of genetic equilibrium.

UNIT - III: Fine Structure of Gene and Regulation of Gene action

Fine structure of gene - regulation of gene action - 'Lac and His' operon system - genes and metabolism – inborn errors of carbohydrate, proteins and lipid metabolism in man. One gene one enzyme concept – One gene one polypeptide concept.

UNIT - IV: Chromosomal Alterations, Gene Mutation and Oncogenes

Chromosomal aberrations – types and causes – point mutation – mutagens-chemical mutagens – molecular mechanism of gene mutation, mutant types – lethal, conditional biochemical loss of function – oncogene and cancer.

UNIT - V: Microbial Genetics and Genetic Engineering

Microbial genetics: Methods of genetic transduction – sex-duction – genetic engineering - restriction enzymes – recombinant DNA techniques – applications of recombinant DNA technology.

PRACTICAL

1. Experiments on Mendelian inheritance
2. Experiments on polygenic inheritance
3. Human traits survey and data collection
4. Gene frequency calculations in population - Autosomal, multiple alleles and sex linked genes.
5. Testing the significance of genetic data - Chi-square test.
6. Human pedigree construction to study the inheritance of autosomal character.
7. Human pedigree for sex linked character and counseling
8. Culturing and maintenance of *Drosophila* in lab - Demonstration.
9. Identification of sex and mutant characters in *Drosophila*
10. Karyotyping of normal man using metaphase chromosomal plate.
11. Identification of human syndromes from karyotyping

TEXT BOOKS

1. Snustad, D.P. and M. J. Simmons. (2017). *Principles of Genetics*, John Wiley & Sons Inc., India.
2. Karvita B. Aluwalia, (1991). '*Genetics*', Wiley Eastern Ltd., New Delhi.
3. Robert. H Tamirin, (2004). '*Principles of Genetics*', Tata Mc. Graw-Hill Publishing Company Ltd., New Delhi.
4. Sarin, C., (1990). '*Genetics*'. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
5. Verma P.S. and V.K. Agarwal, (2015): *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, S. Chand and Company, New Delhi.
6. Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick. (2015). *Lewins's Genes XI*, Jones and Bartlett Publishers, Inc., USA.

REFERENCE BOOKS

- 1) William S. Klug, Michael R. Cummings and Chariotte A. Spencer. (2016). *Concept of Genetics*. Pearson, UK.
- 2) Gangane S.D. (2017). *Human Genetics*. Elsevier, India.
- 3) Robert Tamarin. (2017). *Principles of Genetics*. McGraw Hill, New York, USA.
- 4) James D. Watson, A. Baker Tania and P. Bell Stephen. (2017). *Molecular Biology of the Gene*. Pearson, UK.
- 5) Weaver, R.F. and P.W.Hedrick. (2015). *Genetics*, Brown (William C.) Co.,

- U.S.
- 6) Peter Snustad, D. and Michael J. Simmons. (2011). *Genetics*. John Wiley & Sons.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
C01	3	2	3	3	1	3	2	3	3	3	3	3	3	2	3
C02	3	3	3	2	1	3	3	3	3	2	3	3	3	3	3
C03	3	3	3	3	1	3	3	2	3	3	3	3	3	3	3
C04	3	3	2	3	1	3	3	3	3	3	3	2	3	3	2

Semester	19IZOOC83: IMMUNOLOGY	L	T	P	C
VIII		4	0	0	4

Learning Objective (LO):

LO1	To learn the basic concepts, principles and mechanisms involved in Immunology
LO2	To develop awareness regarding the molecules, cells and organ system involved in immunological and their significances in up keeping the organism
LO3	To learn the various types of antigen and antibody
LO4	To acquire skills in the methodologies of antigen antibody interaction
LO5	To gain knowledge regarding the application of immunological techniques

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyze the various in immunological issues
CO2	Apply immunological procedures for various immunological testing procedures
CO3	To Interpret the results of immunological experiments and Take up jobs in clinical labs and related institution
CO4	Carry out immunological investigation and Equip themselves for higher studies

UNIT - I: Overview and Scope of Immunology

Innate and acquired immunity. Humoral and cell mediated immunity. Clonal selection of lymphocytes. MHC/HLA system. Immunological significance of inflammation. Transplantation immunology: Cell mediated graft rejection - hyper acute, acute and chronic rejections.

UNIT - II: Molecules, Cells and Organs of Immune System

Brief description of molecules of immunity (Lysozyme, interferon, complements, cytokines and chemokines). Haematopoietic stem cells: Myeloid and lymphoid progenitors and their derivatives – mononuclear phagocytes and granulocytic cells (monocytes, Th Cells, Tc cells, B Cells, NK cells, mast cells, dendritic cells, neutrophils, eosinophils, basophils) and their immunological significance. Primary lymphoid organs: thymus, bone marrow and bursa of Fabricious. Secondary lymphoid organs: lymph nodes, spleen and MALT.

UNIT - III : Immunogen and Antigen

Definition of antigen and immunogen and classification. Properties of immunogen: Immunogenicity, antigenicity, allergenicity and tolerogenicity. Factors affecting immunogenicity: Contribution of immunogen - foreignness, molecular size,

chemical composition & heterogeneity, degradability; contribution of biological system - genotype of recipient, dosage and route of administration; adjuvants, epitopes, heptens and mitogens.

UNIT - IV: Antibodies

Basic structure of immunoglobulins. Classes of immunoglobulins (IgG, IgM, IgA, IgE, IgD), their structural modifications and biological activities. Monoclonal and polyclonal antibodies. Antigenic determinants on immunoglobulins: isotype, allotype and idiotype. Hyper sensitivity: Brief description of type I, II, III and IV. Autoimmune diseases :Organ specific – insulin dependent diabetes mellitus and Graves' disease; systemic –rheumatoid arthritis and multiple sclerosis.

UNIT - V Antigen – Antibody Interactions

Strength of antigen – antibody interactions: Antibody affinity, antibody avidity; cross reactivity; precipitin reaction; agglutination reaction - haemagglutination, bacterial agglutination, passive agglutination and agglutination inhibition. Radial immuno diffusion, double immuno diffusion. Radio immuno assay (RIA). Enzyme linked Immunosorbant Assay (ELISA). Western blotting.

Current Streams of Thought (Not for final exam): Significant immunological development in recent years. Immunotherapy. Autoimmune diseases and immune deficiencies. Organ transplantation and stem cell research.

PRACTICAL

1. Demonstration of lymphoid organs
2. Cell imprinting of lymphoid organs
3. Histology of lymphoid organs
4. Study of bone marrow cells
5. Identifications of leucocytes in human blood smear.
6. Differential count of W.B.C. from blood smear preparation
7. Human blood grouping
8. Antigen antibody interaction - Demonstration
9. Rapid plasma reagent (RpR) test for syphilis

TEXT BOOKS

1. Kannan, I. (2019). *Immunology*, MJP Publications, Chennai, Tamil Nadu.
2. Kinndt, T. J. Goldsby, R. A. and Osborne, B.A. (2007). *Immunology*, 6th Ed. W.H. Freeman and Company, New York.
3. Murphy, K.M. and C. Weaver. (2017). *Janeway's Immunology*, W. W. Norton & Company.
4. Nair, N.C., S.Leelavathy, N.Soundarapndian, T.Murugan an N.Arumugam. (2015). *A text book of Immunology*, Saras Publications, Nagercoil, Tamil Nadu.
5. Madhavee, L.P. (2012). *A text book of Immunology*, S. Chand and Co., New Delhi.

REFERENCE BOOKS

1. Jenni Punt, Sharon Stranford, Patricia Jones and Judith A Owen. (2018). *Kuby Immunology*. WH Freeman, USA.
2. Ramesh, S. R. (2017). *Immunology*. McGraw Hill, New York, USA.
3. Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai. (2017). *Cellular and Molecular Immunology*. Elsevier.
4. Peter J. Delves, Seamus J. Martin and Dennis R. Burton. (2017). *Roitt's Immunology (Essentials)*. Wiley Blackwell, UK.
5. Raj Khanna. (2011). *Immunology*. Oxford University Press, USA.
6. Rao, C. V. (2011). *Immunology, A Text Book*. 2nd Ed. Narosa Publishing House, New Delhi.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	1	2	3	3	2	3	3	2	3	2	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

FIFTH YEAR

Semester	19IZOOC91: EVOLUTION- II	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To gain awareness about the origin of life
LO2	To understand the roles of variations, polymorphisms, and polyploidy in evolution
LO3	To familiarize the role of isolation and speciation in evolution
LO4	To understand the various types of adaptations and mimicry
LO5	To learn the evolution of mankind

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyse the evolutionary history of biological organisms
CO2	Critically assess the evolutionary relationship among various phyla
CO3	Identify the role of natural selection in the survival of the species
CO4	Understand the various mechanisms involved in evolution.

UNIT - I: Origin

- i. Environment:- nature and origin of life - proteins nucleic acids - Container membrane – Molecular interactions - Pool origin – Volcanic origin - Metaoric origin – Chemical Evolution.

Theories

- I. Theories of organic evolution: Lamarck's Evolutionary propositions - Critical analysis of Lamarck's prepositions - Neo-Lamarckism..
- ii. Theory of natural selection : Darwin – Wallace theory of natural selection - Critical analysis of Darwinism – Neo-Darwinism - Modern synthetic theory.

Natural Selection and process:

- i. Process of evolutionary change: Two – Step process Random mating – the Hardy – Weinberg Law and its Application – Migration - Random. Genetic Drift - founder effect and bottlenecks - Genetic Assimilation – Genetic Homeostasis.
- ii. The concept of natural selection - Darwinism Fitness – Selection against recessive homozygotes - selection against dominants and selection without dominance. Selection and mutation – Estimation of mutation rates - selection against heterozygotes - Frequency – Dependent selection.

UNIT - II : Mechanism

i) Variation and evolution

Basic units of variability – effect and types. Genetic mutations - chromosomal rearrangements – change in chromosome number, chromosome segregation and recombination - crossing over - mutation and its role in evolution.

