



FYUGP

ZOOLOGY HONOURS/ RESEARCH

FOR UNDER GRADUATE COURSES UNDER RANCHI UNIVERSITY



Implemented from
Academic Session 2022-2026

Members of Board of Studies for preparing Provisional Syllabus of the Four-Year Undergraduate Programme (FYUGP)

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Students are Instructed to

Refer Syllabus of Allied/ Opted Subjects from R.U. Website

HIGHLIGHTS OF REGULATIONS OF FYUGP

PROGRAMME DURATION

- The Full-time, Regular UG programme for a regular student shall be for a period of four years with multiple entry and multiple exit options.
- The session shall commence from **1st of July**.

ELIGIBILITY

- The selection for admission will be primarily based on availability of seats in the Major subject and marks imposed by the institution. Merit point for selection will be based on marks obtained in Major subject at Class 12 (or equivalent level) or the aggregate marks of Class 12 (or equivalent level) if Marks of the Major subject is not available. Reservation norms of The Government of Jharkhand must be followed as amended in times.
- UG Degree Programmes with Double Major shall be provided only to those students who secure a minimum of overall 75% marks (7.5 CGPA) or higher.
- Other eligibility criteria including those for multiple entry will be in light of the UGC Guidelines for Multiple Entry and Exit in Academic Programmes offered in Higher Education Institutions.

ADMISSION PROCEDURE

- The reservation policy of the Government of Jharkhand shall apply in admission and the benefit of the same shall be given to the candidates belonging to the State of Jharkhand only. The candidates of other states in the reserved category shall be treated as General category candidates. Other relaxations or reservations shall be applicable as per the prevailing guidelines of the University for FYUGP.

VALIDITY OF REGISTRATION

- Validity of a registration for FYUGP will be for maximum for Seven years from the date of registration.

ACADEMIC CALENDAR

- An Academic Calendar will be prepared by the university to maintain uniformity in the CBCS of the UG Honours Programmes, UG Programmes, semesters and courses in the college run under the university (Constituent/Affiliated).
- **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- **Semester:** The Odd Semester is scheduled from **July to December** and the Even Semester is from **January to June**. Each week has a minimum of 40 working hours spread over 6 days.
- Each semester will include – Admission, course work, conduct of examination and declaration of results including semester break.
- In order to undergo 8 weeks' summer internship/ apprenticeship during the summer camp, the Academic Calendar may be scheduled for academic activities as below:
 - a) Odd Semester: **From first Monday of August to third Saturday of December**

b) Even Semester: **From first Monday of January to third Saturday of May**

- An academic year comprising 180 working days in the least is divided into two semesters, each semester having at least 90 working days. With six working days in a week, this would mean that each semester will have $90/6 = 15$ teaching/ working weeks. Each working week will have 40 hours of instructional time.
- Each year the University shall draw out a calendar of academic and associated activities, which shall be strictly adhered to. The same is non-negotiable. Further, the Department will make all reasonable endeavors to deliver the programmes of study and other educational services as mentioned in its Information Brochure and website. However, circumstances may change prompting the Department to reserve the right to change the content and delivery of courses, discontinue or combine courses and introduce or withdraw areas of specialization.

PROGRAMME OVERVIEW/ SCHEME OF THE PROGRAMME

- Undergraduate degree programmes of either 3 or 4-year duration, with multiple entries and exit points and re-entry options within this period, with appropriate certifications such as:
 - UG Certificate after completing 1 year (2 semesters) of study in the chosen fields of study provided they complete one vocational course of 4 credits during the summer vacation of the first year or internship/ Apprenticeship in addition to 6 credits from skill-based courses earned during first and second semester.,
 - UG Diploma after 2 years (4 semesters) of study diploma provided they complete one vocational course of 4 credits or internship/ Apprenticeship/ skill based vocational courses offered during first year or second year summer term in addition to 9 credits from skill-based courses earned during first, second, and third semester,
 - Bachelor's Degree after a 3-year (6 semesters) programme of study,
 - Bachelor's Degree (Honours) after a 4-year (8 semesters) programme of study.
 - Bachelor Degree (Honours with Research) after a 4-year (8 semesters) programme of study to the students undertaking 12 credit Research component in fourth year of FYUGP.

CREDIT OF COURSES

The term 'credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. The workload relating to a course is measured in terms of credit hours. It determines the number of hours of instruction required per week over the duration of a semester (minimum 15 weeks).

- a) One hour of teaching/ lecture or two hours of laboratory /practical work will be assigned per class/interaction.

One credit for Theory = 15 Hours of Teaching i.e., 15 Credit Hours

One credit for Practicum = 30 Hours of Practical work i.e., 30 Credit Hours

- b) For credit determination, instruction is divided into three major components:

Hours (L) – Classroom Hours of one-hour duration.

Tutorials (T) – Special, elaborate instructions on specific topics of one-hour duration

Practical (P) – Laboratory or field exercises in which the student has to do experiments or other practical work of two-hour duration.

CALCULATION OF MARKS FOR THE PURPOSE OF RESULT

- Student's final marks and the result will be based on the marks obtained in Semester Internal Examination and End Semester Examination organized taken together.
- Passing in a subject will depend on the collective marks obtained in Semester internal and End Semester University Examination both. However, students must pass in Theory and Practical Examinations separately.

PROMOTION CRITERIA

First degree programme with single major:

- i. The Requisite Marks obtained by a student in a particular subject will be the criteria for promotion to the next Semester.
- ii. No student will be detained in odd Semesters (I, III, V & VII).
- iii. To get promotion from Semester-II to Semester-III a student will be required to pass in at least 75% of Courses in an academic year, a student has to pass in minimum 9 papers out of the total 12 papers.
- iv. To get promotion from Semester-IV to Semester-V (taken together of Semester I, II, III & IV) a student has to pass in minimum 18 papers out of the total 24 papers.
- v. To get promotion from Semester-VI to Semester-VII (taken all together of Semester I, II, III, IV, V & VI) a student has to pass in minimum 26 papers out of the total 34 papers.
- vi. However, it will be necessary to procure pass marks in each of the paper before completion of the course.

First degree programme with dual major:

- vii. Above criteria are applicable as well on the students pursuing dual degree programmes however first degree programme will remain independent of the performance of the student in dual major courses.
- viii. To get eligible for taking ESE, a student will be required to pass in at least 75% of Courses in an academic year. a student has to pass in minimum 3 papers out of the total 4 papers.
- ix. It will be a necessity to clear all papers of second major programme in second attempt in succeeding session, failing which the provision of dual major will be withdrawn and the student will be entitled for single first degree programme.

PUBLICATION OF RESULT

- The result of the examination shall be notified by the Controller of Examinations of the University in different newspapers and also on University website.
- If a student is found indulged in any kind of malpractice/ unfair means during examination, the examination taken by the student for the semester will be cancelled. The candidate has to reappear in all the papers of the session with the students of next coming session and his one year will be detained. However, marks secured by the candidate in all previous semesters will remain unaffected.
- There shall be no Supplementary or Re-examination for any subject. Students who have failed in any subject in an even semester may appear in the subsequent even semester examination for clearing the backlog. Similarly, the students who have failed in any subject in an odd semester may appear in the subsequent odd semester examination for clearing the backlog.

Regulation related with any concern not mentioned above shall be guided by the Regulations of the University for FYUGP.

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COURSE STRUCTURE FOR FYUGP ‘HONOURS/ RESEARCH’

Table 1: Credit Framework for Four Year Undergraduate Programme (FYUGP) under State Universities of Jharkhand [Total Credits = 160]

Level of Courses	Semester	MJ; Discipline Specific Courses – Core or Major (80)	MN; Minor from discipline (16)	MN; Minor from vocational (16)	MDC; Multidisciplinary Courses [Life sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc.] (9)	AEC; Ability Enhancement Courses (Modern Indian Language and English) (8)	SEC; Skill Enhancement Courses (9)	VAC; Value Added Courses (6)	IAP; Internship/ Dissertation (4)	RC; Research Courses (12)	AMJ; Advanced Courses in lieu of Research (12)	Credits	Double Major (DMJ)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
100-199: Foundation or Introductory courses	I	4	4		3	2	3	4				20	4+4
	II	4+4		4	3	2	3					20	4+4
Exit Point: Undergraduate Certificate provided with Summer Internship/ Project (4 credits)													
200-299: Intermediate-level courses	III	4+4	4		3	2	3					20	4+4
	IV	4+4+4		4		2		2				20	4+4
Exit Point: Undergraduate Diploma provided with Summer Internship in 1st or 2nd year/ Project (4 credits)													
300-399: Higher-level courses	V	4+4+4	4						4			20	4+4
	VI	4+4+4+4		4								20	4+4
Exit Point: Bachelor's Degree													
400-499: Advanced courses	VII	4+4+4+4	4									20	4+4
	VIII	4		4						12	4+4+4	20	4+4
Exit Point: Bachelor's Degree with Hons. /Hons. with Research												160	224

Note: Honours students not undertaking research will do 3 courses for 12 credits in lieu of a Research project / Dissertation.

Session 2022-26 onwards

COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME **2022 onwards****Table 2: Semester wise Course Code and Credit Points for Single Major:**

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits
	Code	Papers	
I	AEC-1	Language and Communication Skills (MIL-1; Modern Indian language including TRL)	2
	VAC-1	Value Added Course-1	4
	SEC-1	Skill Enhancement Course-1	3
	MDC-1	Multi-disciplinary Course-1	3
	MN-1A	Minor from Discipline-1	4
	MJ-1	Major paper 1 (Disciplinary/Interdisciplinary Major)	4
II	AEC-2	Language and Communication Skills (English)	2
	SEC-2	Skill Enhancement Course-2	3
	MDC-2	Multi-disciplinary Course-2	3
	MN-2A	Minor from Vocational Studies/Discipline-2	4
	MJ-2	Major paper 2 (Disciplinary/Interdisciplinary Major)	4
	MJ-3	Major paper 3 (Disciplinary/Interdisciplinary Major)	4
III	AEC-3	Language and Communication Skills (MIL-2; Modern Indian language including TRL)	2
	SEC-3	Skill Enhancement Course-3	3
	MDC-3	Multi-disciplinary Course-3	3
	MN-1B	Minor from Discipline-1	4
	MJ-4	Major paper 4 (Disciplinary/Interdisciplinary Major)	4
	MJ-5	Major paper 5 (Disciplinary/Interdisciplinary Major)	4
IV	AEC-3	Language and Communication Skills (MIL-2/ English-2)	2
	VAC-2	Value Added Course-2	2