The mechanism of natural selection by internal characters - selection by environmental factors.

Direction of selection – centripetal selection – Centrifugal selection.

ii) Polymorphism and evolution:

Transient polymorphism and industrial melanism - Balanced and neutral polymorphism - genetic polymorphism - chromosomal polymorphism - criticism of the polymorphism concept - Evolutionary significance of polymorphism

ii) Polyploidy and evolution

Polyploidy in animal and plants - types of polyploids - direct effect of Polyploidy - origin of polyploidy and the origin of higher categories in plants – practical significance.

UNIT - III

i) Isolation and evolution:

Premating isolation mechanism – Geographical – Ecological, seasonal - ethological – physiological and mechanical isolation.

Postmating isolation mechanism - Gametic – zygotic mortality - hybrid in viability - hybrid break down – genetic basis of reproductive isolation - origin – significance.

ii) Speciation and evolution:

Species concept - morphological – Genetic - Sterility based – Biological – sibling concepts - Monotypic and polytypic – Sub-species categories .

Types of speciation: Mechanism of speciation - allopatric speciation sympatric – speciation - quantum evolution - evolutionary significance.

UNIT - IV

i) Adaptation Mimicry and colouration:

Mimicry – Protective – aggressive - conscious sound and scent mimicry - Batesian and Mullerian mimicry - Experimental proof of mimicry – evolution of mimicry - significance.

Colouration: Chemical colours - physical colours - indifferent colours - valuable colours – Symoathetic - cryptic and concealing colouration - standard faunal colours – warning or revealing colours - mimetic colouration – confusing and sexual colouration.

UNIT - V:

i) Trends and rated

Evolutionary trends: Phylogenetic patterns, - Micro, macro and mega evolution - adaptive radiation trend - convergent-parallel – orthogenetic - non adaptive and interactive trends in evolution.

Evolutionary rates: Morphological rate of evolution - Taxonomic rate - Molecular rate-the role of extinction in macro evolution-measuring of extinction rate.

ii) Mankind evolution

Past evolution: Fossil history of mankind - primate, apes - Hominid evolution, early and history middle phase of hominid ancestor - the earliest humans; towards modern human; modern humans.

Present evolution: Cultural and social evolution of hominids.

Future evolution: Biological future of mankind - positive and negative eugenics - mankind and the organic world evolution – biochemical evolution.

Practicals:

1. Genetic drift in small and large population using dummy materials
2. Sexual selection (a) Secondary sexual characters, e.g. Chimeroid fish (male), (b) Brooding organs - Sea Horse (male), (c) Special sound producing organs - scale insect (male), (d) Rhinoceros beetle (male).
3. Polymorphism - (a) Transient Polymorphism e.g. industrial melanism, (b) Neutral Polymorphism e.g. Umbonium shells, (c) Balanced Polymorphism
4. Genetic Assimilation – in *Drosophila*
5. Identification of male and female *Drosophila*
6. Mimicry and Colouration - Concealing mimicking, e.g. Kallima butterfly, Geometrid moth, Stick insect, Leaf insect.
Warning mimicry - Viceroy and Monarch butterfly, Batesian and Mullerian mimicry.
7. Paleontology: Invertebrate fossil - Trilobite, Vertebrate Fossil - Archaeopteryx.
8. Osteology: Evolution of reptilian skull and its interrelationship
9. Evolution of mankind - similarities and differences between apes and man. Evolution of human skull.

Text book:

1. Bergstrom, Carl T. and Lee Alan Dugatkin, (2016). *Evolution (Second Edition)*, W.W. Norton and company, New York, USA.
2. Hall, B.K. and B.Hallgrimson. (2014). *Strickbergers Evolution*, Jones and Bartlett Publishers Ltd., New Delhi.
3. Verma P.S. and V.K. Agarwal, (2007): *Evolution*, S. Chand and Company, New Delhi.
4. Arumugam, N. (2014). *Organic Evolution*. Saras Publication. Nagercoil, Tamil Nadu.
5. Verma P.S. and V.K. Agarwal, (2015): *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*, S. Chand and Company, New Delhi.

Reference:

1. Darwin, C. The Origin of species, Te.Oup.Desmond Morris, (1990). *Animal Watching* (Field Guide), Crown Pup Co., London.
2. Dobzhansky, T. (1951). *Genetics and the origin of species*, Columbia University Press, USA.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3	3	2	3	2	3
CO3	3	2	3	3	1	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	1	3	3	3	3	3	2	3	3	3	3

Semester	19IZOOC92: ENVIRONMENT AND BIODIVERSITY CONSERVATION	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To gain awareness about the basic concepts of environment and ecology
LO2	To create a mindset for conservation of biodiversity
LO3	To familiarize the concept of environmental impact assessment
LO4	To understand the significance of natural resources and sustainable development
LO5	To create awareness about environmental pollution and its prevention
LO6	To learn the phenomenon of global warming and its prevention

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyse and appreciate the basic ecological concepts
CO2	Critically assess environmental disasters and suggest counter measures
CO3	Develop a mind set to safeguard natural resources and take forward the concept of sustainable development
CO4	Protect the environment by acting against pollution, Take up employment in environment related agencies and institution and Educate the public regarding the importance of rain water harvesting and water Conservation

UNIT - I: Basic concepts and environmental impact assessment

Concept of ecosystem, environment and biosphere. Biogeochemical cycles - carbon, nitrogen and phosphorous cycles. Environmental impact assessment (EIA): Objectives: General operational procedures and process, places in EIA, environmental planning and decision making. Describe properties of EIA methods. General procedures for environmental audit.

UNIT - II: Natural resource and sustainable development

Non-renewable and renewable natural resources and their conservation. Forest resources and types of forests in India. Use and over exploitation of forests. Deforestation and afforestation, land degradation, landslides, soil erosion and desertification. Food resources, world food problems, effect of modern agriculture and overgrazing. Concept of sustainable development and brundtland report.

UNIT - III: Environmental pollution and disaster management

Cause, effects and remedial measures of air, water, noise thermal, radioactive and agriculture pollution. Disasters caused by floods, earthquake and cyclones and their management. Solid waste issues and its management

UNIT - IV: Biodiversity and its conservation

Types of biodiversity, species richness and heterogeneity and significance of biodiversity. Threats to biodiversity and biodiversity crisis. Socio economic and political causes of loss of biodiversity. Conservation of biodiversity: in-situ and ex-situ conservation and biodiversity hotspots. Endangered faunal species of India

UNIT - V: Global warming and water conservation

Global warming: Concept, causes and impacts, Green house effect, Green house gases, their sources and control measures of global warming. Acid rain and Ozone depletion. Impact of over utilization of surface and ground water. Water conservation, rainwater harvesting and watershed management.

Current Streams of Thought (Not for final exam): Anthropocene biodiversity crisis and genesis of anthropocene. Salient markers of anthropocene and its impending dangers. Possible sixth mass extinction and probable means to avert it.

Practicals:

1. Estimation of dissolved Oxygen content of water samples
2. Determination of Oxygen sag curve from river
3. Estimation of dissolved Carbon –Dioxide
4. Estimation of Hydrogen sulphide in water samples
5. Estimation of Residual chlorine in water samples
6. Estimation of total dissolved solids of water samples
7. Determination of sulphate in water samples
8. Determination of iron in water samples
9. Determination of silicate in water samples
10. Determination of nitrate/Nitrate in water samples
11. Field visits to areas of environmental and biodiversity significance
12. Behavioural changes of organisms in polluted environment
13. Food chain and bioaccumulation

Text books:

1. Arumugam, N. (2019). *Ecology & Toxicology*, Saras Publications, Nagercoil, Tamil Nadu.
2. Prabhat Patnaik and Jayanath Bhattacharjee, (2012). *Environmental Biodiversity*, Wisdom Press, New Delhi.
3. Khitoliya, R. K. (2004). *Environmental pollution: Management and control for sustainable developments*. S. Chand & company (p) Ltd., New Delhi, India
4. Saha, T. K. (2007) . *Ecology and environmental Biology*. Books and allied(P) Ltd. Kolkata, India

Reference Books:

1. Krebs C. J. (2016). *Ecology: The experimental analysis of distribution and abundance*. Pearson India Education service (p) Ltd., New Delhi, India
2. Arumugam, A. and. Kumaresan, V. (2016). *Environmental studies*. Saras Publication, Nagercoil, Tamil Nadu,
5. Mehta, M. (2010). *Understanding environmental science*. Discovery publishing house, New Delhi, India
6. Agarwal, K. C. (1999). *Environmental Biology*. Agro Botanica, New Delhi, India
7. Pandey S. N. and S. P. Misra (2011). *Environment and ecology*. Anne Books Pvt. Ltd., New Delhi, India

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	2	1	3	2	3	3	3	2	3	3	2	3
CO3	3	3	3	3	1	3	3	3	2	3	3	2	3	3	3
CO4	3	3	2	3	1	3	3	3	3	3	3	3	3	3	2

Semester	19IZOOC93: ANIMAL BEHAVIOUR	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To gain awareness about the basic concepts of animal behaviour
LO2	To create a mindset for conservation
LO3	To understand the genetic principles behind behavioral patterns
LO4	To familiarize the concept of sociobiology
LO5	To understand the significance of Territoriality

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical as well as practical knowledge in the field of animal behaviour
CO2	Interpret the genetic basis of behavioral patterns
CO3	Appreciate the socio-biological elements in the behavior of various animal groups and their significance.
CO4	Understand the impact of hormones in the manifestation of various behaviours

UNIT - I: Introduction

Introduction to ethology, Principles and mechanism of animal behaviour (Ethology) - four propositions of Nikolaas Tinbergen - Adaptive values of behaviour – instinct verses learning – circadian and circadian rhythms in animal behaviour .

UNIT - II: Communication behaviour

Communication and programmed behaviour – Visual communication – Dance languages of honey bee - Melody dance of birds - Auditory communication - songs of birds and sounds of mammals – chemical communications - pheromones of insects –pheromones of mammals – migration of fishes and birds - mechanism of migration.

UNIT - III: Behavioural genetics

Fundamentals of behavioural genetics – Genetic basis of behaviour – Mutations –knockout genes - genetic mosaic fruitflies - multiple genes – polygenic effects on behaviour – genes effect on physiological – Feeding behaviours of animals

UNIT - IV: Social behaviour

Introduction to Sociobiology, Social organization in animals – social behaviour - habitat selection – Advantages of social behaviour – conflict - situations. Conflict behaviours. Sexual selection - courtship behaviour - mechanism of courtship – courtship in fishes - courtship mating in amphibians, reptiles, birds and mammals - Parental care in insects, fishes, amphibians, birds and mammals.

UNIT - V: Territoriality

Territoriality – characters of territoriality - functions of territoriality - group foraging –Game theory model and strategies. Effects of hormones on behaviour – aggression and aggressive behavior. Drugs and behaviour.

Practicals

1. Study of behavioural adaptations of Cursorial animals
2. Study of behavioural adaptations of Arboreal animals
3. Study of behavioural adaptations of Volant animals
4. Study of behavioural adaptations of Aquatic animals
5. Reflex behaviour in animals
6. Mimicry
7. Polymorphism

Text Book

1. Agarwal, V.K. (2019). *Animal behaviour (Ethology)*, S. Chand & Co. Ltd, New Delhi -110055.
2. Aubrey Manning and Marian Stamp Dawkins. (2015). *An Introduction to Animal Behaviour*. Cambridge University Press, London, UK.
3. Hoshang S. Gundevia and Hare Govind Singh, (2016). *A text book of Animal Behaviour*. S. Chand & company, New Delhi

Reference Books

1. Prakash, M. (1994). *Recent Advances in Animal behaviour*, Anmol. Publishers, Delhi.
2. Reena Mathur, (2014). *Animal behaviour*, Rastogi & Co, Meerut.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	3	1	3	3	3	3	3	3	2	3	3	3
CO3	2	3	3	3	1	3	2	3	3	3	3	3	2	3	3
CO4	3	3	3	3	1	3	3	3	3	2	3	3	3	2	3

Semester	19IZOOC94: BIOTECHNOLOGY	L	T	P	C
IX		4	0	0	4

Learning Objective (LO):

LO1	To learn the basic concepts in biotechnology
LO2	To learn the various techniques used in biotechnology
LO3	To acquire biotechnological knowledge related to medical, agricultural and environmental disciplines

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical as well as practical knowledge in various field of biotechnology
CO2	Perform various experiments related to biotechnology
CO3	Carry out biotechnological applications in the fields of medicine, agriculture and environmental fields
CO4	Equip the students to take up jobs in various biotechnological companies and labs

UNIT - I: Basic Biotechnology

Definition – Scope – Achievements of Biotechnology – Enzymes in genetic engineering - Restriction Enzymes, DNA ligase, DNA polymerase of Cloning vectors – Plasmids - Bacteriophage, Cosmids, Yeast plasmids - Genomic DNA libraries, cDNA libraries.

UNIT - II: Techniques in Biotechnology

Southern blotting, Northern blotting, Western blotting, In-situ hybridization, DNA sequencing, PCR, DNA finger printing, DNA probes, site – directed mutagenesis, particle gun, microinjection, electroporation.

UNIT - III: Medical Biotechnology

rDNA Technology - Insulin, Somatotrophin, Somatostatin - hormone production, vaccines, interferons, gene therapy, monoclonal antibodies, Prenatal diagnosis, In-vitro Fertilization Technology (IVF) in Human beings, Human Genome Project (HGP).

UNIT - IV: Agricultural Biotechnology

Micropropagation, protoplast culture, Biofertilizers - Symbiotic and Non symbiotic nitrogen fixation, Biofertilizers - Mass production of BGA, VAM Rhizobium. Biopesticides - Transgenic plants and animals. Mushroom culture. single cell protein- Bio control of insect pests.

UNIT - V: Microbial and Environmental Biotechnology

Bioreactor, Growth curve, primary metabolites – Vitamins, alcohols, Secondary metabolites – Antibiotics, Toxins, Microbial enzyme production – amylase. Biomass as a source of energy. Biogas production, Bioremediation, Microbial leaching - Vermicomposting. Ethical issues and Biosafety regulations, Intellectual Property Right (IPR) and Protection (IPP).

Current Streams of Thought (Not for final exam): Recent discoveries in Biotechnological field – Nobel prize in biotechnology research-Stem cell -definition-preservation, sources, culture-characterization- uses- stem cell therapy.

PRACTICALS

1. Methods of sterilization
2. Preparation of culture media
3. Preparation of Agar slants
4. Estimation of microflora of milk by MBR test
5. Estimation of microflora of milk by RESAZURINE Test.
6. C.S. of stem and root nodule of leguminous plants
7. Isolation , Identification and enumeration of bacteria from soil
8. Isolation , Identification and enumeration of fungi from soil
9. Isolation , Identification and enumeration of actinomycetes from soil
10. Counting of soil microbial population by Quebec colony counter
11. Gram staining of Bacteria
12. Identification of algal Bio-fertilizers
13. Identification of bacterial bio-fertilizers
14. Agarose Gel Electrophoresis - Demonstration
15. Study of Biogas Plant - Demonstration

TEXT BOOKS

1. Dubey. R.C., (2018). *A Text Book of Biotechnology*. S.Chand & Co. Ltd., New Delhi.
2. Lohar, P.S. (2014). *Text Book Of Biotechnology*, MJP Publishers, Chennai, Tamil Nadu.
3. Glick, B.R. and C.L Patten. (2018). *Molecular Biotechnology : Principles and Applications of Recombinant DNA*, ASM Pres, USA.
4. Clark, D.P. and N.J. Pazdernik. (2017). *Biotechnology*, Academic Cell.
5. Lohar, P.S. (2017). *Biotechnology*, MJP Publishers, Chennai, Tamil Nadu.
6. Gupta. P.K., (2009). *Elements of Biotechnology*. Rastogi & Company, Meerut.
7. Purohit, S.S. (2007). *Biotechnology, Fundamentals and Applications*. Agrobios. New Delhi.

REFERENCE BOOKS

- 1) William J. Thieman and Michael A. Palladino. (2014). *Introduction to Biotechnology*. Pearson.
- 2) Singh B.D. (2015). *Biotechnology: Expanding Horizons*. Kalyani.

- 3) Dubey R.C. (2014). *Advanced Biotechnology*. S Chand & Co., New Delhi.
- 4) Bernard R. Glick and Chery L Patten . (2017). *Molecular Biotechnology*. Taylor & Francis.
- 5) Pratibha Nallari and V. Venugopal Rao. (2010). *Medical Biotechnology*. Oxford University Press, USA.
- 6) Kumarsan, V and N.Arumugam. (2016). *Fundamentals of Biotechnology*, Saras Publications, Nagercoil, Tamil Nadu.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
C01	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
C02	2	3	3	3	1	3	2	3	3	3	2	3	2	3	3
C03	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
C04	3	3	2	3	1	3	3	2	3	3	3	3	3	3	2

Semester	19IPSC090 - CONSTITUTION OF INDIA	L	T	P	C
III		2	0	0	2

Learning Objective (LO):

LO1	To understand the basic features of Indian Constitution.
LO2	To grasp about the basic Rights & duties of Indian Citizenry
LO3	To ponder over the form of Indian Political System.
LO4	To have broad understanding about the pivotal provisions related with liberty, Equality and fraternity.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Imbibe about the basic features of Indian Political System.
CO2	Enlighten with the rights & duties of Indian Citizens.
CO3	Become knowledgeable about construction of sentence structures
CO4	Understand the significance of rule of law.

Unit - I : Introduction

Meaning of the Constitutional law and Constitutionalism – Historical Perspective of the Constitution of India – Salient features, Characteristics of the Constitution of India

Unit - II : Rights and Duties

Scheme of the Fundamental Rights – The scheme of the Fundamental Duties and its legal status – The Directive Principles of State Policy-Its importance and implementation

Unit - III : Centre State Relationship

Federal Structure and distribution of legislative and financial powers between the union and the states- Parliamentary form of Government in India – The Constitution powers and status of the president of India.

Unit - IV : Amendments and Provisions

The Historical perspectives of the constitutional amendments in India – Emergency Provision: National Emergency, President Rule. Financial Emergency

Unit - V: Institutions

Judiciary –Judiciary Activism – Amending Procedures- Recent Trends –Rights to Information- Lokpal and LokAyukta

Text Books :

1. Bipan Chandra, Mridula Mukherjee, Aditya Mukherjee (2016). India after Independence 1947-2000, Penguin Publishers, New Delhi.

2. Durga Das Basu, (2018). Introduction to the Constitution of India Prentice Hall, New Delhi.
3. Jogendra Yadav (2000). Transforming India: Dynamics of Democracy, Oxford University Press, New Delhi

Supplementary Readings:

1. The Constitution of India 1950 (Bare Act), Government Publications.
2. Busi S.N Ambedkar B.R (2015). Framing of Indian Constitution
3. Jain M.P (2014). Indian Constitution Law Lexis Nexis
4. Paul R.Brass (1999). The politics of India Since Independence Cambridge University Press
5. Granvila Austin (2006). The Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi.