	MN-2B	Minor from Vocational Studies/Discipline-2	4
	MJ-6	Major paper 6 (Disciplinary/Interdisciplinary Major)	4
	MJ-7	Major paper 7 (Disciplinary/Interdisciplinary Major)	4
	MJ-8	Major paper 8 (Disciplinary/Interdisciplinary Major)	4
V	MN-1C	Minor from Discipline-1	4
	MJ-9	Major paper 9 (Disciplinary/Interdisciplinary Major)	4
	MJ-10	Major paper 10 (Disciplinary/Interdisciplinary Major)	4
	MJ-11	Major paper 11 (Disciplinary/Interdisciplinary Major)	4
	IAP	Internship/Apprenticeship/Field Work/Dissertation/Project	4
VI	MN-2C	Minor from Vocational Studies/Discipline-2	4
	MJ-12	Major paper 12 (Disciplinary/Interdisciplinary Major)	4
	MJ-13	Major paper 13 (Disciplinary/Interdisciplinary Major)	4
	MJ-14	Major paper 14 (Disciplinary/Interdisciplinary Major)	4
	MJ-15	Major paper 15 (Disciplinary/Interdisciplinary Major)	4
VII	MN-1D	Minor from Discipline-1	4
	MJ-16	Major paper 16 (Disciplinary/Interdisciplinary Major)	4
	MJ-17	Major paper 17 (Disciplinary/Interdisciplinary Major)	4
	MJ-18	Major paper 18 (Disciplinary/Interdisciplinary Major)	4
	MJ-19	Major paper 19 (Disciplinary/Interdisciplinary Major)	4
VIII	MN-2D	Minor from Vocational Studies/Discipline-2	4
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4
	RC/ AMJ-1 AMJ-2 AMJ-3	Research Internship/Field Work/Dissertation OR Advanced Major paper-1 (Disciplinary/Interdisciplinary Major) Advanced Major paper-2 (Disciplinary/Interdisciplinary Major) Advanced Major paper-3 (Disciplinary/Interdisciplinary Major)	12/ 4 4 4
			Total Credit	160

NUMBER OF CREDITS BY TYPE OF COURSE

The hallmark of the new curriculum framework is the flexibility for the students to learn courses of their choice across various branches of undergraduate programmes. This requires that all departments prescribe a certain specified number of credits for each course and common instruction hours (slot time).

Table 3: Overall Course Credit Points for Single Major

Courses	Nature of Courses	3 yr UG Credits	4 yr UG Credits
Major	Core courses	60	80
Minor	i. Discipline/ Interdisciplinary courses and ii. Vocational Courses	24	32
Multidisciplinary	3 Courses	9	9
AEC	Language courses	8	8
SEC	Courses to be developed by the University	9	9
Value Added Courses	Understanding India, Environmental Studies, Digital Education, Health & wellness, Summer Internship/ Apprenticeship/ Community outreach activities, etc.	6	6
Internship (In any summer vacation for Exit points or in Semester-V)		4	4
Research/ Dissertation/ Advanced Major Courses	Research Institutions/ 3 Courses		12
Total Credits =		120	160

Table 4: Overall Course Code and Additional Credit Points for Double Major

Courses	Nature of Courses	3 yr UG Credits	4 yr UG Credits
Major 1	Core courses	60	80
Major 2	Core courses	48	64
Minor	i. Discipline/ Interdisciplinary courses and ii. Vocational Courses	24	32
Multidisciplinary	3 Courses	9	9
AEC	Language courses	8	8
SEC	Courses to be developed by the University	9	9
Value Added Courses	Understanding India, Environmental Studies, Digital Education, Health & wellness, Summer Internship/ Apprenticeship/ Community outreach activities, etc.	6	6
Internship (In any summer vacation for Exit points or in Semester-V)		4	4
Research/ Dissertation/ Advanced Major Courses	Research Institutions/ 3 Courses		12
Total Credits =		168	224

Table 5: Semester wise Course Code and Additional Credit Points for Double Major:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Credits
	Code	Papers	
I	DMJ-1	Double Major paper-1 (Disciplinary/Interdisciplinary Major)	4
	DMJ-2	Double Major paper-2 (Disciplinary/Interdisciplinary Major)	4
II	DMJ-3	Double Major paper-3 (Disciplinary/Interdisciplinary Major)	4
	DMJ-4	Double Major paper-4 (Disciplinary/Interdisciplinary Major)	4
III	DMJ-5	Double Major paper-5 (Disciplinary/Interdisciplinary Major)	4
	DMJ-6	Double Major paper-6 (Disciplinary/Interdisciplinary Major)	4
IV	DMJ-7	Double Major paper-7 (Disciplinary/Interdisciplinary Major)	4
	DMJ-8	Double Major paper-8 (Disciplinary/Interdisciplinary Major)	4
V	DMJ-9	Double Major paper-9 (Disciplinary/Interdisciplinary Major)	4
	DMJ-10	Double Major paper-10 (Disciplinary/Interdisciplinary Major)	4
VI	DMJ-11	Double Major paper-11 (Disciplinary/Interdisciplinary Major)	4
	DMJ-12	Double Major paper-12 (Disciplinary/Interdisciplinary Major)	4
VII	DMJ-13	Double Major paper-13 (Disciplinary/Interdisciplinary Major)	4
	DMJ-14	Double Major paper-14 (Disciplinary/Interdisciplinary Major)	4
VIII	DMJ-15	Double Major paper-15 (Disciplinary/Interdisciplinary Major)	4
	DMJ-16	Double Major paper-16 (Disciplinary/Interdisciplinary Major)	4
		Total Credit	64

Abbreviations:

AEC	Ability Enhancement Courses
SEC	Skill Enhancement Courses
IAP	Internship/Apprenticeship/ Project
MDC	Multidisciplinary Courses
MJ	Major Disciplinary/Interdisciplinary Courses
DMJ	Double Major Disciplinary/Interdisciplinary Courses
MN	Minor Disciplinary/Interdisciplinary Courses
AMJ	Advanced Major Disciplinary/Interdisciplinary Courses
RC	Research Courses

AIMS OF BACHELOR'S DEGREE PROGRAMME IN ZOOLOGY

The aim of bachelor's degree programme in Zoology are as follows:

Zoology is the study of all animal life; from primitive microscopic malaria-causing protozoa to large advanced mammals, across all environmental spheres from red deer in mountain forests to dolphins in deep oceans, and from underground burrowing voles to golden eagles in the skies. Some of these animals are useful to us and we nurture them as pets or livestock; some are serious pests or disease-causing; and some are simply splendid and awe-inspiring. No matter what our relation with the animals is, we need to understand their behaviour, population dynamics, physiology and the way they interact with other species and their environments. It provides students with the knowledge and skill base that would enable them to undertake further studies in Zoology and related areas or in multidisciplinary areas that involve advanced or modern biology and help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

The modern era requires a classical zoologist with a modern approach to master many subjects of Zoology. There is a need for the students to compete with the globe, therefore, the main focus of this curriculum is to enable the student to be professionally competent and successful in a career. Having Zoology as backbone of the curriculum, this course, with the department centric electives will enhance the skills required to perform research in laboratory and experimental research. The students can choose to focus on a “whole animal” or a “bits of animals” approach. The “whole animal” pathway makes the students proficient in the identification and study of animals while the latter approach provides the skills required to pursue laboratory and experimental work such as disease research, DNA technologies, wildlife forensics etc. The curriculum can be modified to such extent that a student at B.Sc. level can be a specialist in immunology, ornithology, animal behaviour or entomology. For such specializations, the curriculum needs to focus on special skills to maximise the students' employment probability; for example, few skills needed by industry may include the species-specific monitoring for key species, handling of dangerous/ poisonous/ wild animals and the use of Geographic Information Systems (GIS) for data collection.

PROGRAM LEARNING OUTCOMES

The programme learning outcomes relating to Honours/Research Degree in Zoology:

Knowledge and Understanding

Demonstrate:

(i) in-depth knowledge and understanding about the fundamental concepts, principles and processes underlying the academic field of Zoology and its different subfields (animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and evolutionary biology, animal biotechnology, applied Zoology, aquatic biology, immunology, reproductive biology, and insect, vectors and diseases, apiculture, aquarium fish keeping, medical diagnostics, and sericulture)

(ii) procedural knowledge that creates different types of professionals in the field of Zoology and related fields such as, apiculture, aquarium fish keeping, medical diagnostics, and sericulture, etc.

(iii) skills related to specialization areas within Zoology as well as within subfields of Zoology, including broader interdisciplinary subfields (Chemistry, Physics and Mathematics).

- Over the years, Zoologists were able to find many differences within the same breed of an animal species. As a Zoology professional one can study extinct animals by specializing in Paleozoology, on the different types of birds in Ornithology opt for studying Herpetology and Arachnology, the branches dealing with the study of snakes and spiders, respectively or
- Appreciate the complexity of life processes, their molecular, cellular and physiological processes, their genetics, evolution and behaviour and their interrelationships with the environment.
- Study concepts, principles and theories related with animal behaviour and welfare.
- Understand and interpret data to reach a conclusion
- Design and conduct experiments to test a hypothesis.
- Understand scientific principles underlying animal health, management and welfare.
- Accept the legal restrictions & ethical considerations placed for animal welfare.
- Understand fundamental aspects of animal science relating to management of animals.

The core courses would fortify the students with in-depth subject knowledge concurrently; the discipline specific electives will add additional knowledge about applied aspects of the program as well as its applicability in both academia and industry. Generic electives will introduce integration among various interdisciplinary courses. The skill enhancement courses would further add additional skills related to the subject as well as other than subject. In brief, the students graduated with this type of curriculum would be able to disseminate subject knowledge along with necessary skills to suffice their capabilities for academia, entrepreneurship and Industry. For each syllabus, the course content has been divided into four units with a breakup of the topics to be covered to provide the students better understanding of the main theme represented in the title of each unit. Such type of design is to indicate the breadth of content to be taught thus ensuring more or less uniform coverage of information on a certain theme. The teacher has to take up the contents in such a manner by asking questions and answering them that the whole process appears to be an interesting narrative with topics falling in line rather than appearing as unrelated complex terms. Learning will be more enjoyable and imbibing if appropriate examples are cited from our daily lives.

SEMESTER WISE COURSES IN ZOOLOGY MAJOR-1 FOR FYUGP

2022 onwards**Table 7: Semester wise Examination Structure in Discipline Courses:**

Semester	Courses		Examination Structure			
	Code	Papers	Credits	Mid Semester Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical/ Viva (F.M.)
I	MJ-1	NON –CHORDATES AND CHORDATES	4	25	75	---
II	MJ-2	ECOLOGY AND BIOCHEMISTRY	4	25	75	---
	MJ-3	Practical-I (To prepare from UG Syllabus)	4	---	---	100
III	MJ-4	CELL BIOLOGY AND BIostatISTICS	4	25	75	---
	MJ-5	Practical-II (To prepare from UG Syllabus)	4	---	---	100
IV	MJ-6	ANIMAL PHYSIOLOGY	4	25	75	---
	MJ-7	COMPARATIVE ANATOMY	4	25	75	---
	MJ-8	Practical-III (To prepare from UG Syllabus)	4	---	---	100
V	MJ-9	MOLECULAR BIOLOGY	4	25	75	---
	MJ-10	GENETICS & EHTOLOGY	4	25	75	---
	MJ-11	Practical-IV (To prepare from UG Syllabus)	4	---	---	100
VI	MJ-12	DEVELOPMENTAL BIOLOGY	4	25	75	---
	MJ-13	EVOLUTION	4	25	75	---
	MJ-14	ENDOCRINOLOGY & IMMUNOLOGY	4	25	75	---
	MJ-15	Practical-V (To prepare from UG Syllabus)	4	---	---	100
VII	MJ-16	INSECTA, FISH & FISHERIES	4	25	75	---
	MJ-17	PG-1 (To prepare from PG Syllabus)	4	25	75	---
	MJ-18	PG-2 (To prepare from PG Syllabus)	4	25	75	---
	MJ-19	Practical-VI (To prepare from PG Syllabus)	4	---	---	100

VIII	MJ-20	PG-3 (To prepare from PG Syllabus)	4	25	75	---
	AMJ-1	PG-4 (To prepare from PG Syllabus)	4	25	75	---
	AMJ-2	PG-5 (To prepare from PG Syllabus)	4	25	75	---
	AMJ-3	Practical-VII (To prepare from PG Syllabus)	4	---	---	100
	or RC-1	Research Methodology	4	25	75	---
	RC-2	Project Dissertation/ Research Internship/ Field Work	8	---	---	200
		Total Credit	92			

Table 8: Semester wise Course Code and Credit Points for Skill Enhancement Courses:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure			
	Code	Papers	Credits	Mid Semester Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical/ Viva (F.M.)
I	SEC-1	WILDLIFE CONSERVATION AND MANAGEMENT	3	---	75	---
II	SEC-2	SERICULTURE & APICULTURE	3	---	75	---
III	SEC-3	ELEMENTARY COMPUTER APPLICATION SOFTWARES	3	---	---	75
		Total Credit	9			

Table 9: Semester wise Course Code and Credit Points for Minor Courses:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure			
	Code	Papers	Credits	Mid Semester Theory (F.M.)	End Semester Theory (F.M.)	End Semester Practical/ Viva (F.M.)
I	MN-1A	INTRODUCTORY ZOOLOGY	4	15	60	25
III	MN-1B	ANIMAL DIVERSITY	4	15	60	25
V	MN-1C	FOOD NUTRITION AND HEALTH	4	15	60	25
VII	MN-1D	ENVIRONMENT & PUBLIC HEALTH	4	15	60	25
		Total Credit	16			

INSTRUCTION TO QUESTION SETTER

SEMESTER INTERNAL EXAMINATION (SIE):

There will be Only One Semester Internal Examination in Major, Minor and Research Courses, which will be organized at college/institution level. However, Only One End semester evaluation in other courses will be done either at College/ Institution or University level depending upon the nature of course in the curriculum.

A. (SIE 10+5=15 marks):

There will be two group of questions. **Question No.1 will be very short answer type in Group A** consisting of five questions of 1 mark each. **Group B will contain descriptive type** two questions of five marks each, out of which any one to answer.

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks, (b) Class Attendance Score (CAS) of 5 marks.

B. (SIE 20+5=25 marks):

There will be two group of questions. **Group A is compulsory** which will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type** two questions of ten marks each, out of which any one to answer.

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 20 Marks, (b) Class Attendance Score (CAS) of 5 marks.

Conversion of Attendance into score may be as follows:

Attendance Upto 45%, 1mark; 45<Attd.<55, 2 marks; 55<Attd.<65, 3 marks; 65<Attd.<75, 4 marks; 75<Attd, 5 marks.

END SEMESTER UNIVERSITY EXAMINATION (ESE):

A. (ESE 60 marks):

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer.

B. (ESE 75 marks):

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to answer.

C. (ESE 100 marks):

There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of ten questions of 1 mark each. **Question No. 2 & 3 will be short answer type** of 5 marks. Group B will contain descriptive type six questions of twenty marks each, out of which any four are to answer.

FORMAT OF QUESTION PAPER FOR SEMESTER INTERNAL EXAMINATION

Question format for 10 Marks:

Subject/ Code		Exam Year
F.M. =10	Time=1Hr.	
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 1 out of 2 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[5x1=5]
i.	.....
ii.	.....
iii.	.....
iv.	.....
v.	.....
<u>Group B</u>		
2.	.....	[5]
3.	.....	[5]
Note: There may be subdivisions in each question asked in Theory Examination.		

Question format for 20 Marks:

Subject/ Code		Exam Year
F.M. =20	Time=1Hr.	
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 1 out of 2 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[5x1=5]
i.	.....
ii.	.....
iii.	.....
iv.	.....
v.	.....
2.	.....	[5]
<u>Group B</u>		
3.	.....	[10]
4.	.....	[10]
Note: There may be subdivisions in each question asked in Theory Examination.		

FORMAT OF QUESTION PAPER FOR END SEMESTER UNIVERSITY EXAMINATION

Question format for 50 Marks:

F.M. =50	Subject/ Code Time=3Hrs.	Exam Year
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 3 out of 5 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[5x1=5]
i.	
ii.	
iii.	
iv.	
v.	
<u>Group B</u>		
2.	[15]
3.	[15]
4.	[15]
5.	[15]
6.	[15]
Note: There may be subdivisions in each question asked in Theory Examination.		

Question format for 60 Marks:

F.M. =60	Subject/ Code Time=3Hrs.	Exam Year
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 3 out of 5 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[5x1=5]
i.	
ii.	
iii.	
iv.	
v.	
2.	[5]
3.	[5]
<u>Group B</u>		
4.	[15]
5.	[15]
6.	[15]
7.	[15]
8.	[15]
Note: There may be subdivisions in each question asked in Theory Examination.		

Question format for 75 Marks:

F.M. = 75	Subject/ Code	Exam Year
	Time=3Hrs.	
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 4 out of 6 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[5x1=5]
i.	
ii.	
iii.	
iv.	
v.	
2.	[5]
3.	[5]
<u>Group B</u>		
4.	[15]
5.	[15]
6.	[15]
7.	[15]
8.	[15]
9.	[15]
Note: There may be subdivisions in each question asked in Theory Examination.		

Question format for 100 Marks:

F.M. = 100	Subject/ Code	Exam Year
	Time=3Hrs.	
General Instructions:		
i. Group A carries very short answer type compulsory questions. ii. Answer 4 out of 6 subjective/ descriptive questions given in Group B . iii. Answer in your own words as far as practicable. iv. Answer all sub parts of a question at one place. v. Numbers in right indicate full marks of the question.		
<u>Group A</u>		
1.		[10x1=10]
i.	
ii.	
iii.	
iv.	
v.	
vi.	
vii.	
viii.	
ix.	
x.	
2.	[5]
3.	[5]
<u>Group B</u>		
4.	[20]
5.	[20]
6.	[20]
7.	[20]
8.	[20]
9.	[20]
Note: There may be subdivisions in each question asked in Theory Examination.		

SEMESTER I

I. MAJOR COURSE –MJ 1: NON –CHORDATES AND CHORDATES

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40
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(Credits: Theory-04) **60 Hours****Learning outcomes**

After successfully completing this course, the students will be able to:

1. Develop understanding on the diversity of life with regard to protists, non-chordates and chordates.
2. Group animals on the basis of their morphological characteristics/ structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
5. Understand how morphological change due to change in environment helps drive evolution over a long period of time.
6. The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills.

Course Content:**GROUP A****UNIT I: Kingdom Protista****(04 Lecture)**

1. General introduction and classification upto class
2. Locomotion in Protista
3. Reproduction and Nutrition in Protista

UNIT II: Phylum Porifera, Cnidaria, Ctenophora.**(04 Lecture)**

1. General characters and classification upto class
2. Canal system in Porifera
3. Coral and coral Reef formation.
4. Alteration of Generation in cnidarian.
5. Evolutionary significance of ctenophore

UNIT III: Helminthes**(04 Lecture)**

1. General characters and classification of Platyhelminthes, Nematelminthes and Aschelminthes. upto class
2. Life cycle of Fasciola hepatica

UNIT IV: Annelida**(04 Lecture)**

1. Segmentation in Annelids
2. Origin of coelom

UNIT V: Arthropoda**(04 Lecture)**

1. General characters, Classification upto class
2. vision in Arthropods, Appendages in Arthropods

UNIT VI: Mollusca**(05 Lecture)**

1. General characteristic of Mollusca. Classification upto class

2. Torsion and Detorsion in Mollusca

UNIT VII: Echinodermata**(05 Lecture)**

1. General characters, classification upto class
2. Water vascular system in Echinodermata

GROUP B**Chordates (Pisces to Mammals)****UNIT I: Chordata****(04 Lecture)**

Introduction to chordates and its origin general characters and outline classification

UNIT II: Protochordates**(04 Lecture)**

1. General characters of Hemichordates Urochordates and Cephalochordates.

UNIT III: Agnatha**(03 Lecture)**

General characters and classification of cyclostomes.

UNIT IV: Pisces**(03 Lecture)**

1. General classification of chondrichthyes and Osteichthyes
2. Parental care in fishes

UNIT V: Amphibia**(04 Lecture)**

1. General Classes and classification of Amphibia
2. Parental care in Amphibians.

UNIT VI: Reptilia**(04 Lecture)**

Poison apparatus and Biting mechanism in snakes.

UNIT VII: Aves**(04 Lecture)**

1. General characters of Aves
2. Flight adaptations in birds
3. Flightless Birds, a brief idea.

UNIT VIII: Mammalia**(04 Lecture)**

- I. **General characters and classification up to classes, Dentition in mammals.**

Reference Books:

1. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Singh, S. Keshari S. and Abhishek, K.S. (2016). Medical Zoology and Parasitology, Jharkhand Jharokha, Classical Publishing Company.
6. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
7. Pough H. Vertebrate life, VIII Edition, Pearson International.
8. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
9. Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

SEMESTER II

II. MAJOR COURSE- MJ 2: ECOLOGY AND BIOCHEMISTRY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) 60 Hours

Learning outcomes

After successfully completing this course, the students will be able to:

1. Know the evolutionary and functional basis of animal ecology.
2. Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.
3. Solve the environmental problems involving interaction of humans and natural systems at local or global level.
4. Understand about the importance and scope of biochemistry.
5. Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
6. Understand the structure and function of immunoglobulins.
7. Understand the concept of enzyme, its mechanism of action and regulation.
8. Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
9. Learn measurement of enzyme activity and its kinetics.

Course Content:

GROUP A: Ecology

UNIT I: An Overview of Ecology

(06 Lecture)

1. Structure and function of an ecosystem
2. Energy flow in an ecosystem: Lindeman's trophic dynamic concept
3. Laws of limiting factor: Shelford's law of tolerance
4. Food chain and Food web
5. Productivity and its management
6. Biome: An introduction and its type.