OUTCOME MAPPING

CO/PO	PO												PSO				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
CO1	0	3	3	0	2	0	0	0	0	2	0	0	3	3	0	0	0
CO2	0	3	2	0	3	2	0	0	0	0	0	0	3	0	0	3	2
CO3	0	3	2	3	2	0	0	0	0	2	0	0	0	0	3	2	2

*1-Low *2-Medium *3-Strong

Semester	19IZOOCX1: BIOCHEMISTRY	L	T	P	C
X		4	0	0	4

Learning Objective (LO):

LO1	To learn classification and metabolism of carbohydrates
LO2	To understand the structure and metabolism of protein
LO3	To learn the structure and functions of lipids
LO4	To acquire knowledge about various enzymes and hormones and their actions
LO5	To acquire knowledge about the significance of vitamins

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Able to understand various micro and macro molecules and their significance
CO2	Able to discriminate various metabolic disorders
CO3	To take up jobs in clinical labs
CO4	To analyze biological samples of bio-chemical importance

UNIT - I: Buffers and Carbohydrate.

- i). pH and buffers – Water, carbondioxide and oxygen, properties, outlines of Biochemical energies.
- ii). Carbohydrates: Methods of study of intermediary metabolism of Carbohydrates;
A general account of classification – Structure and properties of mono and polysaccharides - metabolism of carbohydrates, glycolysis, Citric acid cycle, Gluconeogenesis ; defect in carbohydrate metabolism.

UNIT - II : Proteins:

Classification and isolation - The fundamental physiochemical principles and structure of amino acids, peptides and proteins - protein metabolism – Metabolism of amio acids in general.

UNIT - III: Lipids:

Classification of lipids - Structure and chemistry of single and compound lipids; metabolism of fats and fatty acids - Defects in lipid metabolism.

UNIT - IV: Enzymes and Hormones

- i) Enzymes : Classification – Enzyme kinetics - Effects of substrate concentration –Inhibition and mechanism of enzyme action - Co-enzymes.
- ii) Hormones: Classification, biosynthesis and function – Pancreatic and thyroid hormones.

UNIT - V: Nucleic acids and Vitamins

Composition and structure of nucleic acids; RNA and DNA - Major pathways in the synthesis of RNA and DNA.

Vitamins – occurrence – grouping - deficiency diseases.

Current Streams of Thought (Not for final exam) : Recent discoveries in Biochemical field – Nobel prize in biochemical (or) medical research-New method uses fluorescence to identify disease-causing forms of proteins.

Practicals:

Preparation and use of buffers.

1. Qualitative tests for carbohydrates, Amino acids, proteins lipids and nucleic acids; amines urea; (thiourea).
2. Determination of the molecular weight of a monocarboxylic amino acid by sorenson formol titration
3. Determination of isoelectric pH of a protein.
4. Estimation of glycogen, phosphate, cholesterol and protein in tissues.
5. Determination of protein digestion by trypsin. Fractionation and estimation of serum proteins.
6. Estimation of RNA and DNA in tissues.
7. Kinetics or enzyme action-effect of substrate concentration (Calculation of M), temperature (calculation of energy of activation)
8. Enzyme concentration and pH on enzyme activity.
9. Determination of AChE activity in brain.
10. Paper chromatography of sugars and amino acids-column chromatography of separation of amino acids
11. Paper electrophoresis of proteins.
12. Colour reactions of urine composition.

Text books

1. Vasudevan,, D.M., S. Sreekumari and Kannan Vaidyanathan. (2019). *Textbook Of Biochemistry For Medical Students*, Jaypee Brothers Medical Publishers, New Delhi.
2. Victor W. Rodwell. (2018). *Harper's Illustrated Biochemistry*, McGraw-Hill Education.
3. Satyanarayana, U. and U.Chakrapani. (2017). *Biochemistry*, Elsevier New Delhi.
4. Agarwal, R.A., Anil K.; Srivastava and Kaushal Kumar, (2014). *Animal Physiology and Biochemistry*. S. Chand and Company. New Delhi

5. Sastry, K.V. (2011). *Animal Physiology and Biochemistry*. Rastogi Publications, Meerut. New Delhi
6. Annie Ragland and N. Arumugam. (2015). *Biochemistry and Biophysics*, Saras Publications, Nagercoil, Tamil Nadu.

References

1. Voet,D.And J.G.Voet. (2005). *Biochemistry*, John Wiley & Sons.
2. Freifelder,D (2007). *Physical Biochemistry*, W.H.Freeman & Co
3. Segal,I.H (2015). *Biochemical Calculations*, John Wiley and Sons
4. Creighton, T.E(2012) . *Protein Structure and Molecular properties* , W.H. Freeman & Co.
5. Nelson, D.L. and M.M. Cox. (2013). *Lehninger principles of Biochemistry*, W.H.Freeman.
6. Firley, Jems, L. and Gardon L. Kilgour. (1971). *Essentials of Biological chemistry*, Affiliated East West press, London.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	1	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	1	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2

Semester	19IZOOCX2: ENDOCRINOLOGY	L	T	P	C
X		4	0	0	4

Learning Objective (LO):

LO1	To learn general concepts of hormones and pituitary gland
LO2	To understand structure and functions of thyroid and parathyroid gland
LO3	To learn the structure and functions of pancreas and adrenal glands
LO4	To acquire knowledge in the endocrinological basis of vertebrate reproduction
LO5	To understand endocrinology of insects and crustaceans.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical and practical aspects of endocrinology across various phyla
CO2	Apply the endocrinological methods and procedures for higher studies and research
CO3	To take up jobs in clinical labs
CO4	To analyze biological samples of endocrinological importance

UNIT - I: General concept of Hormones and pituitary Gland

General characteristics of hormones – concept of hormone secretion – hormones as messengers – classification of hormones - steroid hormones – peptide hormones – mechanism of hormone action - Cell signaling – Signal transduction.

Pituitary gland – structural organization – anterior pituitary, Pars intermedia and neurohypophysis - Hypothalamic control of pituitary function. Pituitary hormones – functions - neurohormonal peptides - diuresis and antidiuresis.

UNIT - II: Thyroid gland and parathyroid gland

Thyroid gland – structural organization – Biosynthesis of thyroid hormones - biological function of thyroid hormones – Thyroid dysfunction.

Parathyroid – structure and functions of parathyroid hormone – hormonal regulation of calcium and phosphorus metabolism.

UNIT - III: Pancreas and adrenal glands

Structure of pancreas – function of insulin – Biosynthesis and regulation of the secretion of insulin – Biological action of insulin – function of glucagon – Biological action of glucagon.

Adrenals – structural organization - synthesis of adrenocortical hormones – Mineralocorticoids – Glucocorticoids - functions – regulation of cortisol secretion- abnormalities of adrenocortical secretions – hormones of adrenal medulla and their biological actions.

UNIT - IV: Vertebrate Reproductive Endocrinology

Structure of mammalian testis and ovary – male, female sex accessory organs – hormones of testis and ovary – estrus and menstrual cycle – hormones of pregnancy – parturition – hormonal control of lactation.

UNIT - V: Insect and Crustacean Endocrinology

The concepts of neurosecretion – Endocrine systems in crustacea – endocrine control of moulting and metamorphosis – Neuroendocrine system in insects - endocrine control of development – thorocotrophic hormones – ecdysone - Juvenile hormone functions moulting in adult insects.

PRACTICAL

1. Dissection of endocrine organs in vertebrates
2. Dissection of reproductive systems in vertebrates
3. Histological study of pituitary, adrenal, testis, ovary, corpus luteum, pancreas and thyroid gland
4. Dissection of reproductive systems in insects.
5. Dissection of neuroendocrine complex in insects.
6. Histology of ovary, accessory glands, corpus allatum and brain in insects
7. Parabiosis in cockroach
8. Ovariectomy in cockroach
9. Vaginal smear showing various stages of estrus cycles.
10. Study on influence of insulin in blood glucose level.

TEXT BOOKS

1. Shlomo Melmed , Kenneth S. Polonsky , P. Reed Larsen and Henry M. Kronenberg . (2017). *William's textbook of Endocrinology* , Elsevier India.
2. Handley, M.E. and J.E. Levine. (2017). *Endocrinology* , Pearson Education India.
3. Turner C.D. 1996. General endocrinology. 4th Ed, W.B. Saunders Co., London.
4. Bentley P.J. 1998. Comparative Vertebrate Endocrinology. Cambridge University Press.
5. Barrington E.J. W., 1968. An Introduction to General and comparative endocrinology. Academic press, London.
6. Williams. R.H. 1974, Text book of endocrinology 5thEd. W B Souanders & co.

Philadelphia

REFERENCE BOOKS

- 1) Pandey B.N. (2019). *Endocrinology*. Atlantic Publishers, Chennai, Tamil Nadu.
- 2) Lawrence I. Gilbert. (2011). *Insect Endocrinology*. Academic Press, USA.
- 3) Bruce A. White and Susan P. Porterfield. (2013). *Endocrine and Reproductive Physiology*. Elsevier, India.
- 4) Jameson, J.L. (2016). *Harrison's Endocrinology*. McGraw Hill Education, New Delhi.
- 5) David O. Norris and J.A.Carr. (2013). *Vertebrate Endocrinology*, Academic Press, USA.
- 6) Yadav B.N. (2011). *Mammalian Endocrinology*. Vishal Publishing Co., Punjab.

Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	2	3	3	3	3	3	3	3	3
CO3	3	2	3	3	1	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19IZOODX4: PROJECT (DISSERTATION AND VIVA-VOCE)	L	T	P	C
X		0	0	12	6

DEPARTMENT ELECTIVE COURSES

Semester	Elective 1	L	T	P	C
I	19IZOOE16: MEDICAL ENTOMOLOGY	3	0	0	3

Learning Objective (LO):

LO1	To acquire Knowledge of the Classification of Arthropod Vector insects in Medical Entomology.
LO2	To study the life Cycles of Vector Insects.
LO3	To Learn Various Vector borne diseases - Transmission and Control Measures.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify insects based on morphological features
CO2	Start entrepreneurial activities in sericulture and apiculture
CO3	Take up jobs in vector control and public health departments
CO4	Take up integrated pest management activities

UNIT - 1 :Introduction

Scope of Medical Entomology- Classification of Arthropoda. Classification of Arthropods of Medical and Public Health importance. Mechanism of Transmission of diseases by Arthropods - Mechanical and Biological; Metamorphosis – Complete and Incomplete. Insect Mouth Parts – Chewing and Sucking.