UNIT II: Population Ecology:

(06 Lecture)

1. Population its attributes, Survivorship curve.
2. Exponential and logistic growth.
3. Population Regulation –Density and density independent factors/

UNIT III: Community Ecology:

(06 Lecture)

1. Community Characters, Analytical and synthetic characters
2. Community Diversity Indices
3. Community Interactions –positive and Negative interactions
4. Niche concept: Niche overlap. Gause's principle with laboratory and field examples.
5. Community Dynamics-Succession and climax concept

UNIT IV: Environment Management:

(06 Lecture)

1. Natural resources-types
2. Biogeochemical cycles –Water, Carbon, Nitrogen

3. Biodiversity-Alpha, Beta, Gamma. Hotspots
4. Environmental Degradation causes and its management including air, Water, Soil. and Noise

UNIT V: Environmental movements: (06 Lecture)

1. Chipko movement
2. Silent valley
3. Sardar Sarovar Mega Dam project.
4. Role of Gender and cultures in environmental conservation

GROUP B**Biochemistry****UNIT I: Biomolecules: A brief account of Carbohydrates, protein and lipids. (06 Lecture)****UNIT II: Carbohydrates: (06 Lecture)**

1. Structure and classification. Metabolism of carbohydrates. Glycolysis, Krebs's cycle, ETS and ATP synthesis.
2. Glycogenesis, Gluconeosis. Glycogenesis HMP shunt.

UNIT III: Lipids (06 Lecture)

Structure and classification. Steroids ketogenesis and synthesis of Palmitic Acid.

UNIT IV: Proteins (06 Lecture)

1. Composition, structure and Biological significance.
2. Amino acids: structure and classification.
3. Catabolism of Amino acid: Transamination & Deamination.

UNIT V: Enzymes (06 Lecture)

1. Nomenclature and classification.
2. Enzyme kinetics. Regulation of Enzyme action Coenzymes and Isoenzymes.
3. Enzyme inhibition and Km equation Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Reference Books:**Group A**

1. 1.Raziuddin, M., Mishra P.K. 2014, A Handbook of Environmental Studies, Akanaksha Publications, Ranchi.
2. 2.Mukherjee, B. 2011: Fundamentals of Environmental Biology.Silverline Publications, Allahabad.
3. 3.Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
4. 4.Gadgil, M., &Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
5. 5.Gleeson, B. and Low, N. (eds.) 1999.Global Ethics and Environment, London, Routledge.
6. 6.Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
7. 7.Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
8. 8.Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36--37.
9. 9.McCully, P. 1996. Rivers no more: the environmental effects of dams(pp. 29--64). Zed Books.
10. 10.McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
11. 11.Odum, E.P., Odum, H.T. & Andrews, J. 1971.Fundamentals of Ecology. Philadelphia: Saunders.

Group B

1. 1.Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
 2. 2.Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
 3. 3.Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009,). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
 4. 4.Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
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III. MAJOR COURSE- MJ 3: PRACTICALS-I

Marks: Pr (ESE: 3Hrs) =100

Pass Marks: Pr (ESE) = 40

(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

1. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SEMESTER III

I. MAJOR COURSE- MJ 4: CELL BIOLOGY AND BIOSTATISTICS

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40
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(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing this course, the students will be able to

1. Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
2. Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
3. Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.
4. Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.
5. Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor.
6. Know basic concepts of probability and statistics
7. Understand data mining tool and its practical application in a case study
8. Apply the knowledge in future course of their career development in higher education and research

Course Content:

GROUP A

UNIT I: A general concept of prokaryotic and eukaryotic cells (03 Lecture)

Cell theory, General structure of different cell organelles including Mitochondria, Golgi complex,

UNIT II: Endoplasmic reticulum, Nucleus. Ribosome, Lysosome (05 Lecture)

UNIT III: Cytoskeleton-Composition and function. Microtubules and microfilaments GERL system (04 Lecture)

UNIT IV: Cell membrane structure: Chemical composition of Plasma membrane of Erythrocyte, Active and Passive transport, (Diffusion and osmosis) ATPase Pump and Exchange. (10 Lecture)

UNIT V: Cell Adhesion molecules and ECM (05 Lecture)

UNIT VI: Cell cycle, cell signaling, and cell culture: (15 Lecture)

1. A brief introduction to cell cycle, its various phases
2. Mitosis and Meiosis, Cell division, Check points and its regulation.
3. Apoptosis and Cancer
4. Cell signaling, Regulation of signaling pathways. (GPCR and RTR)
5. Cell Cell communication

UNIT VII: Types of culture media: Sterlization methods (08 Lecture)

Somatic cell hybridization.

GROUP B:**Biostatistics****(10 Lecture)**

1. Types of data: Primary and secondary data
2. Mean, Median, Mode, Standard Deviation, Standard error, Chi square test, t-test, f-test, ANOVA, Correlation, Regression Analysis.
3. Basics of statistics software – SPSS and R

Reference Books:**GROUP-A**

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London

GROUP B

1. W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley.
 2. Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and Health Sciences (2nd edition) McGraw Hill.
 3. Zar, J.H. (2013) Biostatistical Analysis (5th edition) Pearson.
-

II. MAJOR COURSE- MJ 5: PRACTICALS-II

Marks: Pr (ESE: 3Hrs) =100

Pass Marks: Pr (ESE) = 40

(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

1. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

3. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SEMESTER IV

I. MAJOR COURSE- MJ 6: ANIMAL PHYSIOLOGY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of the evolution of various organ systems which work in coordination.
2. Have a detailed discussions of major organ systems.
3. Understand how cells, tissues, and organs function at different levels.
4. Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc.
5. Get a flavor of research besides improving their writing skills and making them well versed with the current trends.
6. Undertake research in any aspect of animal physiology in future.

Course Content:

UNIT I: Tissue

(06 Lecture)

Structure and classification, Bone and Cartilage

UNIT II: Digestive System

(06 Lecture)

Gastrointestinal tract and its associated glands, Mechanical and Chemical digestion of food, Absorption of Carbohydrate, Protein and Lipid

UNIT III: Respiratory System

(06 Lecture)

Histology of trachea and Lungs, Respiratory volumes, Respiratory Pigments, Diffusion of respiratory gases and Transport of O₂ and CO₂

UNIT IV: Circulatory System

(06 Lecture)

Structure and Working of Mammalian Heart
Blood groups, Rh factor Blood and its components, Blood clotting Mechanism
Cardiac cycle

UNIT V: Skeletal system

(06 Lecture)

Ultra-structure of Skeletal Muscle, chemical basis of muscle contraction.

UNIT VI: Excretory System

(06 Lecture)

Kidney: structure and function, Mechanism of urine formation, Counter- Current theory, Ornithine-Arginine cycle

UNIT VII: Reproductive System

(08 Lecture)

Histology of male and female reproductive organs, physiology of reproduction in male and female, Accessory Reproductive organs, Methods of Contraception, Reproductive Hormone.

UNIT VIII: Endocrine system:

(08 Lecture)

Basics of Endocrine glands (Pituitary, Pineal, Thyroid, Pancreas Adrenal, Thymus, and Gonads). Classification of hormone
Mode of hormone action. (TSH/Adrenaline)

UNIT IX: Nervous System**(08 Lecture)**

Ultrastructure of Neuron, Physiology of nerve conduction, Reflex Action,

Reference Books:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
 2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons.
 3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
 4. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.
 5. DeFiore Atlas of Human histology. Physiology Vandor
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II. MAJOR COURSE- MJ 7: COMPARATIVE ANATOMY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.
2. Have an overview of the evolutionary concepts including homology and homoplasy, and detailed discussions of major organ systems.
3. Understand how cells, tissues, and organisms function at different levels. The course content also provides the basis of understanding their abnormal function in animal and human diseases and new methods for treating those diseases.
4. Get a flavor of research besides improving their writing skills and making them well versed with the current trends. It will further enable the students to think and interpret individually due to different aspects chosen.

Course Content:

UNIT I: Integumentary System	(06 Lecture)
Structure Function and Derivatives of integument	
UNIT II: Skeletal System	(07 Lecture)
An Overview of Axial and Appendicular Skeleton, Jaw suspensorium	
UNIT III: Digestive System	(07 Lecture)
Alimentary Canal and associated gland, Dentition	
UNIT IV: Respiratory System	(08 Lecture)
Skin, Gills, Lungs, Air Sacs and accessory respiratory organs	
UNIT V: Circulatory System	(08 Lecture)
Evolution of Heart and Aortic arches, General plan of Circulation	
UNIT VI: Urinogenital System	(08 Lecture)
Succession of Kidney, Evolution of Urinogenital duct	
UNIT VII: Nervous system	(08 Lecture)
Comparative account of brain, Autonomic Nervous System, Spinal Cord, Cranial Nerves in Mammals	
UNIT VIII: Sense Organs	(08 Lecture)
Brief account of Visual and Auditory receptors	

Reference Books:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills

4. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
 5. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
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III. MAJOR COURSE- MJ 8: PRACTICALS-III

Marks: Pr (ESE: 3Hrs) =100

Pass Marks: Pr (ESE) = 40

(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

1. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SEMESTER V

I. MAJOR COURSE- MJ 9: MOLECULAR BIOLOGY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario.
2. Get well versed in recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Therefore, a fundamental understanding of Molecular Biology will help in career building in all these fields.
3. Apply their knowledge in problem solving and future course of their career development in higher education and research.
4. Get new avenues of joining research in related areas

Course Content:

UNIT I: DNA- Chemistry of nucleic acids (DNA & RNA):

(08 Lecture)

N-bases, Pentose sugar, Nucleosides & Nucleotides, Watson-Crick model of DNA, Types of DNA (A, B & Z), Base pairing, Major & minor grooves of DNA, uninterrupted genes.

UNIT II: DNA synthesis in E. coli:

(08 Lecture)

Semi-conservative DNA replication, Replication fork, DNA polymerases, Phases- initiation, elongation and termination. Errors in DNA and their repair (base excision repair & nucleotide excision repair)

UNIT III: Transcription in E. coli:

(08 Lecture)

Consensus sequences, Promoter (-35 & -10 elements), RNA polymerase, Phases- initiation, elongation and termination. RNA processing of mRNA.

UNIT IV: RNA:

(08 Lecture)

chemistry of RNA, types of RNA (mRNA, rRNA, tRNA, snoRNA), Structure of mRNA & tRNA (clover-leaf model), Basics of RNA edit, RNAi.

UNIT V: Genetic codes:

(08 Lecture)

History of genetic codes, Features of genetic codes, Wobble hypothesis. Central dogma.

UNIT VI: Translation in E. coli:

(05 Lecture)

Translation factors, charging of tRNAs, Phases- initiation, elongation and termination.

UNIT VII: Gene recombination:

(05 Lecture)

Homologous recombination.

UNIT VIII: Operon concept:

(05 Lecture)

Operon and its types, Lac operon – inducible, constitutive & non-inducible.

UNIT IX: Basics of the genetics of cancer:**(05 Lecture)**

Proto-oncogenes, Gene regulation of the cell cycle. Gene therapy, Stem cell therapy, BLAST.

Reference Books:

1. Lehninger Principles of biochemistry: Cox & Nelson, MacMillan & Freeman, USA
 2. Molecular biology of Gene: Watson et al., Pearson Publication, USA
 3. Strickberger's Genetics, Prinitis Hall of India (PHI), Delhi
 4. Principles of Genetics: Snustad& Simmons, John Wiley & Sons, USA
 5. Modern Genetics Analysis: Integrating Genes and Genomes, Griffith et al., W. H. Freeman & Company, USA
 6. Genetics: Russell & Benjamin, Cummings Publishing Company, USA.
 7. Genetics: PK Gupta, Rastogi Publication, New Delhi.
 8. Gene regulation: Latchmann, Taylor & Francis, USA
 9. Molecular biology of cancer: Lecorino, Oxford University Press, UK.
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II. MAJOR COURSE- MJ 10: GENETICS & EHTOLOGY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing this course, the students will be able to:

1. Understand how DNA encodes genetic information and the function of mRNA and tRNA
2. Apply the principles of Mendelian inheritance.
3. Understand the cause and effect of alterations in chromosome number and structure.
4. Relate the conventional and molecular methods for gene manipulation in other biological systems.
5. Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.
6. Get new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity, etc
7. Learn a wide range of theoretical and practical techniques used to study animal behaviour. • Develop skills, concepts and experience to understand all aspects of animal behaviour.
8. Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives.
9. Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild.

Course Content:

GROUP A: Genetics

UNIT I: Pre-Mendelian genetics, Mendel's life, Symbols, and terminologies, Laws of dominance, segregation & independent assortment, Back cross & test cross, Multiple alleles, and Incomplete Dominance. (05 Lecture)

UNIT II: Linkage:

Coupling & repulsion hypothesis, Morgan's view of linkage, kinds of linkage, Chromosomal theory of linkage, Human chromosomal maps. (05 Lecture)

UNIT III: Crossing over or Gene recombination:

Somatic & germinal crossing over, kinds of crossing over, Theories of the mechanism of crossing over. (06 Lecture)

UNIT IV: Eukaryotic Chromosomes:

Structure & chemical composition of chromosomes. Karyotype, Ideogram, Human karyotype, Lampbrush chromosome (06 Lecture)

UNIT V: Sex determination:

Genic balance theory, Chromosomal theory &, Types of sex determination, Environmental sex determination, Role of SRY gene in sex determination, and developing gonads. (06 Lecture)

UNIT VI: Sex-linked inheritance:

Sex chromosomes, X-linked genes (colour blindness & haemophilia in humans), Y-linked inheritance, Sex-limited & Sex influenced traits. (04 Lecture)

UNIT VII: Pedigree analysis:

Penetrance & expressivity, Symbols, Pedigree analysis of dominance inheritance (polydactyly in man), Recessive inheritance (cystic fibrosis), and sex-linked inheritance (colour blindness).

(06 Lecture)**UNIT VIII: Mutation:**

Historical background, Mutagens, Chromosomal mutation & gene mutation, Chromosomal aberrations in humans, Euploidy & aneuploidy.

(06 Lecture)**GROUP B: Ethology****UNIT I: General concepts of Ethology:**

Motivation; Fixed Action Pattern, Imprinting

(02 Lecture)**UNIT II: Behaviour and its types:**

Individual and social interaction, Social organization, Innate and learned behavior, **(04 Lecture)**

UNIT III: Orientation in animals - its nature and types**(02 Lecture)****UNIT IV: Biological rhythms – occurrence and significance:****(02 Lecture)****Reference Books:****GROUP A**

1. Strickberger's Genetics, Prinitis Hall of India (PHI), Delhi
2. Principles of Genetics: Snustad & Simmons, John Wiley & Sons, USA
3. Modern Genetics Analysis: Integrating Genes and Genomes, Griffith et al.,
4. W. H. Freeman & Company, USA
5. Genetics: Russell & Benjamin, Cummings Publishing Company, USA.
6. Principles of Genetics: Tamerin, Tata McGraw Hills, Delhi
7. Genetics: PK Gupta, Rastogi Publication, New Delhi.

GROUP B

1. Manning A. & Dawkins M.S. – An Introduction to Animal Behaviour. Cambridge 1995
 2. Prasad S. – Animal Behaviour. CBS 2004
 3. Mathur R. – Animal Behaviour. Rastogi 2002
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III. MAJOR COURSE- MJ 11: PRACTICALS-IV

Marks: Pr (ESE: 3Hrs) =100

Pass Marks: Pr (ESE) = 40

(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

3. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

4. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
5. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SEMESTER VI

I. MAJOR COURSE- MJ 12: DEVELOPMENTAL BIOLOGY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing the course, the students will be able to

1. Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.
2. Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms.
3. Realize that very similar mechanisms are used in very diverse organisms; and development is controlled through molecular changes resulting in variation in the expression and function of gene networks
4. Understand how the field of developmental biology has changed since the beginning of the 19th century with different phases of developmental research predominating at different times.
5. Understand the relevance of developmental biology in medicine or its role in development of diseases.

Course Content:

UNIT I: Basic concept of Development

(20 Lecture)

1. Basic concept of Development- Potency, Commitment, Specification, Induction, Competence.
2. Phase of Development: Embryogenesis, Organogenesis, Blastogenesis in sea urchin & chick.
3. Period of Development: Embryonic period, Post embryonic period.
4. History of Embryology: Baer's law, theory of preformation, theory of epigenesis, mosaic theory.
5. Pattern & axes formation in amphibian.
6. Differential gene expression: cytoplasmic determinants and asymmetric cell division.

UNIT II: Early Embryonic Development

(20 Lecture)

1. Gametes: sperm or male gametes: types of sperms, Eggs or Female gametes: types of eggs.
2. Gametogenesis: Spermatogenesis, Oogenesis.
3. Egg membranes.
4. Fertilization (External sea urchin and Internal Chick) & its mechanism.
5. Planes and patterns of cleavage.
6. Types of Blastula.
7. Fate Maps
8. Early development of frog and chick up to gastrulation.

UNIT III: Late Embryonic Development

(05 Lecture)

1. Extra embryonic membranes in birds.
2. Implantation of embryo in humans.
3. Placenta: Structure, types and functions of placenta.

UNIT IV: Post embryonic Development**(10 Lecture)**

1. Metamorphosis:
Types of Metamorphosis.
Metamorphosis in amphibians
Hormonal control of metamorphosis in amphibians
2. Regeneration: Types of Regeneration
3. Epimorphosis
4. Morphallaxis
5. Compensatory regeneration
6. Ageing: Concepts and Theories.

UNIT V: Implications of Developmental Biology**(05 Lecture)**

1. Teratogenesis: Teratogenic agents and their effect on embryonic development.
2. In vitro: fertilization (IVF)
3. Embryonic stem cells (Esc)
4. Amniocentesis.

Reference Books:

1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
 2. Balinsky B.I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press.
 3. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers.
 4. Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press
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II. MAJOR COURSE- MJ 13: EVOLUTION

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing the course, the students will be able to

1. Develop a holistic appreciation on the phylogeny and adaptations in animals.
2. Enable the students to understand the evolution of universe and life.
3. Understanding on the process and theories in evolutionary biology.
4. Examine the evolutionary history of the taxa based on developmental affinities.
5. Understand the process of evolution
6. Evolution of life forms in through geological time scale
7. To trace the phylogeny of species.

Course Content:

UNIT I: Introduction to Evolutionary Theories

(06 Lecture)

1. History of Evolution.
2. Historical review of evolutionary concept:
3. Lamarkism, Darwinism, Mordern synthetic theory

UNIT II: Evidence of Evolution

(10 Lecture)

1. Evidence of Evolution:
2. Geological time and scale
3. Fossil record (types of fossils, transitional forms,)
4. Adaptive Radiation, Homology and analogy
5. Evolution of horse.

UNIT III: Process of Evolutionary change

(06 Lecture)

1. Sources of Variations:
2. Heritable variations and their role in evolution.
3. Concept of co evolution, parallel evolution.

UNIT IV: Principles of Population genetics

(10 Lecture)

1. Population genetics.
2. Hardy – Weinberg law (statement and derivation of equation, application of law to human population)
3. Evolutionary forces upsetting H-W equilibrium
4. Natural selection
5. Genetic Drift

UNIT V: Species concept

(10 Lecture)

1. Product of Evolution:
2. Micro evolutionary changes (Inter population variations, clines, races)
3. Species concept
4. Isolating mechanism
5. Modes of speciation- allopatric, sympatric.

6. Macro evolution (Adaptive Radiation)

UNIT VI: Extinctions**(06 Lecture)**

1. Back ground and Mass extinctions (causes and effects)
2. Detailed example of K-T extinctions

UNIT VII: Origin and Evolution of Man**(06 Lecture)**

1. Unique hominin characteristics contrasted with primate characteristics.
2. Primate phylogeny from Dryopithecus leading to Homo sapiens.

UNIT VIII: Phylogenetic trees**(06 Lecture)**

1. Multiple sequence alignment
2. Construction of Phylogenetic trees.
3. Interpretation of phylogenetic trees.

Reference Books:

1. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
 2. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
 3. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
 4. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. Wiley- Blackwell.
 5. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
 6. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
 7. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
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III. MAJOR COURSE- MJ 14: ENDOCRINOLOGY & IMMUNOLOGY

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After successfully completing the course, the students will be able to

1. Understand neurohormones and neurosecretions.
2. Learn about hypothalamo and hypophysial axis.
3. Understand about different endocrine glands and their disorders.
4. Understand the mechanism of hormone action.
5. Carry out common procedures for culturing, purifying and diagnostics of micro-organisms understand the disease-causing potential of bacteria and viruses, and the responses of the immune system.
6. Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.
7. Assess the importance of incidence, prevalence and epidemiology in microbiological diagnostic activities.
8. Know how resistance development and resistance transfer occur.
9. Identify the major cellular and tissue components which comprise the innate and adaptive immune system.
10. Understand how are immune responses by T cells and B cells initiated and regulated.
11. Understand how does the immune system distinguish self from non-self.