UNIT - 2 : Mosquitoes and Louse

MOSQUITO: Morphology – Life history, Difference of Anopheles and Culex - Public Health importance – Control Measures.

LOUSE :- Morphology - Life cycle- Difference between Head & Body - Public Health importance – Control Measures

UNIT - 3 : Tsetse fly and Sand fly

TSETSE FLY: Morphology - Life history - Public Health importance - Control Measures.

SAND FLY :- Morphology –Difference between Male and Female - Life history - Public Health importance – Control Measures.

UNIT - 4 : Fleas and House fly

FLEAS: Morphology –Difference between Male and Female - Life history - Public Health importance – Control Measures.

HOUSE FLY:- Morphology – Life history - Public Health importance – Control Measures.

.UNIT - 5 : Other Arthropod vectors

TICKS : Morphology - Life cycle- Difference between Hard and Soft ticks - Public Health importance – Control Measures.

MITES : Morphology – Life history - Public Health importance – Control Measures.

Text Books:

- 1) Tembhare, D.B. (2012). *Modern Entomology*, Himalaya Publishing House, New Delhi.
- 2) Tyagi , B.K. (2012). *Medical Entomology*, Scientific publishers, Chennai

Reference Book

- 1) Rathanswamy, G.K, (2010). A Hand book of Medical Entomology. S.Viswanatham Printers & Private & Ltd., Chennai
- 2) Vasantharaj Devid, and V.V. Ramamurthy, (2011). Elements of Economic Entomology. Namrutha Publications , Chennai -600116

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 1	L	T	P	C
I	19IZOOE17 : BIO-PHYSICS	3	0	0	3

Learning Objective (LO):

LO1	To refresh knowledge of basics biophysics
LO2	To appreciate how various laws of physics are applicable in biological system
LO3	To understand movements and dynamics properties of molecules in biological systems
LO4	To gain the knowledge on physical properties of molecules in structural and physiological process
LO5	To apply physical principles in chemical reactions and physiological systems

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	To analyze the various forces responsible of biological molecular structure
CO2	To gain the knowledge of cellular permeability
CO3	To understand the dynamics of biological systems
CO4	To correlate the biomolecular structure to its specific functions

Unit – 1: Introduction

Introduction to Biophysics - Application of Physics in Biological Sciences - Biophysics of water - Molecular structure of water - Hydrogen bonds - physical properties of water.

Thermodynamics - Laws of thermodynamics and its applications to biology

Unit – 2: States of matter

States of matter - Colloidal state – size of colloidal particles – Different types of colloidal dispersion (sol, aerosol, emulsion, foam, gel) - Preparation of lyophilic and lyophobic sols – Protective colloids, gold number - Stability of colloids – Precipitation, coagulation, flocculation of colloidal particles – Colloidal particles of milk and blood with their functions. Properties of colloids – Tyndall effects, surface tension, viscosity, surface absorption, detergent action, electrical, optical and kinetic properties.

Osmosis - Phenomenon of osmosis – Osmoregulation in the body – Electro osmosis – Donnan membrane equilibrium – Applications – artificial kidney - dialysis of blood.

Unit – 3: Membrane Biophysics

Membrane Biophysics – Cell membrane structure, Composition of biological membrane and stability of bio membranes – membrane transport.

Determination of molecular weight of macro molecules by Chemical composition, Sedimentation – Molecular sieving – Light scattering – Osmotic pressure methods.

Units of measurement of solutes in solution – normal, molar, molal, milli equivalents and milli osmol, ionic strength.

Unit – 4: Biophysical basis

Biophysical basis for gaseous exchange in lungs and tissues – Partial pressure of CO₂ (pCO₂) and O₂ (pO₂) – Influence of O₂ and CO₂ in RBC and body fluids during respiration – Physiological curve of formation and dissociation of oxyhaemoglobin (HbO₂) and carbon dioxide haemoglobin (HbCO₂) – Various physiological factors in these curves

Molecular organization of protein – primary, secondary, tertiary and quaternary structure. Main chain and side chain torsion angles, Alpha helix, beta sheet, turns. Ramachandran plot.

Unit – 5: Bioenergetics

Physics behind vision mechanism of accommodation, visual activity, Ophthalmoscope, colour vision, perimetry), hearing (hearing mechanics and abnormality) and mechanism of conduction of nerve impulse.

Bioenergetics – Energy and its forms – Concept of Free energy – Enthalpy and entropy – Redox potential and its calculation, redox coupling. High energy compounds in biological system, ATP: ATP bioenergetics.

Text Books

1. Narayanan, P. (2007). *Essentials of Biophysics*. New Age Internationals, New Delhi.
2. Paul Davidovits.(2012). *Physics in Biology and Medicine*. Academic Press, N.Y., USA.
3. Vasantha Pattabhis and N.Gauthem. (2016). *Biophysics*, Narosa Publishing House, New Delhi.
4. Rodney Cotterill. (2014). *Biophysics - An Introduction*. Wiley, USA.
5. Srivastava, P.K. (2011). *Elementary Biophysics*, Narosa Publishing House, New Delhi.
6. Subramanian, M.A. (2016). *Biophysics – Principles and Techniques*. MJP Publishers, Chennai.

Reference Books

1. Claycomb, J.R. (2011). *Introductory Biophysics: Perspectives on the Living State*. Jones & Bartlett, New Delhi..
2. Haynie, D.T. (2010). *Biological Thermodynamics*. Cambridge University Press, India.
3. Meyer B. Jackson. (2010). *Molecular and Cellular Biophysics*. Cambridge University Press. London.
4. Roland Glaser (2012). *Biophysics: An Introduction*. Springer, German.
5. Volbenshtein, M.V. (1983). *Biophysics*. MIR Publishers, Moscow.
6. William Stillwell. (2016). *An Introduction to Biological Membranes: Composition, Structure and Function*. Elsevier Science.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 2	L	T	P	C
III	19IZOOE36: AQUACULTURE	3	0	0	3

Learning Objective (LO):

LO1	To acquire knowledge about the important of aquaculture
LO2	To know the different types culture
LO3	To obtain knowledge about aquarium keeping
LO4	To gather information about mariculture
LO5	To learn the role of organizations involved in aquaculture

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical and practical aspects of fisheries across different species
CO2	Apply the Aquaculture methods and procedures for higher studies and research
CO3	To take up jobs in Aquaculture farms
CO4	To analyze biological samples of Aquaculture ponds

Unit -1

Aquaculture - definition - scope and importance -status of aquaculture in India and world. Biology of Indigenous cultivable fishes(Catla, Rogu, Mrigal).

Unit - 2

Different types of cultures, Monoculture, Poly culture. Composite fish culture, Cage culture , Pen culture, Race way culture - Extensive and intensive culture.

Unit - 3

Aquarium – Setting – requirements. Major aquarium fishes (Guppy, Gold fish, fighter fish, Gourami and Zebra fish) and their biology.

Unit - 4

Mariculture – pearl oyster culture- pearl production, laboratory phase and farm phase ;Shrimp culture- PL stocking in pond maintenance and management culture ponds ; seaweed culture.

Unit - 5

Economics of Aquaculture. Organizations involved and their role of aquaculture – CIBA, RGCA, CIFA, CIFE, MPEDA and CMFRI.

Text Books:

1. Srivastava, C.B.L. (1985). *A Text book of Fisheries science and Indian Fisheries*, Kitab Mahal, Allahabad.
2. Gupta.SK & P.C. Gupta.(2017). *General and Applied Ichthyology*. S. Chand & Co, New Delhi.
3. Pillay, T.V.R. (2012). *Aquaculture Principles and practices*. Blackwell publishing, New Delhi.

Reference Books:

1. Keshav Kumar Jha. (2010). *Aquaculture*, Daya publishing, Delhi.
2. Santhanam, Sugmaran and P.Natarajan, (1997). *Manual of fresh water Aquaculture* . Oxford and IBH Pub. Co., Ltd., New Delhi.
3. Shanmugam. K. (1990). *Fishers Biology and Aquaculture*. Leo Pathippagam, Madras – 600083.
4. Kuraian C.V. and V.O. Sebastien (1982). *Prawns and Prawn Fisheries of India*. Hindustan Publishing Corporation New Delhi.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 2	L	T	P	C
III	19IZOOE37: PISCICULTURE	3	0	0	3

Learning Objective (LO):

LO1	To generate interest in culturing fish for human consumption
LO2	To create awareness about common cultivable fishes
LO3	To learn various breeding techniques in fishes
LO4	To acquire knowledge regarding various fish diseases
LO5	To learn management of fish farm
LO6	To develop skills in common methods of fish harvesting, preservation and processing

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Take up employment in commercial fish farms
CO2	Start entrepreneurship in fish farming sector
CO3	Take up employment in industrial fisheries sector
CO4	Start entrepreneurship involving harvesting and post harvesting technologies

Unit – 1 : Scope of Pisciculture and Common Cultivable Fishes

Definition, overview and scope of finfish culture in India. Desirable characteristics of cultivable fishes. Biology of Indian major carps: *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*. Biology of exotic carps: Grass carp, Silver carp and Common carp.

Unit – 2 : Fish Breeding Techniques

Natural and induced breeding. Bundh breeding techniques: Dry and wet bundhs. Hypophysation technique. Recent trends in induced breeding: HCG, SG-G100/ LH-RH dopamine antagonist combination.

Unit – 3 : Fish Farm and its Management

Construction of fish farm: Selection of site, topography, soil type and water supply. Layout, Embankment, size of ponds, outlet, inlet. Types of ponds: Nursery,

rearing and stocking ponds. Farm management: Management of nursery, rearing and stocking ponds.