Course Content:

Endocrinology

UNIT I: Introduction to Endocrinology (05 Lecture)

1. Definition and Classification of hormones.
2. Endocrine, paracrine and merocrine modes of hormone delivery
3. Feedback mechanisms

UNIT II: Epiphysis, Hypothalamo- hypophysial Axis. (20 Lecture)

1. Structure of the pineal gland, secretions and their function in biological rhythms and reproduction.
2. Structure of hypothalamus, hypothalamic nuclei and their functions, Regulation of neuroendocrine glands.
3. Structure of pituitary gland, hormones of pituitary gland and their functions.
4. Hypothalamo- hypophysial portal system.
5. Hypothalamic control of adenohypophysis

UNIT III: Structure and functions of endocrine glands in Mammals. (20 Lecture)

1. Structure, hormones, functions and regulation of endocrine glands:
2. Pituitary
3. Pineal
4. Thyroid
5. Parathyroid
6. Adrenal
7. pancreas
8. Testis

9. Ovary
10. Local endocrine gland

UNIT IV: Mechanism of Hormone Action (10 Lecture)

1. General mechanism of hormone action
2. Regulation of Hormone action: Hormone action at cellular level, Hormone receptors, Transduction and regulation of hormone action at molecular level, molecular mediators, genetic control of hormone action

UNIT V: Hormonal dysfunction and diseases (05 Lecture)

1. Dwarfism and acromegaly
2. Goiter
3. Addison's disease
4. Diabetes mellitus

Immunology**UNIT I: Overview of Immune System (08 Lecture)**

1. Introduction-Concept of Health & Disease.
2. Cells & Organs of the Immune System

UNIT II: Innate and Adaptive Immunity (08 Lecture)

1. Anatomical Barriers
2. Inflammation
3. Cells & Molecules involved in Innate Immunity
4. Adaptive Immunity (Cell mediated + humoral)

UNIT III: Antigens (08 Lecture)

1. Antigenicity & Immunogenicity
2. Immunogens, Adjuvants and Haptens
3. Factors affecting Immunogenicity
4. B and T cell Epitopes.

UNIT IV: Immunoglobulins. (08 Lecture)

1. Structure, Function of different types of Ig
2. Antigen – antibody Interactions
3. Immuno assays (ELISA and RIA)
4. MAB

UNIT V: Major Histocompatibility Complex (MHC) (08 Lecture)

1. Structure & function of MHC molecules.
2. Structure of T-cell receptor and its signaling.
3. T Cell development and selection

UNIT VI: Cytokines (05 Lecture)

Types, Properties and functions of Cytokines.

UNIT VII: Complement system (05 Lecture)

Components and pathways of complement activation.

UNIT VIII: Hypersensitivity**(05 Lecture)**

Gell and coombs classification and brief description of various types of hypersensitivity.

UNIT IX: Vaccines**(05 Lecture)**

1. Introduction to vaccine
2. Various types of vaccines.

Reference Books:

1. Kindit, T.J., Goldsby R.A., Osborne, B.A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
 2. David, M., Jonathan, B., David, R.B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
 3. Abbas, K. Abul and Lichtman H. Andrew (2003) Cellular and Molecular Immunology. V edition. Saunders Publication.
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IV. MAJOR COURSE- MJ 15: PRACTICALS-V

Marks: Pr (ESE: 3Hrs) =100	Pass Marks: Pr (ESE) = 40
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(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

1. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 - 2.
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SEMESTER VII

I. MAJOR COURSE- MJ 16: INSECTA, FISH & FISHERIES

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Learning outcomes

After completing this course, the students will be able to

1. Identify the types of insects.
2. Know the general physiology of insects.
3. Understand the importance of insects in environment.
4. Understand the interaction of insects with animal and plant kingdom.

Course Content:

Insecta

UNIT I: Introduction (04 Lecture)

1. General features of insects
2. Distribution and success of Insect on earth

UNIT II: Insect Taxonomy (08 Lecture)

1. Basics of insects classification: Classification of insects up to orders (Orthoptera, Coleoptera, Dictyoptera, Lepidoptera)

UNIT III: General Morphology of Insects (08 Lecture)

1. External features of a typical insect
2. Structure & Type of antennae
3. Structure & Types of Mouthparts w.r.t feeding habits Type of legs adapted to diverse habitat

UNIT IV: Physiology of Insects (10 Lecture)

1. Reproductive system
2. Endocrine system
3. Nervous system
4. Sensory receptors – vision and sound receptors

UNIT V: Insect Animal Interaction (10 Lecture)

1. Social economic insects (honey bees and termites) – Social organization & Social behaviour.
2. Insects as a vector – Mechanical and biological vectors
3. (Muscadomestica, Anopheles & Culex)

UNIT VI: Insect Plant Interaction (10 Lecture)

1. Role of allochemicals & pheromones in host plant mediation.
2. Host plant selection by phytophagous insects
3. Insect as plant pests & concept integrated pest management

4. (IPM)

UNIT VII: Developmental Biology of Insects (10 Lecture)

1. Developmental biology of Insects – oogenesis &
2. spermatogenesis. Structure of egg and sperm
3. Fertilization, Growth, types of Metamorphosis and its hormonal regulation

Reference Books:

1. A general textbook of entomology. Imms. A. D. Chapman & Hall, UK
 2. The insects: Structure and functions. Chapman. R.F. Cambridge University Press, UK
 3. Principles of insect morphology. Snodgrass. R.F. Cornell University Press, USA.
 4. Introduction to the study of insects. Norro. D.J. Triplehorn. C.A. and Johanson. N.F. Saunders. College Publication, USA.
 5. Developmental Biology. Gilbert. Sinauer Associates, Inc., Publishers. Sunderland, Massachusetts U.S.A.
 6. The insect Societies. Wilson. Howard University Press. UK
 7. Host selection by Phytophagous insects. Bernays and Chapman. Chapman and Hall. NY, USA.
 8. Advances in Insect Physiology. Russell Jurenka. Academic Press, London, UK
 9. Insect Physiology and Biochemistry. James L. Nation. CRC Press, London, UK
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Learning outcomes

After successfully completing this course, the students will be able to:

1. Understand and apply relevant scientific principles in the area of aquatic biology
2. Understand the basic taxonomy and physiology of fishes
3. Critically analyse, interpret and evaluate information relevant to aquatic biology
4. Appreciate the multidisciplinary nature of the study of aquatic biology and engage positively with people and ideas beyond their own discipline.
5. Explore some of the unique environmental problems dealing with aquatic environments.
6. Develop employable skills in freshwater biological water quality analysis.

Course Content:**GROUP A: Fish****UNIT I: Taxonomy of Fin Fish (08 Lecture)**

1. Major taxa of inland and Marine fishes upto order.
2. Commercially important fresh water and marine fishes of India and their morphological characteristics.

UNIT II: Biology of Fin fish (10 Lecture)

1. A brief idea of Circulatory, respiratory, Nervous, Urinogenital system, endocrine system, skeletal system and sensory system of fin fishes.

UNIT III: Physiology of Fin fish (10 Lecture)

1. Effects of environmental factors on physiology of Fin fish.
2. Study of Osmoregulation, excretion and stress related changes, bioluminescence, electric organs
3. ARO (accessory respiratory organs)
4. Lateral line organ system

UNIT IV: Fish pathology and Health management (04 Lecture)

1. A brief idea of Fish parasites, diseases, and their treatment

GROUP B: Fisheries**UNIT I: Inland Fisheries (04 Lecture)**

1. Hill stream fishes
2. Cold water fisheries of India.
3. Fishing crafts and gears.

UNIT II: Marine fishery (04 Lecture)

1. Marine fishery resources in india
2. Estuarine fishes.

UNIT III:I: Aquaculture (10 Lecture)

1. Principles of Aquaculture: Definition and scope
2. Systems of Aquaculture – Pond culture, Pen culture, Cage culture, Biofloc culture
3. Extensive and intensive fish culture
4. Monoculture, Polyculture and integrated culture system, Composite fish culture system of India.

UNIT IV: Fish technology and research (10 Lecture)

1. Preservation and processing of harvested fish, fishery by-products, transgenic fish, Zebra fish as a model of research.
2. Introductory Ornamental fish culture and aquarium maintenance.

Reference Books:

1. An Introduction to the Study of Fishes – Albert C.L.G. Gunther, Discovery Publishing House, New Delhi – 110 002
 2. Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
 3. D.H. Evans and J.d. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK
von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
 4. C.B.L. Srivastava, Fish Biology, Narendra Publishing House
 5. J.R. Norman, A history of Fishes, Hill and Wang Publishers
 6. S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House
 7. Modern Ichthyology, S.M. Shafi, Inter India Publications
 8. Feeding and Digestive Functions of Fishes, J.E.P. Cyrino, D.P. Bureau, B.G. Kapoor, CRC Press, Taylor & Francis Group, Boca Raton, London, New York
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II. MAJOR COURSE- MJ 17: AAAAAAAAAA

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Course Objectives:

On completion of this course, the students will be able to understand understand

1. Atomic theory and its evolution.
2. Learning scientific theory of atoms, concept of wave function.
- 3.

Course Learning Outcomes:

On successful completion of this course the student should know:

1. Electronic configuration of various elements in periodic table
2. Predicting structure of molecules
- 3.

Course Content:

Atomic Structure: (10 classes each of 60 minutes duration)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation,

Reference Books:

1. Lee, J. D. *Concise Inorganic Zoology*, Wiley, 5th Edⁿ.
 2. Douglas, B.E., McDaniel, D.H., Alexander J.J., *Concepts & Models of Inorganic Zoology*, (Third
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III. MAJOR COURSE- MJ 18: AAAAAAAAAA

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Course Objectives:

pletion of this course, the students will be able to understand understand

4. Atomic theory and its evolution.
5. Learning scientific theory of atoms, concept of wave function.
- 6.

Course Learning Outcomes:

On successful completion of this course the student should know:

4. Electronic configuration of various elements in periodic table
5. Predicting structure of molecules
- 6.

Course Content:

Atomic Structure: (10 classes each of 60 minutes duration)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation,

Reference Books:

3. Lee, J. D. *Concise Inorganic Zoology*, Wiley, 5th Edⁿ.
 4. Douglas, B.E., McDaniel, D.H., Alexander J.J., *Concepts & Models of Inorganic Zoology*, (Third
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IV. MAJOR COURSE- MJ 19: PRACTICALS-VI

Marks: Pr (ESE: 3Hrs) =100	Pass Marks: Pr (ESE) = 40
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(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

2. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

3. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SEMESTER VIII

I. MAJOR COURSE- MJ 20: AAAAAAAAAA

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Course Objectives:

On completion of this course, the students will be able to understand

7. Atomic theory and its evolution.
8. Learning scientific theory of atoms, concept of wave function.
- 9.

Course Learning Outcomes:

On successful completion of this course the student should know:

7. Electronic configuration of various elements in periodic table
8. Predicting structure of molecules
- 9.

Course Content:

Atomic Structure: (10 classes each of 60 minutes duration)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation,

Reference Books:

5. Lee, J. D. *Concise Inorganic Zoology*, Wiley, 5th Edⁿ.
 6. Douglas, B.E., McDaniel, D.H., Alexander J.J., *Concepts & Models of Inorganic Zoology*, (Third
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**II. ADVANCE MAJOR COURSE- AMJ 1:
AAAAAAAAAA****Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100****Pass Marks: Th (SIE + ESE) = 40****(Credits: Theory-04) 60 Hours****Course Objectives:****Course Objectives:**