Unit – 4 : Common Fish Diseases and Their Management

Environmental stress and their management: Temperature, light, dissolved gases, pH and ammonia. Nutrient deficiency diseases related to protein, carbohydrate, lipid and vitamins. Bacterial diseases: Furunculosis and abdominal dropsy. Viral diseases: Viral haemorrhagic septisemia and infections pancreatic necrosis. Fungal diseases: Saprolegniasis and gill rot. Protozoan diseases: Ichthyophthiriasis and whirling diseases: Disease caused by helminths: Ligulosis and dactylogyrosis. Disease caused by arthropods: Argulosis and ergasilosis.

Unit – 5 : Fish Harvesting and Post Harvesting Technologies

Fishing gears: Gill nets, traps, cast net and drag net. Causes of fish spoilage and common methods of preservation: Chilling, freezing, freeze-drying, smoking, sun drying, salting and canning. Fish products and by-products: Fish liver oil, fish meal, fish manure and isinglass.

Text Book

1. Agarwal, S.C. (2007). *A Hand Book of Fish Farming*, Narendra Publishing House, New Delhi, India.
2. Arumugam, No. (2008). *Aquaculture*. Saras Publication, Nagercoil, Tamil Nadu, India.

References Books

1. M.S. Reddy and K.R.S.S. Rao (2008). *A Text Book of Aquaculture*, Discovery Publishing House, New Delhi, India.
2. R.K. Rath (2011). *Freshwater Aquaculture*, Scientific Publishers, Jodhpur, India.
3. K.K. Jha (2010). *Aquaculture*, Daya Publishing House, Delhi, India.
4. R. Thanavel (2014). *A Handbook of Fish Diseases*. Astha Publishing, New Delhi, India.
5. S.K. Gupta and P.C. Gupta. (2006). *General and Applied Ichthyology*. S. Chand and Company, New Delhi, India.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 3	L	T	P	C
V	19IZOOE57: BIOINFORMATICS	3	0	0	3

Learning Objective (LO):

LO1	To make the students to understand about Bioinformatics and its scope.
LO2	To search and retrieve information from primary and secondary databases
LO3	To work with the sequence alignment tools available in internet
LO4	To gain the knowledge about various tools and applications of genomics and proteomics.
LO5	To know about the applications of bioinformatics in various fields.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical and practical aspects of Bio-informatics
CO2	Apply the Bio-informatics methods and procedures for higher studies and research
CO3	To take up jobs in medical industries
CO4	To analyze biological samples through bioinformatics importance

UNIT 1: Overview of Bioinformatics

Introduction to Bioinformatics – Definition – History of bioinformatics – scope. Sequences – homology – similarity – sequence retrieval.

UNIT 2: Bioinformatics Databases

Primary Databases – Nucleotide databases – EMBL – DDBJ – GENBANK, Protein databases – SWISSPROT – PIR – MIPS, Metabolic Databases KEGG – ECOCYE, Secondary databases – PROSITE – PRINTS – BLOCKS,

UNIT 3: Sequence Alignment Tools

Search engines – Entrez, SRS, STAG. Sequence similarity search – Pairwise alignment – BLAST, FASTA, Multiple sequence alignment – Clustal W – Clustal X.

UNIT 4: Genomics and Proteomics

Genomics – DNA sequencing – Applications. Proteomics – Protein structure classifications – Tools and applications – Metabolomics – Tools and applications,

UNIT 5: Applications of bioinformatics

Industrial applications – Clinical and research applications – ethical and legal issues in bioinformatics – accuracy and error – appropriate uses and users.

Text Books:

1. Terasa K. Attwood, David J. Parry Smith and Samiron Phukan, (2007). *Introduction to Bioinformatics*, Dorling Kindersley ppvt. Ltd., licenses to Pearson Education, South Asia.
2. Arthur M. Lesk, (2014). *Introduction to Bioinformatics*, Oxford university press, United Kingdom.

Reference Books:

1. Rastogi, S.C. Namita Mendiratta and Parag Rastogi. (2013). *Bioinformatics: Methods and Applications: (genomics, proteomics and drug discovery)* 4th Edition, Kindle Edition, PHI Learning Pvt. Ltd., New Delhi.
2. Marketa J Zvelebil and Jeremy O. Baum,.(2007). *Understanding Bioinformatics*, Garland Science, Taylor and Francies Group, New york and London.
3. Anna Tramontano. (2007). *Introduction to Bioinformatics*, Chapman & Hall/CRC, Taylor and Francies Group, New york and London.
4. Harisha, S. (2007). *Fundamentals of Bioinformatics*, I.K International Publishing, New Delhi.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 3	L	T	P	C
V	19IZOOE58: Medical Laboratory Techniques	3	0	0	3

Learning Objective (LO):

LO1	To learn the design of lab and sterilization methods.
LO2	To know the method of blood sample collection, blood cells count.
LO3	To learn the analysis techniques of various blood parameter.
LO4	To acquire knowledge on the microbial and parasitic diseases.
LO5	To learn the preparation of report.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Master the theoretical and practical aspects of endocrinology across various phyla
CO2	Apply the endocrinological methods and procedures for higher studies and research
CO3	To take up jobs in clinical labs
CO4	To analyze biological samples of endocrinological importance

Unit –1 Introduction and scope

Introduction and scope of the subject - Design of a lab - GLP, lab grades (level 1,2,3,4) - Cleaning, maintenance and care of glassware - Sterilization - physical and chemical method - Disposal of specimens and infected materials

Unit – 2 Collection of Sample

Hematology- Collection of Blood Sample -Smear Preparation - Blood Cells - Enumeration of RBC And WBC - Packed Cell Volume - Erythrocyte Sedimentation Rate - MCV - MCH - MCHC - Platelet Count Bleeding Time - Clotting Time - Prothrombin Time - Hemoglobin estimation - Blood Pressure.

Unit – 3 Analysis

Liver Function Test- Enzymes SGOT, SGPT, Liver Pigments - Urine - collection - physical and chemical parameters routinely analyzed - Pregnancy test - Analysis of stool, semen, cerebrospinal fluid - Pathology tests for viral diseases - measles, poliomyelitis, hepatitis, HIV I

Unit – 4 Diagnosing

Tests for bacterial diseases - tuberculosis, whooping cough - tetanus - diphtheria, cholera - Tests for protozoans - amoebic dysentery, malaria, leishmaniasis - Tests for helminths - filariasis, cysticercoids - Tests for life style

disease - Cardiac disorders - Diabetes I and II - Obesity –Allergy - Tests for auto immune disease - SLE, MG, RA, autoimmune hepatitis, MS - Tests for cancer, Alzheimer, Parkinson’s disease.

Unit – 5 Reporting

Records and preparation of reports

Text Books

1. Baker F.J. and Silvertan R.E (1998). *Introduction To Medical Laboratory Technology*. Hodder Arnold Publication.
2. Praful B. Gudkor (2005). *Text book of Medical Laboratory Technology*. Baalani Publication House.
3. Ochei, J. and A. Kothakkar (2000). *Medical Laboratory Science and Theory* Mc. Growth Hill.

Reference Books

1. Ramakrishnan, S. and K.N. Sulochana (2012). *Manual of Medical Laboratory Technology*, Jaya Pee Brothers Medical Publishers (P) Ltd.
2. Naigaonkar, A.V. and M.D.Burande. (2018). *A Manual Of Medical Laboratory Technology*, Pragates Book (P) Ltd.
3. Barbara H. Estridge and Anna P. Reynolds (2000). *Basic MLT Techniques (Medical Lab Tech)*, Delmar Learning.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 5	L	T	P	C
VIII	19IZOOE85: ENTOMOLOGY	3	0	0	3

Learning Objective (LO):

LO1	To learn various insects and their classification
LO2	To learn the morphological, anatomical and physiological systems in insects
LO3	To learn knowledge in agricultural entomology as well as beneficial insects
LO4	To learn vector insects and their role in public health
LO5	To learn knowledge on pest management

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify insects based on morphological features
CO2	Start entrepreneurial activities in sericulture and apiculture
CO3	Take up jobs in vector control and public health departments
CO4	Take up integrated pest management activities

Unit-1: Insect Morphology

Insect taxonomy up to orders – Salient features with suitable examples of the insect orders – Thysanura, Odonata, Isoptera, Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera and Diptera - Insects collection – Preservation – Identification- insect head – types of antennae – mouth parts and wing venation – Abdomen.

Unit-2: Insect Physiology

Structure and Physiology of integumentary, Digestive system: Foregut, Mid gut, Hind gut, Salivary gland and Physiology of digestion.

Circulatory system: Components of Circulatory system, Haemocoel – Haemolymph of – types of haemocytes, Functions of fatbody and Physiology of circulation.

Excretory system: - Types-excretory organs – accessory excretory organs – Physiology of excretion.

Reproductive system: Male reproductive system, Testis – Vasadeferens – Seminal vesicle - accessory glands and Female excretory system – Ovaries – Ovariole – types-oviduct –spematheca- accessory glands.

Respiratory system: Trachea – Spiracles-types – terrestrial respiration – Aquatic respiration – Endoparasitic respiration

Unit–3: Agricultural Entomology

Insect pest- pest outbreak – assessment of insect population- Identification, seasonal history, biology, nature of damage and control measures of major pests of paddy, sugarcane, Vegetables (Brinjal).

Unit–4: Principles and methods of Pest Management

Principles of Insect control – Prophylactic measures – cultural, mechanical, physical methods – Genetic control and quarantine. Biological control: parasitoids, Predators and Microbial agents. Chemical methods: Pesticides- general classification – classification based on mode of action, mode of entry and Biopesticides: Integrated Pest Management (IPM) – definition, Integration of methods – potential components – need for IPM and uses.

Unit–5: Beneficial insects and Vector insects

Sericulture: Biology of silk worm, silk gland, cultivation of mulberry plants, rearing of silkworm and uses of silk – Apiculture: types of bees, bee colony, life history, Structural adaptations - Social organization - Beekeeping accessories - composition of honey and uses of honey. Useful insects - Biology and control measures of important insect vector – mosquitoes.

Unit 6 Current Streams of Thought : Recent Techniques : Ericulture –Newer insecticides in pest management – Recently introduced pests- Pheromones in pest management – Insect migration – Monarch butterfly and dragon fly migration.

TEXT BOOKS

1. Chapman, F., S.J.Simpson and A.E.Douglas. (2017). *The Insects structure and function*, Cambridge University Press, UK.
2. Temphare D.B. (1984). *A Text Book of Insect Morphology, Physiology and Endocrinology*. S.Chand and Co., New Delhi.
3. Chapman R.F. (1982). *The Insect Structure and Functions*. English Language Book society, Hoober Strongron.
4. Temphare, D.B., (2011). *Modern Entomology*, Himalaya publishing, Mumbai.

REFERENCE BOOKS

- 1) Ganga G. and J. Sulochana Chetty. (2019). *Introduction to Sericulture*. Oxford and IBH Publishing Co. Pvt. Ltd.
- 2) Vasantharaj David B. and V.V. Ramamurthy. (2016). *Elements of Economic Entomology*. Brillion Publishing.
- 3) Prasad T.V. (2019). *Handbook of Entomology*. New Vishal Publications.
- 4) Ashok Kumar Sharma. (2012). *Anatomy and Physiology of Insects*. Oxford Book Company.

- 5) Jayashree K.V., C.S. Tharadevi and N.Arumugam. (2014). *Apiculture*. Saras publication, Nagercoil, Tamil Nadu.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 5 19IZOOE86: PUBLIC HEALTH AND HYGIENE	L	T	P	C
VIII		3	0	0	3

Learning Objective (LO):

LO1	To learn important vector borne diseases of human being
LO2	To understand diseases caused by protozoans
LO3	To acquire knowledge in diseases caused by helminthes
LO4	To learn common air, food and water borne disease.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Analyse various common vectors and diseases, causing organisms
CO2	Impart skills the general Public for public health and hygiene
CO3	Work in clinical labs
CO4	Take up research on issues related to public health and hygiene

Unit-1: Introduction to Important Disease to Human Beings

Mosquito borne diseases – malaria, filariasis and chikungunya – symptoms and treatments. Morphology, life cycle and control measures of vector mosquitoes - Anopheles, Culex and Aedes species and vector management.

Unit-2: Vector borne Diseases to Human Beings

Vector borne diseases – Kala - azar, typhoid, amoebic dysentery, cholera and sleeping sickness- Symptoms and treatments - Morphology, life cycle and control measures of sand flies, House flies and Tsetse fly.

Unit-3: Protozoan Diseases to Human Beings

Protozoan diseases – Trypanosomiasis, Leishmaniasis and Trichomoniasis symptoms and treatments - Morphology, life cycle and control measures of Trypanosoma, Leishmania and Trichomona.

Unit-4: Helminthes Diseases to Human Beings

Helminthes diseases - Taeniasis, Schistosomiasis and Ascariasis – symptoms and treatments - Morphology, life cycle and control measures of *Taenia solium*, *Schistosoma* and *Ascaris*.

Unit-5: Air, Food and Water – borne diseases

Airborne diseases – Tuberculosis, Diphtheria and pneumonia. Food and water – borne diseases – sources of water pollutants – cholera, botulism, shigellosis and typhoid fever. Cancer – sources, different types of tumors and treatment.

TEXT BOOKS

1. Rathinasamy G.K., (1974). *A Handbook of Medical Entomology and Elementry Parastitology*.S.Viswanathan Printers and Publication Pvt., Ltd.
2. Dubey, R.C. and D.K. Maheswari, (2005). *A text book of Microbiology*, S.Chand & Company Ltd., New Delhi.
3. Gupta, P.K and V.Rampraksh, (1985). *Advance in Toxicology and Environmental Health*. Jagmender Book GENCY, New Delhi
4. Jordon, E.L. and P.S.Verma, (2005), *“Invertebrate Zoology”*, S.Chand & Company Ltd., New Delhi.
5. Parthiban, M. and B. Vasantharaj David, (2007). *“Manual of Household & Public Health pests and their control”*, Namrutha Publications, Chennai.

REFERENCE BOOKS

- 1) Sudhir R. Wagh and Vishnu K. Deshmukh. (2015). *Medical Entomology*. Success Publications.
- 2) Mark F. Wiser. (2012). *Protozoa and Human Disease*. Garland Science.
- 3) Burton J. Bogitsh, Clint E. Carter and Thomas N. Oeltmann. (2012). *Human Parasitology*. Academic Press.
- 4) Ruth Leventhal. (2011). *Medical Parasitology*. F.A. Davis Company.
- 5) Kenrad E. Nelson and Carolyn Williams. (2013). *Infectious Disease Epidemiology*. Jones and Bartlett Publishers.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 7	L	T	P	C
IX	19IZOOE96: FISHERIES AND AQUACULTURE	3	0	0	3

Learning Objective (LO):

LO1	To learn the principles and practices followed in Inland fisheries and aquaculture
LO2	To learn biology and fisheries potential of marine fisheries
LO3	To acquire skills in culturing fin fishes
LO4	To develop skill non fin fish culture
LO5	To learn fish harvesting and post harvesting technology

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand and analyse various issues related to fisheries and aquaculture
CO2	Take up jobs in fisheries and aquaculture sectors
CO3	Start aquaculture activities on their own
CO4	Take up jobs in marine product export sectors

Unit-1: Inland fisheries

Biology and commercial importance of major inland fishes of India: Indian major carps; air breathing fishes-Channa, Clarias, Common carp, grass carp, silver carp, trouts, mahaseer and English carp. Food and feeding habits of cultivable fishes. Age and growth determination: Scale reading, length-weight relationship.

Unit-2: Marine Fisheries

Brief out line of inshore, coastal, offshore and deep sea fishery potential of India. Biology of commercially important fishes: Hilsa, oil sardine, Mackerel and Bombay duck. Crustacen fisheries: prawns, shrimps and crabs. Molluscan fisheries: edible oyster, mussels and cephalopodes (Sepia and Loligo)

Unit-3: Fin Fish culture

Types of culture, types of ponds, fish pond preparation, algal bloom and its eradication. Stocking of seeds, feeding. Predators and their control. Sampling and harvesting. Transport of fish seed. Major diseases, symptoms and treatment.

Unit-4: Shell fish and sea weed culture

Culture of fresh water prawn - *Macrobrachium rosenbergii*. Culture of brakishwater prawn *Litopenaeus vannamei*. Culture of pearl oyster (*Pinctada*

fucata), green mussel (*Perna viridis*), lobster (*Panulirus homarus*). Culture of sea weed.

Unit-5: Harvesting and Post harvest technology and Economics of Aquaculture

Fish finding devices: Sonars and Echosounder. Fishing gears: Nets and seines –gill nets, fyke net, pound net, dip net, casting net; hooks and lines. Fish preservation: Common principles of fish preservation and major methods of fish preservation. Fishery products and by products: Fish liver oil, fish body oil, fish meal, fish flour, fish silage, fish manure and guano, fish sausage, fish glue, isinglass, fish leather, fish macroni. Fish and prawn economics of aquaculture – Fish and prawn marketing.

Current Streams of Thought : *Penaeus vannamei* – Asia pacific white prawn – resistant to white spot virus – high stocking density – probiotics – No water exchange - higher profit in aquaculture – GEM tilapia culture - Sea bass culture in freshwater .

TEXT BOOKS

1. Gupta, S.K. and P.C.Gupta.(2017). *General and Applied Ichthyology (Fish & Fisheries)*, S. Chand and Co., New Delhi.
2. Pillay, T.V.R., (1995). *Aquaculture Principles and Practices*. Fishing News Books, Blackwell Science Ltd., Oxford.
3. Jhingran,V.J., (1991). *Fish and Fisheries of India*. Hindustan Publishing Corporation, New Delhi.
4. Santhanam, R., Sugmaran, N. and P.Natarajan, (1997). *A Manual of Fresh Water Aquaculture*. Oxford and IBH Pub. Co., Ltd., New Delhi.
5. Biswas, K.P. (2012). *Advancement of Fish, Fisheries and Technology*, Narendra Publishing House, New Delhi.
6. Lakshmi Prasad, T. and K.Ramasway. (2014). *Fish Processing Technology*, Crescent Publishers Corporation, New Delhi.

REFERENCE BOOKS

- 1) Singh B. and Dey A. (2017). *Fish and Fisheries*. Invincible Publishers.
- 2) Dholakia, A.D. (2016). *Fisheries and Aquatic Resources of India*, Daya Publishing House, New Delhi.
- 3) Arumugam N.(2014). *Aquaculture and Fisheries*. Saras Publications, Nagercoil, Tamil Nadu.
- 4) Vishwas B. Sakhare. (2013). *Inland Fisheries*. Daya Publishing House.
- 5) Pillay T.V.R. and M.N. Kutty. (2011). *Aquaculture: Principles and Practices*. Wiley India Pvt. Ltd.
- 6) Rajendra Kumar Rath. (2011). *Freshwater Aquaculture*. Scientific Publishers.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	Elective 7	L	T	P	C
IX	19IZOOE97 : TOXICOLOGY	3	0	0	3

Learning Objective (LO):

LO1	To learn the concepts and processes involved in toxicology
LO2	To understand the various methods of absorption and distribution of toxicology
LO3	To study the biotransformation and excretion of toxicants
LO4	To learn the impacts of toxicants and human beings.
LO5	To learn the application of anti dotes and Biomonitoring

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Carry out toxicological analysis of various environmental samples
CO2	Make observations and biochemical analysis of biological samples
CO3	Carry out toxicological testing using live specimen to determine toxicity of toxicants
CO4	Take up jobs in toxicological research institutions and clinical labs

UNIT- 1: Introduction to Toxicology

Definition – Brief history of toxicology — Disciplines of toxicology – Scope of toxicology – Toxicity methods – Acute toxicity tests – Sub-acute toxicity test – Chronic toxicity test – Bio-assay – Determination of LC₅₀ and LD₅₀ – Dose-Response relationship – Indices of toxicity – Threshold dose – Margin of safety and therapeutic index - Selective toxicity - Response of toxicity - Factors influencing toxicity – Chemical interaction – Types of interactions.