On completion of this course, the students will be able to understand

10. Atomic theory and its evolution.
11. Learning scientific theory of atoms, concept of wave function.
- 12.

Course Learning Outcomes:

On successful completion of this course the student should know:

10. Electronic configuration of various elements in periodic table
11. Predicting structure of molecules
- 12.

Course Content:**Atomic Structure: (10 classes each of 60 minutes duration)**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation,

Reference Books:

7. Lee, J. D. *Concise Inorganic Zoology*, Wiley, 5th Edⁿ.
 8. Douglas, B.E., McDaniel, D.H., Alexander J.J., *Concepts & Models of Inorganic Zoology*, (Third
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III. ADVANCE MAJOR COURSE- AMJ 2: AAAAAAAAAA

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (SIE + ESE) = 40

(Credits: Theory-04) **60 Hours**

Course Objectives:

On completion of this course, the students will be able to understand understand

1. Atomic theory and its evolution.
2. Learning scientific theory of atoms, concept of wave function.
- 3.

Course Learning Outcomes:

On successful completion of this course the student should know:

1. Electronic configuration of various elements in periodic table
2. Predicting structure of molecules
- 3.

Course Content:

Atomic Structure: (10 classes each of 60 minutes duration)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation,

Reference Books:

1. Lee, J. D. *Concise Inorganic Zoology*, Wiley, 5th Edⁿ.
 2. Douglas, B.E., McDaniel, D.H., Alexander J.J., *Concepts & Models of Inorganic Zoology*, (Third
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IV. ADVANCED MAJOR COURSE- AMJ 3: PRACTICALS-I

Marks: Pr (ESE: 3Hrs) =100

Pass Marks: Pr (ESE) = 40

(Credits: Practicals-04) **120 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 60 marks

Practical record notebook = 15 marks

Viva-voce = 25 marks

Practicals:

1. Purification of organic compounds by crystallization using the following solvents:
a. Water b. Alcohol c. Alcohol-Water

Reference Books

5. Mann, F.G. & Saunders, B.C. *Practical Organic Zoology*, Pearson Education (2009)
 6. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Zoology, 5th Ed.*, Pearson (2012)
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SKILL ENHANCEMENT COURSES FOR “ZOOLOGY” HONOURS

SKILL ENHANCEMENT COURSE-1

(SEM-I)

**I. SKILL ENHANCEMENT COURSE- SEC 1:
WILDLIFE CONSERVATION AND MANAGEMENT**

Marks: 75 (ESE: 3Hrs) = 75

Pass Marks: Th (ESE) = 30

(Credits: Theory-03) 45 Hours

About the course

1. The course is an introduction to wildlife management and gives an account of the tools used by wildlife managers.
2. Topics covered are to equip students with adequate knowledge of various biodiversity monitoring methodologies, conservation and management issues of vertebrate pests, wildlife conflict and over abundant species, wildlife health and diseases.

Learning outcomes

After successfully completing this course, the students will be able to:

1. Develop an understanding of how animals interact with each other and their natural environment
2. Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues
3. Develop the ability to work collaboratively on team-based projects
4. Demonstrate proficiency in the writing, speaking, and critical thinking skills needed to become a wildlife technician
5. Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management
6. Develop an ability to analyze, present and interpret wildlife conservation management information.

Course Content:**UNIT I: Value of wildlife and need for its conservation****(20 Lecture)**

Definition, value and importance of wildlife; Types of ecosystems. Causes of depletion of wildlife; Inventory and classification of wetland and animal inhabitants; Population vulnerability analysis and its components; Factors responsible for the extinction of animals; Types of protected areas and the concept of zoning within the protected areas; Wildlife Sanctuaries and National Parks in India: general strategies and issues; Theories of population dispersal; Animal movement, concept of home range and territory; Tracking movement by remote sensing and GIS.

UNIT II: Population and prey-predator dynamics**(20 Lecture)**

Wildlife conservation, ethics and importance of conservation; Impact of topography, geology, soil and water on wildlife; Impact of habitat destruction and fragmentation on wildlife; Biological parameters such as food, cover, forage and their impact on wild life; Population attributes; concepts of exponential and logistic growth rates of wildlife; Density dependent and independent population regulation; Impact of introduced species on preexisting flora and fauna of wildlife; Identification and estimation of wild animals by fecal sample analysis, hair identification, pug marks and census methods. Predator-prey models and impact of predation.

UNIT III: Wildlife Conservation**(20 Lecture)**

Wildlife conservation objectives- strategies and issues; Captive breeding techniques and translocation and reintroduction; Inviolable area and critical habitats and their impact on wildlife; Different terrestrial habitats of wildlife in India; Restoration of degraded habitat; Damage caused by wildlife in India and its mitigation; Sick animal refuges in protected areas.

UNIT IV: Rehabilitation and management**(20 Lecture)**

Type of wildlife management-manipulative, custodial; Management of over abundant wild animal populations causing damages to nearby inhabitants and their crops and animals; Tools and techniques to control the menace of wild animals; man wildlife conflict resolution and mitigation; Management of exotic and invasive wetland species in India. Habitat manipulation □ control and regulation of grazing. Weed eradication; Major diseases of domestic and wild animals and their control and impact of wild life tourism.

PRACTICALS:

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna.
 2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses).
 3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
 4. Demonstration of different field techniques for flora and fauna.
 5. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences). Group discussion or Seminar presentation on one or two related topics from the list
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SKILL ENHANCEMENT COURSE-2

(SEM-II)
**II. SKILL ENHANCEMENT COURSE- SEC 2:
SERICULTURE & APICULTURE**

Marks: 75 (ESE: 3Hrs) = 75

Pass Marks: Th (ESE) = 30

(Credits: Theory-03) **45 Hours****Course Objectives:****Course Contents:****SERICULTURE****Unit1: Introduction****(3 Lectures)**

Sericulture: Definition, history and present status; Silk route. Types of silk worms, Distribution and Races. Exotic and indigenous races. Mulberry and non-mulberry Sericulture

Unit2: Biology of Silk worm**(3 Lectures)**

Life cycle of Bombyxmori
Structure of silk gland and secretion of silk

Unit3: Rearing of Silk worms**(13 Lectures)**

Selection of mulberry variety and establishment of mulberry garden. Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO. Silk worm rearing technology: Early age and Late age rearing. Types of mountages Spinning, harvesting and storage of cocoons

Unit4: Pests and Diseases**(4 Lectures)**

Pests of silk worm: Uzifly, dermestid beetles and vertebrates Pathogenesis of silk worm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases

Unit5: Entrepreneurship in Sericulture**(2 Lectures)**

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various Sericulture centres.

Suggested Readings:

- Handbook of Practical Sericulture: S.R. Ullaland M.N. Narasimhanna CSB, Bangalore
 - Appropriate Sericultural Techniques; Ed. M.S. Jolly, Director, CSR & TI, Mysore.
 - Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub.Co. Ltd., Tokyo, Japan 1972.
 - Manual of Silkworm Egg Production; M.N. Narasimhanna, CSB, Bangalore 1988.
 - Silkworm Rearing; Wupang —Chunand Chen Da-Chung, Pub. By FAO, Rome 1988.
 - A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
 - Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.
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APICULTURE**Unit1: Biology of Bees**

History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit2: Rearing of Bees

Artificial Bee rearing (Apiary), Beehives–Newton and Langstroth
Bee Pasturage
Selection of Bee Species for Apiculture
Bee Keeping Equipment
Methods of Extraction of Honey (Indigenous and Modern)

Unit3: Diseases and Enemies Bee Diseases and Enemies, Control and Preventive measures

Unit4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit5: Entrepreneurship in Apiculture

Bee Keeping Industry– Recent Efforts, Modern Methods in employing artificial
Beehives for cross pollination in horticultural gardens

Suggested Readings:

- Prost, P.J.(1962). *Apiculture*. Oxford and IBH, New Delhi.
 - Bisht D.S., *Apiculture*, ICAR Publication.
 - Singh S., *Bee keeping in India*, Indian council of Agricultural Research, New Delhi.
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SKILL ENHANCEMENT COURSE-3

(SEM-III)
**III. SKILL ENHANCEMENT COURSE- SEC 3:
ELEMENTARY COMPUTER APPLICATION SOFTWARES**

Marks: 75 (ESE: 3Hrs) = 75

Pass Marks: Th (ESE) = 30

A Common Syllabus Prescribed by Ranchi University

(Credits: Theory-03) **45 Hours***Instruction to Question Setter for**End Semester Examination (ESE):*

*There will be **objective type test** consisting of **Seventy-five questions of 1 mark each**. Students are required to mark their answer on **OMR Sheet** provided by the University.*

Course Objectives:

The objective of the course is to generate qualified manpower in the area of Information Technology (IT) and Graphic designing which will enable such person to work seamlessly at any Offices, whether Govt. or Private or for future entrepreneurs in the field of IT.

A. INTRODUCTION TO COMPUTER SYSTEM**1. Basic Concept of Computer**

What is Computer, Applications of Computer, Types of computer, Components of Computer System, Central Processing Unit (CPU) **(3 Lecture)**

2. Concepts of Hardware

Input Devices, Output Devices, Computer Memory, Types of Memory, processing Concept of Computer **(4 Lecture)**

3. Operating system

What is an Operating System, Operating System Examples, Functions of Operating System(Basic), Introduction to Windows 11, Working on Windows 11 environment, Installation of Application Software, My Computer, Control Panel, searching techniques in windows environment, Basic of setting **(6 Hours)**

4. Concept of Software

What is Software, Types of Software, Computer Software- Relationship between Hardware and Software, System Software, Application Software, some high level languages **(4 Hours)**

5. Internet & its uses

Basic of Computer networks; LAN, WAN, MAN, Concept of Internet, Applications of Internet; connecting to internet, what is ISP, World Wide Web, Web Browsing software's, Search Engines, URL, Domain name, IP Address, using e-governance website, Basics of electronic mail, getting an email account, Sending and receiving emails. **(6 Hours)**

B. MICROSOFT OFFICE 2016 AND LATEST VERSIONS**6. Microsoft Word**

Word processing concepts, Creation of Documents, Formatting of Documents, Formatting of Text, Different tabs of word 2016 environment, Formatting Page, Navigation of Page, Table handling, Header and footer, Page Numbering, Page Setup, Find and Replace, Printing the documents

(7 Hours)

7. Microsoft Excel (Spreadsheet)

Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, Formatting worksheet, Excel Formula, Concept of charts and Applications, Pivot table, goal seek, Data filter, data sorting and scenario manager, printing the spreadsheet

(6 Hours)

8. Microsoft Power Point (Presentation Package)

Concept and Uses of presentation package, Creating, Opening and Saving Presentations, working in different views in Power point, Animation, slide show, Master Slides, Creating photo album, Rehearse timing and record narration

(5 Hours)

9. Digital Education

What is digital education, Advantages of digital Education, Concept of e-learning, Technologies used in e learning

(4 Hours)

Reference Books

1. Nishit Mathur, Fundamentals of Computer, APH publishing corporation (2010)
 2. Neeraj Singh, Computer Fundamentals (Basic Computer), T Balaji, (2021)
 3. Joan Preppernau, Microsoft Power Point 2016 step by step, Microsoft press (2015)
 4. Douglas E Corner, The Internet Book 4th Edition, prentice –Hall (2009)
 5. Steven Welkler, Office 2016 for beginners, Create Space Independent Publishing Platform (2016)
 6. Wallace Wang, Microsoft Office 2019, Wiley (January 2018)
 7. Noble Powell, Windows 11 User Guide For Beginners and Seniors, ASIN, (October 2021)
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COURSES OF STUDY FOR FYUGP IN “ZOOLOGY” MINOR

MINOR COURSE-1A**(SEM-I)**
-----**I. MINOR COURSE- MN 1A:
INTRODUCTORY ZOOLOGY****Marks: 15 (5 Attd. + 10 SIE: 1Hr) + 60 (ESE: 3Hrs) = 75****Pass Marks: Th (SIE + ESE) = 30****(Credits: Theory-03) 45 Hours****Course Learning Outcomes:**

1. A general concept of the animal world
2. Awareness of students regarding biological mechanism of various processes, functions as well evolutionary significance could be learnt
3. Students will acquire knowledge about the cell in detail along with the different organelles
4. Will understand their own body processes
5. Will get an idea about origin of life and evolution.