UNIT- 2: Exposure Route, Absorption and Distribution of Toxicants

Route of exposure of Toxicants: Dermal route – Inhalation route – Ingestion route. Absorption of Toxicants: Introduction – Mechanism of absorption – Passive transport and carrier mediated transport – Factors affecting absorption. Distribution of Toxicants: Introduction – Factors determining the distribution – Binding of plasma protein – The storage depots – Liver, Kidney, Fat and Bone – Membrane barriers.

UNIT- 3: Biotransformation and Excretion of Toxicants

Biotransformation: Introduction – Pattern of Biotransformation - Phase I reaction – Oxidation – Mixed Function Oxidase System – Reduction reaction – Hydrolysis – Phase II reaction – Biochemical conjugation – Glucuronidation –

conjugation with Glutathione – Sulfate conjugation – Acetylation and Methylation – Aminoacid conjugation - Deactivation versus Bioactivation.

Excretion of Toxicants: Urinary excretion – Biliary excretion - Lungs and other routes.

UNIT- 4: Toxic effects on Human

Categories of toxic effects – Local and systemic effects – Reversible and irreversible effects – Immediate and delayed effects – Effects on biomolecules - Effects on target organs: Neurotoxic effects – Hepatotoxic effects – Genotoxic effects –mutagenic – Teratogenic - carcinogenic effects.

UNIT- 5: Antidotes and Biomonitoring

Antidotes: Classification of antidotes– Mechanism of action of antidotes-Specific antidotes for metals and pesticides.

Biomonitoring: Introduction – Objectives – Biological Monitoring Programme – Parameters for Biomonitoring – Bioindicators and Environmental Monitoring – Classification of Bioindicators – Criteria for Selection of Bioindicators – Traditional Bioassays – Biotechnology Based Bioassays – Microbial Indicators – Plant Indicators – Animal Indicators – Aeroallergens – Human System – Benefits and Disadvantages of Bioindicators.

Current Streams of Thought : Future of toxicology-An industry case study-Advances in invitro approaches to toxicology –Organ – on a clip models.

TEXT BOOKS

1. Lee, B.M. and S.Kacew. (2018). *Lu's Basic Toxicology*, Informa Healthcare.
2. Sharma, P.D., (1996). *Environmental biology and toxicology*. Rastogi Publication, Meerut, India.
3. Frank C. Lu (1985). *Lu's Basic Toxicology*. Hemispher Publication Corporation Washington, N.Y, London.
4. Gupta, P.K., and Salunka, D.K., (1985). *Modern Toxicology.vol I and II*, Metropolitan, New Delhi.
5. Pandey, K., J. P. Shukla and S. P. Trivedi. (2013). *Fundamentals of Toxicology*, New Central Book Agency, New Delhi.
6. Chris Kent (1998). *Basics of Toxicology*. John Wiley & Sons.

REFERENCE BOOKS

- 1) VijaByung-Mu Lee, Sam Kacew and Hyung Sik Kim. (2017). *Lu's Basic Toxicology: Fundamentals, Target Organs, and Risk Assessment*. CRC Press.
- 2) Stephen M. Roberts, Robert C. James and Phillip L. Williams. (2015). *Principles of Toxicology: Environmental and Industrial Applications*. Wiley Blackwell.
- 3) Frank A. Barile. (2017). *Principles of Toxicology Testing*. CRC Press.
- 4) Karen E. Stine and Thomas M. Brown. (2015). *Principles of Toxicology*. CRC Press.
- 5) Barile, F.A. (2013). *Principles of Toxicology Testing*, CRC Press.

6) Kamalleshwar Pandey, J.P. Shukla and S.P. Trivedi. (2011). *Fundamentals of Toxicology*. New Central Book Agency.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

**M.Sc. ZOOLOGY (Five Year Programme) SYLLABUS FOR ALLIED COURSE
OPTED TO OTHER SCIENCE DEPARTMENT**

Semester	19IZOA15: ALLIED ZOOLOGY - I	L	T	P	C
I	ANIMAL DIVERSITY - I	3	0	0	3

Learning Objective (LO):

LO1	To learn the principles of animal taxonomy
LO2	To learn the classification of animals upto orders
LO3	To learn the salient features and various systems of different phyla

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify a fauna based on morphological character
CO2	Identify poisonous and non- poisonous snakes, and extinct fauna
CO3	Distinguish primitive mammals
CO4	Understand origin of chordates

UNIT- 1.

Principles of classification-salient features and classification upto orders in non-chordates. Protozoa- Type study Entamoeba. Porifera and coelenterata-Type Sycon sponge, Obelia

UNIT- 2

Platyhelminthes and Nematelminthes-Type study – Planaria - parasitic adaptations. Ascaris - Annelida – Salient features -Type study - Earthworm,.

UNIT- 3

Arthropoda-Salient features-Cockroach- Molluscs-Salient features Type study-Fresh water mussel- torsion in mollusca- Echinodermata-Salient features Asterias-Echinoderm larvae-their significance.

UNIT- 4

Origin and salient features of chordates. Agnatha - salient features-Type study-affinities Fishes- parental care, respiratory organs, migration. Amphibians-Salient features -parental care

UNIT- 5

Reptiles-Salient features, extinct reptiles, poisonous snakes of India. Birds-salient features flightless birds - adaptive radiation. Mammals. salient features brief account of monotremes, marsupials - Dentition in mammals.

PRACTICALS

1. Examination of paramecium, amoeba, euglena.
2. Study of sycon, hylonema and spongilla from slides and specimens
3. Slides and specimens of hydra, obelia, aurelia, sea-anemone, 4. Slides and specimens of Fasciola and Taenia
5. Slides and specimens of ascaris
6. Cockroach – demonstration of digestive system and mounting of mouth parts
7. Prawn- demonstration and mounts: Mounts of Radula, ctenidium
8. Echinoderm - specimen study.
9. Amphibia- museum specimens.
10. Reptiles- museum specimens.
11. Aves-mounts and museum specimens.
12. Mammals- museum specimens

TEXT BOOKS:

1. Ekambaranatha Ayyar.M,(1973). *A Manual of Zoology –Part –I, Invertebrata*, S.Viswanathan (Printers and Publishers)Pvt.Ltd.Madras.
2. Jordon, E.L and P.S .Verma ,(1985). *Invertebrate Zoology*. S.Chand and Co. Ltd.New Delhi
3. Ekambaranatha Ayyar.M, (1973). *A Manual of Zoology Part II .Chordata*, S.Viswanathan Printers and publishers, Pvt.Ltd., Madras
4. Young.J.Z, (1988). *The Life of Vertebrates*. Oxford at the clarendon press, London
5. Adam Sedgwick, (1960). *A students Text Book of Zoology Vol.III*. General Book Depot, Allahabad

REFERENCE BOOKS

- 1) Arumugam, N. (2014). *Animal diversity Volume -1 – Invertebrata*. Saras Publication, Nagercoil, Tamil Nadu.
- 2) Arumugam, N. (2014). *Animal diversity Volume -2 – Chordata*. Saras Publication, Nagercoil, Tamil Nadu. .
- 3) Barrington E.J.W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
- 4) Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates*. OUP, USA.
- 5) George C Kent and Robert K. Carr. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill.

Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

Semester	19IZOA25: ALLIED ZOOLOGY - II	L	P	C
II	ANIMAL DIVERSITY - II	3	0	3

Learning Objective (LO):

LO1	To learn the cytological details of cells
LO2	To learn anatomical details of human
LO3	To learn the basic principles of genetics
LO4	To learn the developmental process in frog
LO5	To learn basic concepts of evolution

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Identify various organelles and their functions
CO2	Correlate developmental patterns in animals
CO3	Understand evolutionary process taking place in biological world
CO4	Analyse the anatomical details of human and Critically evaluate genetic principles involved in multiple alleles and sex determination

Unit 1: Cell Biology

Introduction: Microscopy and Cytological techniques.

Animal cell - Ultra structure : Plasma membrane - Nucleus - Mitochondria - Ribosomes - Endoplasmic reticulum - Lysosomes - Golgibodies - Centrosomes - Chromosomes.

Cancer Biology: Cancer definition - Types of cancer - Management of cancer-Radio therapy-Chemotherapy.

Unit 2: Human Anatomy

Human systems : The integumentary - Skeletal - Muscular - Digestive - Respiratory - Circulatory - Lymphatic - Nervous – Sense organs - Endocrine - Excretory – Reproductive systems.

Unit 3: Genetics

Introduction - Multiple alleles - Quantitative inheritance – Sex determination - Sex linked inheritance - Pleiotropy-Hardy Weinberg law- Population genetics.

Unit 4: Developmental Biology

Introduction - Types of eggs - Cleavage and types - Frog's egg - Gastrulation in frog embryo - Organogenesis in frog-Development of eye and heart in frog.

Unit 5: Origin of life

Theories - Geological time scale - Fossils - Extinct animals – Mass extinction- Evidences for evolution-Comparative anatomy-Embryology- Physiology-Vestigial organs-Geographical distribution.

Practicals:

1. Study of microscope-Light Microscope
2. Preparation of mitosis in onion root tip
3. Identification of blood group
4. Experiments on mendelian inheritance
5. Vital staining chick blastoderm
6. Study of animal adaptation

Text Books:

1. Verma P.S and V. K. Agarwal (2002). *Concept of Cell Biology*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.
2. Verma P. S. and V. K. Agarwal Reprint (2003). *Genetics*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.
3. Ranganathan T. S. 6/e Rev. (2002). *A Text book of Human Anatomy*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.
4. Verma P. S. and V. K. Agarwal Reprint (2003). *Chordate Embryology*, S. Chand and Company Ltd, Ram nagar, New Delhi - 110 055.
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Outcome Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3