Course Content:**UNIT I:** General Introduction to Animal World, Need of Classification, General idea of Classification and Taxonomy, Cell theory.**UNIT II:** Cell- Structure, Cell theory. Difference between Prokaryotic and Eukaryotic cells
An overview of various cell organelles, including detailed structure of Mitochondria, Golgi body, Endoplasmic Reticulum, Nucleus, Ribosome, and their significant feature. (Any three)**UNIT III:** A general introduction to human physiology.**UNIT IV:** Basic structure of DNA and RNA,**UNIT V:** Mendel's law of Inheritance and variation.**UNIT VI:** Evolution: Lamarck's Inheritance theory, Darwin's natural selection theory mutation theory.**UNIT VII:** General concept of Ecology, Ecosystem and its various components.

II. MINOR COURSE- MN 1A PR: MINOR PRACTICALS-1A PR

Marks: Pr (ESE: 3Hrs) = 25

Pass Marks: Pr (ESE) = 10

(Credits: Practicals-01) **30 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 15 marks

Practical record notebook = 05 marks

Viva-voce = 05 marks

Practicals:

1. Study of Permanent slides.
2. Amoeba, Paramecium, Sycon, Ascaris, Starfish, wall lizard, frog, Columba Bat, Kidney (T.S Mammal) liver, Pancreas, Ovary, Testis.
3. Homologous and Analogous organs.
4. Project on Food chain

Suggested Books.

1. Animal Diversity (Biology of Invertebrates) -Pechnik
 2. Cell Biology: De Robersies
 3. Cell Biology: Ambrose
 4. Cell Biology: C.B. Powar
 5. Physiology: Gyton
 6. Evolution: V.B. Rastogi
 7. Ecology: M.C. Dash, P.D. Sharma
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MINOR COURSE-1B

(SEM-III)
**III. MINOR COURSE- MN 1B:
ANIMAL DIVERSITY**

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40
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(Credits: Theory-03) **45 Hours****Course Learning Outcomes:**

1. Develop understanding on the diversity of life with regard to protista, non-chordates and chordates
2. Grouping of animals on the basis of their morphological characters.
3. will be able to examine evolutionary history of a taxon

Course Content:**UNIT I: Kingdom Protista****(03 Lecture)**

General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

UNIT II: Phylum Porifera**(03 Lecture)**

General characters and classification up to classes; Canal System in Sycon 3

UNIT III: Phylum Cnidaria**(03 Lecture)**

General characters and classification up to classes; Polymorphism in Hydrozoa

UNIT IV: Phylum Platyhelminthes**(03 Lecture)**

General characters and classification up to classes; Life history of Taeniasolium

UNIT V: Phylum Nematelminthes**(03 Lecture)**

General characters and classification up to classes; Life history of Ascarislumbricoides and its parasitic adaptations

UNIT VI: Phylum Annelida**(03 Lecture)**

General characters and classification up to classes; Metamerism in Annelida

UNIT VII: Phylum Arthropoda**(03 Lecture)**

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

UNIT VIII: Phylum Mollusca**(02 Lecture)**

General characters and classification up to classes; Torsion in gastropods

UNIT IX: Phylum Echinodermata**(03 Lecture)**

General characters and classification up to classes; Water-vascular system in Asteroidea

UNIT X: Protochordates**(04 Lecture)**

General features and Phylogeny of Protochordata

UNIT XI: Agnatha**(04 Lecture)**

General features of Agnatha and classification of cyclostomes up to classes

UNIT XII: Pisces (04 Lecture)

General features and Classification up to orders; Osmoregulation in Fishes

UNIT XIII: Amphibia (04 Lecture)

General features and Classification up to orders; Parental care

UNIT XIV: Reptiles (04 Lecture)

General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

UNIT XV: Aves (05 Lecture)

General features and Classification up to orders; Flight adaptations in birds

UNIT XVI: Mammals (05 Lecture)

Classification up to orders; Origin of mammals

Reference Books:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The
 2. Invertebrates: A New Synthesis, III Edition, Blackwell Science
 3. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
 4. Pough H. Vertebrate life, VIII Edition, Pearson International.
 5. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
 6. Pechnek, J.A.2000. Biology of Invertebrates. Tata McGraw-Hill Publishing Company, New
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IV. MINOR COURSE- MN 1B PR: MINOR PRACTICALS-1B PR

Marks: Pr (ESE: 3Hrs) = 25

Pass Marks: Pr (ESE) = 10

(Credits: Practicals-01) **30 Hours**

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 15 marks

Practical record notebook = 05 marks

Viva-voce = 05 marks

Practicals:

Study of the following specimens:

1. Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taeniasolium, Male and female Ascarislumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis.
2. Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

Study of the following permanent slides:

1. T.S. and L.S. of Sycon
 2. Study of life history stages of Taenia
 3. T.S. of Male and female Ascaris
 4. Key for Identification of poisonous and non-poisonous snakes
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MINOR COURSE-1C

(SEM-V)
**V. MINOR COURSE- MN 1C:
FOOD NUTRITION AND HEALTH**

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40
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(Credits: Theory-03) **45 Hours****Course Learning Outcomes:**

1. Will understand the role of food and nutrition in health and diseases
2. Implement strategies for food access, procurement, preparation and Strategy.

Course Content:**UNIT I: Nutrition and dietary nutrients****(10 Lecture)**

Basic concept of Food: Components and nutrients. Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people.

UNIT II: Macro nutrients and micronutrients**(10 Lecture)**

Nutritional Biochemistry: Macronutrients. Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Micronutrients. Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals viz., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.

UNIT III: Malnutrition and nutrient deficiency diseases**(20 Lecture)**

Definition and concept of health: Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention and government initiatives, if any. Life style dependent diseases- hypertension, diabetes mellitus, and obesity-their causes and prevention. Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention. Other ailments viz., cold, cough, and fever, their causes and treatment.

UNIT IV: Diseases caused by microorganisms**(20 Lecture)**

Food hygiene: Potable water- sources and methods of purification at domestic level. Food and Water-borne infections: Bacterial diseases: cholera, dysentery; typhoid fever, viral diseases: Hepatitis, Poliomyelitis etc., Protozoan diseases: amoebiasis, giardiasis; Parasitic diseases: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. Causes of food spoilage and its prevention.

Reference Books:

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed.; New Age International Publishers
2. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
3. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
4. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
5. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH

Publishing Co. Pvt Ltd.

6. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.
 7. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.
 8. Manay, M.S. and Shadakshara swamy, M. (1998). Food-Facts and Principles; New Age International (P) Ltd.
 9. Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing.
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**VI. MINOR COURSE- MN 1C PR:
MINOR PRACTICALS-1C PR****Marks: Pr (ESE: 3Hrs) = 25****Pass Marks: Pr (ESE) = 10****(Credits: Practicals-01) 30 Hours*****Instruction to Question Setter for******End Semester Examination (ESE):***

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 15 marks

Practical record notebook = 05 marks

Viva-voce = 05 marks

Practicals:

1. Detecting adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric.
2. Estimation of Lactose in milk.
3. Study of the stored grain pests from slides/ photograph (Sitophilusoryzae, Trogoderma granarium, Callosobruchuschinensis and Triboliumcastaneum): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
4. Project- Computer aided diet analysis and nutrition counselling for different age groups.

Reference Books:

- Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
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MINOR COURSE-1D

(SEM-VII)
**VII. MINOR COURSE- MN 1D:
ENVIRONMENT & PUBLIC HEALTH**

Marks: 25 (5 Attd. + 20 SIE: 1Hr) + 75 (ESE: 3Hrs) = 100	Pass Marks: Th (SIE + ESE) = 40
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(Credits: Theory-03) **45 Hours****Course Learning Outcomes:**

After successfully completing this course, the students will be able to:

1. Understand the fundamental issues of environment.
2. Analyze different sources of environmental problems and methods of measurement of pollution.
3. Examine economic growth and quality of life.
4. Examine the microbiology of waste water treatment and its various schemes.
5. Summarise and orally present current microbiological problem areas.
6. Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.
7. Know how resistance development and resistance transfer occur.
8. Understand how does the immune system distinguish self from non-self.

Course Content:**UNIT I: Introduction****(10 Lecture)**

Sources of Environmental hazards, hazards identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

UNIT II: Climate Change**(10 Lecture)**

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

UNIT III: Pollution**(10 Lecture)**

Air, Water, Noise pollution sources and effects, Pollution control

UNIT IV: Waste Management Technologies**(15 Lecture)**

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and three-mile island accident and their aftermath.

UNIT V: Diseases**(15 Lecture)**

Causes, Symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

VIII. Reference Books:

1. Cutter, S.L., Environmental Risk and Hazards, Prentice- Hall of India Pvt. Ltd. New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
3. Kofi Asante Duah "Risk Assessment in Environmental Management", Jhon Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V.N. Univ.

Press, New York, 2003.

5. Joshep F Louvar and B Diane Louver Health and Environmental Risk Ansalysis fundamentals with applications, Prentice Hall, New Jersey 1997.
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**IX. MINOR COURSE- MN 1D PR:
MINOR PRACTICALS-1D PR****Marks: Pr (ESE: 3Hrs) = 25****Pass Marks: Pr (ESE) = 10****(Credits: Practicals-01) 30 Hours*****Instruction to Question Setter for******End Semester Examination (ESE):***

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment = 15 marks

Practical record notebook = 05 marks

Viva-voce = 05 marks

Practicals:

1. To determine pH, Cl, SO₄, NO₃ in soil and water samples from different locations

Reference Books:
