



**MAHATMA GANDHI UNIVERSITY
PRIYADARSHINI HILLS, KOTTAYAM 686 560**

**RESTRUCTURED CURRICULUM
AND SYLLABI IN
CHOICE BASED COURSE,
CREDIT AND SEMESTER SYSTEM
(CBCSS)**

BSc ZOOLOGY PROGRAMME

INTRODUCED FROM 2009 ADMISSION ONWARDS

(Modified syllabus for 2012 admission onwards)

BOARD OF STUDIES IN ZOOLOGY (UG)

Mahatma Gandhi University P D Hills Kottayam .Kerala.

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Report of the Board of Studies

B.Sc. ZOOLOGY PROGRAMME

Programme Objectives

The B.Sc. Zoology programme is designed to help the students to:

1. Impart basic knowledge of various branches of Zoology and General biology meant both for a graduate terminal course and for higher studies.
2. Inculcate interest in and love of nature with its myriad living creatures.
3. Understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance
4. Acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation
5. Acquire basic knowledge and skills in certain applied branches to enable them for self employment
6. Impart awareness of the conservation of the biosphere.

Programme Outcomes

The graduate of this programme should be able to

1. Identify and list out common animals
2. Explain various physiological changes in our bodies
3. Analyze the impact of environment on our bodies
4. Understand various genetic abnormalities
5. Develop respect for nature
6. Explain the role and impact of different environmental conservation programmes
7. Identify animals beneficial to humans
8. Identify various potential risk factors to health of humans
9. Explain the importance of genetic engineering
10. Use tools of information technology for all activities related to zoology

Comments

1. These outcomes do not naturally get translated into specific courses
2. Designing courses to meet these outcomes is very difficult task and would constitute significant deviation from the current text book based approaches.

Course structure:

The U.G.programme in Zoology must include (a) **Common Courses**, (b) **Core Courses**, (c) **Complementary Courses**, (d) **Open Courses** and (e) **Project**. No course shall carry more than 4 credits. The student shall select any **Choice Based Course** offered by the Department which **offers the core courses**, depending on the availability of teachers and infrastructure facilities, in the institution. **Open course** shall be offered in any subject and the **student shall have the option to do courses offered by other Departments**.

Course coding:

Every course in the programme is coded according to the following criteria.

1. The first letter plus second letter /another letter from the programme ie., **ZY**
2. One digit to indicate the semester. ie., **ZY1 (Zoology, 1st semester)**
3. One letter from the type of courses such as, **A** for common course, **B** for core course, **C** for Complementary course, **D** for Open course. ie., **ZY1B (Zoology, 1st semester Core course)**
4. Two digits to indicate the course number of that semester. ie., **ZY1BO1 (Zoology, 1st semester, Core course, course number is 01)**
5. The letter **U** to indicate for Under Graduate Programme.
6. One letter **V** for the Vocational course
7. ie., **ZY1BO1U (Zoology, 1st semester, Core course, courses number 01, U for UG Programme)**
8. **The letter (P) denotes practical**

ZOOLOGY CODES

Code

ZY	Zoology
ZYB	Zoology Core Course Zoology Core, Choice Based (ZY6B13U/ZY6B14U/ZY6B15U)
ZYB (P)	Zoology Core Practical
ZYD	Zoology Open Course (ZY5D01U/ZY5D02U/ZY5D03U)
ZYC	Zoology Complementary Zoology (ZY1C01U/ZY2C02U/ZY3C03U/ZY4C04U)
ZYC (P)	Zoology Complementary Zoology Practical 'Model I' (ZY1C01U [P]/ZY2C02U [P]/ZY3C03U [P]/ZY4C04U [P])
ZAV	Zoology Vocational Aquaculture
ZMV	Zoology Vocational Medical Microbiology
ZFV	Zoology Vocational Food Microbiology
ZBV	UGC Sponsored Vocational – Biological Techniques and Specimen preparation.
ZY6BPVU	Zoology 6 th semester core project viva undergraduate.
ZYCV	Zoology Complementary Zoology for Vocational (Model II) (ZY1CV01U/ZY2CV02U/ZY3CV03U/ZY4CV04U)

INVESTIGATORY PROJECT, FIELD STUDY/ (STUDY TOUR) AND GROUP ACTIVITY

A. Study tour/ field study, visit to research institute and various places of zoological Importance

Field study/study tours should be conducted for not less than 6 days (completed during the entire programme), preferably spreading the study in the first to sixth semesters. Students are expected to visit research institutes and various places of zoological importance.

B. Group Activity

Students are expected to do one group activity in the fifth semester and submit the report in the sixth semester for external practical examination, along with study tour report

A maximum of ten students can choose any one group activity like aquarium management, vermicomposting, bee keeping, and conduct of zoological exhibitions, designing of posters of zoological importance, surveys related to disease outbreaks, community health programmes or any matter of zoological interest.

C. Project Work

Each student is expected to complete 1 investigatory project in the sixth semester and report shall be submitted for the external practical examination. Project presentation and Viva- Voce will be conducted by the external examiners along with the 6th semester practical examinations. The projects are to be identified during the second semester of the programme with the help of the supervising teacher, and the work can be started latest by the beginning of the 3rd semester. The student has to maintain a log book showing the progress of the project work, duly signed by the supervising teacher, and may be shown to the external examiners on demand.

For A, B and C- total 36 hours and total 1 credit (18 hours in 5th semester and 18 hours in 6th semester).

Zero Credit Courses:

Zero Credit courses shall be included in the programme to encourage advanced learners and shall be indicated in the score sheet. Permission for obtaining Zero credit courses shall be in accordance with the rules and regulations of the University. The Zero Credit courses shall be done only under the supervision of a university approved permanent faculty member of the department which offers the core courses.

Examinations:

The evaluation of each course shall contain two parts such as Internal or In-Semester Assessment (IA) and External or End-Semester Assessment (EA). The ratio between internal and external examinations shall be 1:3. The Internal and External examinations shall be evaluated using Direct Grading system based on 5-point scale as given below.

Letter Grade	Performance	Grade point (G)	Grade Range
A	Excellent	4	3.5 to 4.00
B	Very Good	3	2.5 to 3.49
C	Good	2	1.5 to 2.49
D	Average	1	0.5 to 1.49
E	Poor	0	0.00 to 0.49

PROGRAMME CLASSIFICATION. The grade cards shall indicate the percentage equivalent to corresponding points of CGPA with a 7 point scale secured by the student as follows.

CGPA	Grade	Percentage
3.80 to 4.00	A+	95.00--100
3.50 to 3.79	A	87.50<94.99
3.00 to 3.49	B+	75.00<87.49
2.50 to 2.99	B	62.50<74.99
2.00 to 2.49	C+	50.00<62.49
1.50 to 1.99	C	37.50<49.99
1.00 to 1.49	D	25<37.49

A separate minimum of D grade for internal and external are required for a pass for a course. For a pass in a programme a separate minimum of Grade D is required for all the courses and (must score a minimum of CGPA 1.5 to 1.99) an overall grade of C and above.

Internal or In-Semester Assessment (IA):

Internal evaluation is to be done by continuous assessments on the following components. The Components of the internal evaluation for theory and practical and their weights are as below.

Theory

Component	Weight
Attendance*	1
Assignment	1
Seminar	1
Best two test papers	2
Total	5

***Attendance**

% of Attendance	Grade
Above 90%	A
Between 85 and 90	B
Between 80 and 85	C
Between 75 and 80	D
Below 75	E

Assignments: Best of two assignments are considered per course. The student has to take a minimum of 1 seminar per course. A minimum of 2 class tests are to be attended. The grades of best 2 tests are to be taken.

Practical

Component	Weight
Attendance *	1
Laboratory Involvement **	2
Test	2
Record	2
Viva-Voce/Quiz	1
Total	8

Attendance & Laboratory Involvement *

<u>Attendance *</u>	<u>Laboratory Involvement **</u>
Attendance above 90%= A	Punctuality +
89% to 85% = B	Handling Equipments +
84% to 80% = C	Skill in Laboratory work +
79% to 75% = D	Group Interaction = A
Below 75 =E	

The evaluation of all components is to be published and is to be acknowledged by the candidate. All documents of internal assessments are to be kept in the institution for 2 years and shall be made available for verification by the university. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the course.

External or End-Semester Assessment (EA):

The external examination of all semesters shall be conducted by the university on the close of each semester. There will be no supplementary exams. For reappearance/ improvement as per university rules, students can appear along with the next batch.

Examinations (Practical):

The practical examinations for the odd semesters are conducted internally by the question papers and schedule from the university. For even semesters external practical examinations are conducted by the university with a common time-table and questions set by the university. One examiner shall be external and the other internal, both selected from a panel of examiners published by the university. The duration of practical examinations of Core & Complementary of model 1, 2, & 3 Zoology are of 3 hours,

The graded score sheet of practical & theory internals duly certified by the head of the institution, should be sent to the university before the commencement of the end semester university examinations on theory courses.

Pattern of Questions (Theory):

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical

evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

A question paper shall be a judicious mix of objective type, short answer type, short essay type /problem solving type and long essay type questions. Different types of questions shall be given different weights to quantify their range.

For all semesters:

1. The examination has duration of 3 hours
2. Each question paper has four parts A, B, C & D.
3. Part A contains 16 objective type questions of which the candidate has to answer all. Each bunch of 4 questions carries a weightage of 1.
4. Part B contains 8 short answer type questions spanning the entire syllabus and the candidate has to answer 5 questions. Each question carries a weight of 1.
5. Part C contains 6 short essay type spanning the entire syllabus and the candidate has to answer 4 questions. Each question carries a weight of 2.
6. Part D contains 3 essay type questions spanning the entire syllabus and the candidate has to answer 2 questions. Each question carries a weight of 4.

Evaluation of problems in the grading system:

Numerical problems in Biostatistics & Bioinformatics shall be graded in the following way.

1. Correct formula with correct substitution and answer : **A**
2. Correct formula with correct substitution and answer but wrong or no unit. : **B**

3. Correct formula with correct substitution and wrong answer : **C**
4. Formula alone is correct : **D**
5. Even formula is incorrect : **E**

Evaluation of practical examinations:

The Board of Examiners constituted by the University shall have the freedom for formulating the scheme of evaluation of the concerned practical examination.

Student Strength for practical:

There shall be at least one teacher to supervise a batch of not more than 15 students in each laboratory session.

**RESTRUCTURED CURRICULUM FOR
B.Sc. DEGREE IN ZOOLOGY PROGRAMME
COURSE STRUCTURE**

SCHEME OF INSTRUCTIONAL HOURS AND CREDITS

(TOTAL CREDITS 120)

Semester I

Total Credits 20

No	Course Title	Hrs/ Week	Credits
1	Common Course English - 1	5	4
2	Common Course English - 2	4	3
3	Common Course III Second Language - 1	4	4
4	Core Course I General Methodology and Perspectives in Science	2	2
5	Core Course I Practical General Methodology and Instrumentation	2	1
6	1 st Complementary Course Chemistry I/Biochemistry I	2	2
7	1 st Complementary Course Chemistry Practicals I	2	1
8	2 nd Complementary Course Botany I	2	2
9	2 nd Complementary Course Botany Practicals I	2	1
	Total	25 hrs	20

Semester 2

Total Credits 20

No	Course Title	Hrs/ Week	Credits
1	Common Course IV English 3	5	4
2	Common Course V English 4	4	3
3	Common Course VI Second Language -2	4	4
4	Core Course II Biodiversity and Modern Systematics	2	2
5	Core Course II Practical Biodiversity and Modern Systematics	2	1
6	1 st Complementary Course Chemistry II/Biochemistry II	2	2
7	1 st Complementary Course Practicals II	2	1
8	2 nd Complementary Course Botany II	2	2
9	2 nd Complementary Course Practicals II	2	1
	Total	25 hrs	20

Semester 3**Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course VII English 5	5	4
2	Common Course VIII Second Language 3	5	4
3	Core Course III Animal Diversity - Non Chordata	3	3
4	Core Course III Practical Animal Diversity - Non Chordata	2	1
5	1 st Complementary Course III Chemistry III/Biochemistry III	3	3
6	1 st Complementary Course III Practicals III	2	1
7	2 nd Complementary Course III Botany III	3	3
8	2 nd Complementary Course III Practicals III	2	1
	Total	25 hrs	20

Semester 4**Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Common Course IX English -6	5	4
2	Common Course X Second language 4	5	4
3	Core Course IV Animal Diversity –Chordata	3	3
4	Core Course IV Practical Animal Diversity –Chordata	2	1
5	1 st Complementary Course IV Chemistry IV/Biochemistry IV	3	3
6	1 st Complementary Course IV Chem. Practicals.	2	1
7	2 nd Complementary Course IV Botany IV	3	3
8	2 nd Complementary Course IV Botany Practicals.	2	1
	Total	25 hrs	20

Semester 5**Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Core Course V Cell Biology and Molecular Biology	3	3
2	Core Course VI Environmental Biology, Toxicology and Disaster management	3	3
3	Core Course VII Evolution, Zoogeography and Ethology	3	3
4	Core Course VIII Biochemistry, Human Physiology and Endocrinology	3	3
5	Core Course Practicals (Core V, VI, VII & VIII)	8	4
6	Core Course Field Study , Study tour and Group activity (Credit 1 in 6 th semester with investigatory project and visit to research institutes.)	1	
7	Open Course (For other streams)/ Elective 1 – Man, Nature and Sustainable Development Elective 2 – Human Genetics, Nutrition, Community health and Sanitation Elective 3 – Vocational zoology Elective 4 Food Microbiology Elective- 5 Ecotourism	4	4
Total		25 hrs	20

Semester 6**Total Credits 20**

No	Course Title	Hrs/ Week	Credits
1	Core Course IX Reproductive and Developmental Biology	3	3
2	Core Course X Genetics and Biotechnology	3	3
3	Core Course XI Microbiology and Immunology	3	3
4	Core Course XII – General informatics, Bioinformatics and Biostatistics	3	3
6	Core Course Choice based (Electives) Elective I - Ecotourism Elective 2 -Nutrition, Community Health, and Sanitation Elective 3 Economic Zoology	4	3
7	Core Course Practicals (IX, X, XI & XII)	8	4
8	Project work & Field Visit/Study Tour, Visit to research institutes , Group activity	1	1
		25 hrs	20

B.Sc. ZOOLOGY PROGRAMME**CORE COURSES****SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS**

Name of semester	Theory	Practical
First semester	2	2
Second semester	2	2
Third semester	3	2
Fourth semester	3	2
Fifth semester	16	8
Field Study and Group activity	1	
Sixth semester	16	8
Project work (in 6 th semester), Visit to research institutes	1	

RECORDS

1. General Methodology and Instrumentation
2. Biodiversity and Modern Systematics
3. Animal Diversity - Non-Chordata
4. Animal Diversity - Chordata
5. Cell Biology and Molecular Biology
6. Environmental Biology, Toxicology and Disaster Management
7. Evolution, Zoogeography and Ethology
8. Biochemistry, Physiology and Endocrinology
9. Reproductive and Developmental Biology
10. Genetics and Biotechnology
11. Microbiology and Immunology
12. General Informatics, Bioinformatics and Biostatistics

Each Record will be having external and internal evaluation. A total of one credit is allotted for each record and the respective practical.

CORE COURSES

SCHEME OF DISTRIBUTION OF HOURS AND CREDIT

Name of semester	Code	Name of core course	Hrs	Inst Hrs/week	Credit
1	ZY1B01U	General Methodology and Perspectives in science	36	2	2
1	ZY1B01U [P]	(Practical)- General Methodology & instrumentation	36	2	1
2	ZY2B02U	Biodiversity & Modern systematics	36	2	2
2	ZY2B02U [P]	(Practical) Biodiversity & Modern systematics	36	2	1
3	ZY3B03U	Animal Diversity Non Chordata	54	3	3
3	ZY3B03U [P]	(Practical) Animal Diversity Non chordata	36	2	1
4	ZY4B04U	Animal Diversity Chordata	54	3	3
4	ZY4B04U [P]	(Practical) Animal Diversity – Chordata	36	2	1
5	ZY5B05U	Cell Biology and Molecular Biology	54	3	3
5	ZY5B05U [P]	(Practical) – Cell Biology and Molecular Biology	36	2	1
5	ZY5B06U	Environmental Biology, Toxicology and Disaster Management	54	3	3
5	ZY5B06U [P]	(Practical) – Environmental Biology, Toxicology and Disaster	36	2	1

		Management			
5	ZY5B07U	Evolution, Zoogeography and Ethology	54	3	3
5	ZY5B07U [P]	(Practical) Evolution, Zoogeography and Ethology	36	2	1
5	ZY5B08U	Biochemistry, Physiology and Endocrinology	54	3	3
5	ZY5B08U [P]	(Practical) - Biochemistry, Physiology & Endocrinology	36	2	1
6	ZY6B09U	Reproductive and Developmental Biology	54	3	3
6	ZY6B09U[P]	(Practical) - Reproductive and Developmental Biology	36	2	1
6	ZY6B10U	Genetics and Biotechnology	54	3	3
6	ZY6B10U [P]	(Practical) Genetics & Biotechnology	36	2	1
6	ZY6B11U	Microbiology and Immunology	54	3	3
	ZY6B11U [P]	(Practical) – Microbiology and Immunology	36	2	1
6	ZY6B12U	General informatics Bioinformatics and Biostatistics	54	3	3
6	ZY6B12U [P]	(Practical) General Informatics, Bio informatics and Bio statistics	36	2	1

CORE CHOICE BASED COURSE (6th SEMESTER)			Core- Course Electives		
The students of Zoology Programme of each college can select any of the three in consultation with the Faculty of the Department .					
6	ZY6B13U	Ecotourism	72	4	3
6	ZY6B14U	Nutrition, community health and Sanitation	72	4	3
6	ZY6B15U	Economic Zoology	72	4	3
Project 6	ZY6BPVU	Project and Viva (6th Semester)	18	1	1
		Visit to research institutes (6th Semester) Study tour/Field study , Group activity (5th Semester)	18	1	

Students are free to choose any Research Topic related with courses of Zoology programme for their investigatory project work in consultation with their supervising teacher.

OPEN COURSES FOR OTHER STREAMS - Electives					
V th semest er	(Zoology Department can offer any one of the five open courses)				
5	ZY5D01U	Man , Nature and Sustainable Development	72	4	4
5	ZY5D02U	Human Genetics, Nutrition, Community health and Sanitation	72	4	4
5	ZY5D03U	Vocational Zoology	72	4	4
5	ZY5D04U	Food Microbiology	72	4	4
5	ZY5D05U	Ecotourism	72	4	4

COMPLEMENTARY ZOOLOGY COURSES FOR BSc. BOTANY (MODEL I) /HOME SCIENCE / BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION					
Semester 1	ZY1C01U	Animal Diversity – Non-Chordata	36	2	2
	ZY1C01U [P]	(Practical) - Animal Diversity – Non-Chordata	36	2	1
Semester 2	ZY2C02U	Animal Diversity –Chordata	36	2	2
	ZY2C02U [P]	(Practical) - Animal Diversity – Chordata	36	2	1
Semester 3	ZY3C03U	Human Physiology and Immunology	54	3	3
	ZY3C03U [P]	(Practical) - Human Physiology and Immunology	36	2	1
Semester 4	ZY4C04U	Applied Zoology	54	3	3
	ZY4C04U [P]	(Practical) - Applied Zoology	36	2	1

**COMPLEMENTARY ZOOLOGY COURSES FOR B.Sc BOTANY
(MODEL II) OFFERED BY ZOOLOGY DEPARTMENT**

Semester	Code	Course	Hrs	Hrs/week	Credit
Semester 1	ZY1CVO1U	Animal Diversity-Non Chordata	54	3	2
	ZY1CVO1U (P)	Animal Diversity-Non Chordata (Practical)	36	2	1
Semester 2	ZY2CVO2U	Animal Diversity-Chordata	54	3	2
	ZY2CVO2U (P)	Animal Diversity-Chordata (Practical)	36	2	1
Semester 3	ZY3CVO3U	Human physiology & Immunology	54	3	3
	ZY3CVO3U (P)	Human physiology & Immunology (Practical)	36	2	1
Semester 4	ZY4CVO4U	Applied Zoology	54	3	3
	ZY4CVO4U (P)	Applied Zoology (Practical)	36	2	1

SCHEME OF EXAMINATIONS

Theory Examinations will be conducted by the University at the end of the respective semester in which the course is conducted

Duration 3 Hrs (Internal: External weightage =1:3)

SCHEME OF EXAMINATION THEORY (CORE COURSE)

SEME- STER	CODE ZY	COURSE	HRS	Weightage ratio		CREDITS
				INTE- RNAL	EXTE- RNAL	
SEM I	ZY1B01U	General Methodology and Perspectives in Science	3	1	3	2
SEM II	ZY2B02U	Biodiversity and Modern Systematics	3	1	3	2
SEM III	ZY3B03U	Animal diversity -Non Chordata	3	1	3	3
SEM IV	ZY4B04U	Animal Diversity Chordata	3	1	3	3
SEM V	ZY5B05U	Cell Biology And Molecular Biology	3	1	3	3
	ZY5B06U	Environmental Biology Toxicology and Disaster Management	3	1	3	3
	ZY5B07U	Evolution Zoogeography and Ethology	3	1	3	3
	ZY5B08U	Biochemistry Physiology				

		and Endocrinology	3	1	3	3
SEM VI	ZY6B09U	Reproductive and Developmental Biology	3	1	3	3
	ZY6B10U	Genetics and Biotechnology	3	1	3	3
	ZY6B11U	Microbiology and Immunology	3	1	3	3
	ZY6B12U	General Informatics, Bioinformatics and Biostatistics	3	1	3	3
ELECTI VES ZOOLO GY CORE CHOICE BASED	ZY6B13U	Ecotourism	3	1	3	3
	ZY6B14U	Nutrition, Community health And Sanitation	3	1	3	3
	ZY6B15U	Economic Zoology	3	1	3	3

OPEN COURSES FOR OTHER STREAMS						
SEM 5 Electives	ZY5D01U	Man, Nature and Sustainable Development	Exam hr 3	1	3	4
	ZY5D02U	Human Genetics, nutrition, community health and Sanitation	3	1	3	4
	ZY5D03U	Vocational Zoology	3	1	3	4
	ZY5D04U	Food Microbiology	3	1	3	4
	ZY5D05U	Ecotourism	3	1	3	4

SCHEME OF PRACTICAL EXAMINATIONS

University Practical Examinations will be conducted at the end of even Semesters with one external & one internal examiner and for odd semesters with one internal examiner

A. Scheme of Practical Examinations at the end of 1, 2, 3 & 4 semester Weightage ratio 1:3

Semester	Code	Exam duration		Internal	External	Credit
1	ZY1B01U [P]	3Hrs	General Methodology & Instrumentation	1	3	1
2	ZY2B02U [P]	3Hrs	Biodiversity & Modern systematics	1	3	1
3	ZY3B03U [P]	3Hrs	Animal Diversity – Non chordata	1	3	1
4	ZY4B04U [P]	3Hrs	Animal Diversity Chordata	1	3	1

B. Scheme of Practical Examinations at the end of 5th Semester

5	ZY5B05U [P]	3Hrs	Cell Biology & Molecular Biology	1	3	1
5	ZY5B06U [P]	----- 3Hrs	Environmental Biology, Toxicology, and Disaster Management	1	3	1
5	ZY5B07U [P]	3Hrs	Evolution & Zoogeography	1	3	1
5	ZY5B08U [P]	----- 3Hrs	Biochemistry , Physiology & Endocrinology	1	3	1

C. Scheme of Practical Examinations at the end of 6th Semester

6	ZY6B09U [P]	3Hrs	Reproductive and Developmental Biology	1	3	1
6	ZY6B10U [P]	----- 3Hrs	Genetics & Biotechnology	1	3	1
6	ZY6B11U [P]	3Hrs	Microbiology and Immunology	1	3	1
6	ZY6B12U [P]	----- 3Hrs	General Informatics , Bio informatics and Biostatistics	1	3	1
6	ZY6BPVU	3Hrs	Project and Viva Study Tour, Field Study Report, Group activity	1	3	1
					Total	13

	TOTAL CREDIT	
	Theory	
	Core + Choice Based Core	37
	Open course	4
	Practical	
	Practical + Project and Viva + Field Study Report, Group activity	13
	Total	54 credits

SCHEME OF PRACTICAL CORE COURSES

(External exam)

(SEMESTER -1,2,3,4,&6)

External

Weightage: **25**

	Record	4
Part-A	Major practical	a) 4+ b) 4 = 8
Part-B	Minor practical	a) 2+ b) 1 = 3
Part-C	Spotters/problem	a) 5 items of 2 weightage each 5×2 = 10
	Total	25

SEMESTER 5 RECORD WEIGHT -4**PART A MAJOR PRACTICAL WEIGHT a)-4,b)-4,c)-4****PART B MINOR ,, WEIGHT 4&1****PART C SPOTTERS WEIGHT 2X2 =4**

TOTAL WEIGHT 25**CREDIT -1**

**FIELD STUDY, RESEARCH INSTITUTE VISIT, GROUP ACTIVITY,
PROJECT AND VIVA (Credit 1)**

Weightage

	Weightage (Internal)	Weightage (External)
Field Study report	4	
Group Activity	2	
Project	2 Log book showing the progress of project work duly signed by the supervising teacher & HOD	Project report Title-1 Abstract-2 Introduction + Literature review-2 Methodology-4 Results-4 Discussion & Conclusion-4 Neat presentation and Novelty-4 (presentation using OHP / LCD, / chart/ brief narration in front of -examiners & students -in 7 Minutes) Viva Voce-4 /(Question & answer session after powerpoint or OHP / chart/ narration/ any type of presentation -4)
Total	8	25

B.Sc ZOOLOGY PROGRAMME
MODEL - I

SYLLABI**SEMESTER I****ZY1B01U Core Course I****GENERAL METHODOLOGY AND PERSPECTIVES IN SCIENCE**36 hrs
Credits 2**Objectives**

- To make aware of the basic philosophy of science, its history, concepts and scope
- To develop proper scientific mind, culture and work habits
- To familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences

Pre-requisite:

- Basic knowledge on various sciences and definitions of scientific terms
- An awareness on role of research in science

PART – I BIOLOGY - THE LIFE SCIENCE **25 Hrs****Module I. Science and Scientific Studies** **(4 hrs)**

Types of knowledge: practical, theoretical, and scientific knowledge.

Information.

What is science; what is not science; laws of science.

Basis for scientific laws and factual truths.

Science as a human activity, scientific temper, empiricism.

Vocabulary of science, science disciplines.

Revolutions in Science and Technology

Core Readings

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey*. University of Chicago Press, Chicago, IL:

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance*. Published by Harvard University Press.

Ervin Schrodinger 1944. *What is life? Mind and Matter*. Cambridge University Press.

Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*. Vintage Pub. NY

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions* 3rd ed.: University of Chicago Press, Chicago, IL

Taylor, Green, Stout (2008) *Biological Science*, Cambridge University, Press, p 951.

Thomas, A.P. (Editor) 2009. *Biology – Perspectives and Methods*. Green Leaf Publishers, Kottayam.

Module II. What is Biology? (4 hrs)

Life and its manifestations.

History of Biology

Biology in ancient times

Landmarks in the progress of Biology

Branches of Biology

Core Readings

Bowler Peter J. and Iwan Rhys Morus. 2005 *Making Modern Science: A Historical Survey*. University of Chicago Press, Chicago, IL:

Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution and Inheritance*. Published by Harvard University Press.

Ernst Myer. 1997. *This is Biology: The Science of the living World*. University Press, Hyderabad, India

Ernst Myer. 1997. *This is Biology: The Science of the living World*. University Press, Hyderabad, India

Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions* 3rd ed.: University of Chicago Press, Chicago, IL

Thomas, A.P. (Editor) 2009. *Biology – Perspectives and Methods*. Green Leaf Publications, Kottayam.

Module III. Tools and Techniques in Biology (12 hrs)

Scientific drawing -Purpose and principle

Basic understanding on principle and uses of the following:

Microscopy (a) Light microscopy,

Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence, Polarization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM

Micrometry – Stage and Eyepiece micrometers

Camera Lucida

Instrumentation

- pH Meter

Separation Techniques

- Centrifuge

- Chromatography

- Electrophoresis

Analytical techniques

- Colorimeter

- Spectrophotometer

- X-ray crystallography

Core readings

Aggarwal S.K, 2009 *Foundation Course in Biology* Ane's Students Edition P- 79-93.

Eldon D. Enger, Frederick C. Ross and David Bailey 2008(Eleventh Edition)
Concepts in Biology. Tata – McGraw Hill, New Delhi

Taylor, Green, Stout (2008) *Biological Science*, Cambridge University, Press, p 161-163

Wilson & Walkar 2008 *Principles and Techniques of Biochemistry and Molecular Biology* Cambridge University Press. Chapters 9,10,11,15.

Zoological Society of Kerala Study Material 2002 – *Cell Biology, Genetics & Biotechnology*. Chapter- 2 Tools and Techniques.

Module IV. Animal Collection techniques (5 hrs)

- Collection methods, techniques and equipments
 - Plankton
 - Insects
 - Fish
 - Bird
- Preservation techniques – Taxidermy
- Rearing techniques
 - Laboratory and field.

Core Readings

Killick, H.J. 1971. Beginning ecology. Ibadan University Press.

Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Publishers, Kottayam.

PART II: BIOLOGY AND RESEARCH (11 hrs)

Module V. Bioethics (5 hrs)

Introduction

Animal rights and animal laws in India.

Prevention of cruelty to animals Act 1960

Wildlife protection act 1972 and Amendments

Biodiversity Act 2003.

Concept of 3 R – conservation (**R**efined- to minimize suffering, **R**educed – to minimize animals, **R**eplaced – modern tools and alternate means)

Animal use in research and education.

Laboratory animal use, care and welfare

Animal protection initiatives

Animal Welfare, Animal Welfare Board, India CPCSEA

Working with Humans, harm, risk, and benefits.Consent.

Special Cases: Children and Vulnerable people, Equality, Anonymity,

Confidentiality, Information Storage and dissemination

Human Rights Act-1995, 1998.

Right to information- 2005.

Core Readings

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press. P. 288-299.

Marie, M. 2005. Animal Bioethics: Principles and Teaching Methods
Wageningen Academic Publishers

Module VI. Research Methodology (5 hrs)

Scientific method

Research Projects- Steps and process. Types.

Research Communication

Research report writing (Structure of a scientific paper)

Presentation techniques

Project proposal writing

Assignment, seminar, debate, workshop, colloquium, Conference

- Brief description and major differences

Core Readings

Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing.
Wiley Eastern Ltd.

Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the Biosciences. International student Edition: Oxford University Press.
Chapters.1-8.

Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it.
Narosa Publishing House.

Ruxton, G.D. and Colegrave, N. 2006. Experimental design for the life sciences.
Oxford University Press. Chapters 1-6.

Module VII. Units of measurements (1 hr)

Calculations and related conversions of each:

- Metric system- length; surface; weight
- Square measures
- Cubic measures (volumetric)
- Circular or angular measure

- Concentrations- percent volume; ppt; ppm
- Chemical – molarity, normality
- Temperature- Celsius, centigrade, Fahrenheit

Core readings

- D.K. Illustrated Oxford Dictionary.2006 Chapter on Measurements p-968.
- Knut Schmidt – Nielsen 2007 *Animal Physiology*, 5th Edition, Appendix -A
- Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 Biological science
(Third edition Cambridge University press. P-960

Selected Further Readings

- Aggarwal. S.K. 2009 Foundation Course in Biology, 2nd Ed.. Ane's Student
Edition. Ane Books Pvt. Ltd.
- Anderson, J, Durston, B.H. and Poole, M. 1992. Thesis and assignment writing.
Wiley Eastern Ltd.
- Bowler Peter J., and Iwan Rhys Morus. 2005 *Making Modern Science: A
Historical Survey*. University of Chicago Press, Chicago, IL:
- Day, R.A. 1993. How to write and publish a scientific paper. Cambridge
University Press. (Module VI)
- Day, R.A. 2000. Scientific English: A guide for Scientists and other Professionals.
Universities Press. (Module VI)
- Debbies Holmes, Peter Moody and Diana Dine 2006 Research methods for the
Biosciences. International student Edition : Oxford University Press .
- Eldon D. Enger ,Frederick C. Ross and David Bailey 2008 (Eleventh Edition)
Concepts in Biology .Tata-McGraw Hill , New Delhi.(Module VII, II & III)
- Ernst Mayr 1982. *The Growth of Biological Thought: Diversity, Evolution, and
Inheritance*. Published by Harvard University Press.
- Ernst Myer .1997. *This is Biology: The Science of the Living World*. Universities
Press, Hyderabad, India
- Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge University
Press
- Gupta K.C, Bhamrah, H.S and G.S.Sandhu 2006.Research Techniques in
Biological Sciences. Dominant Publishers and Distributors, New Delhi.

- Hawkins C. and Sorgi, M. 1987. Research: How to plan, speak and write about it. Narosa Publishing House.
- Jacques Monod 1971. *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*. Vintage Pub. NY
- Kuhn, Thomas. 1996 *The Structure of Scientific Revolutions*. 3rd ed.: University of Chicago Press, Chicago, IL
- Marie, M. 2005. *Animal Bioethics: Principles and Teaching Methods* Wageningen Academic Publishers
- Michael Roberts, Tim King and Michael Reiss. 1994. *Practical Biology for Advance Level*. Thomas Nelson and Sons Ltd. Surrey, UK.
- Ruxton, G.D. and Colegrave, N. 2006. *Experimental design for the life sciences*. Oxford University Press.
- Sateesh, M.K. 2008 *Bioethics and Biosafety*; I.K. International Publishing House (Module V)
- Taylor D.J. Green N.P.O, Stout G.W. Editor R. S. Oper, 2008 *Biological science* (Third edition Cambridge University press

ZY1B01U [P] Practical I: General Methodology and Instrumentation

36 hours

Credit 1

1. Study of simple and compound light microscopes
2. Micrometry –calibration and measurement of microscopic objects –low power
3. Camera Lucida (draw a few diagrams using Camera Lucida)
4. Paper chromatography (demonstration only)
5. Instrumentation – demonstration (write notes on principle, equipment and its use)
 - pH Meter
 - Colorimeter/ Spectrophotometer
 - Centrifuge
 - Electrophoresis
6. Scientific drawing (representatives from any five taxa)
7. Insect collection and preservation techniques (Group Activity)

SEMESTER II**ZY2B02U Core Course 2****BIODIVERSITY AND MODERN SYSTEMATICS****36 hrs****Credits 2****Objectives:**

- To create appreciation on diversity of life on earth
- To understand different levels of biological diversity
- To familiarize taxa level identification of animals
- To learn biodiversity estimation techniques
- To create interest for conservation of biodiversity

Pre requisite:

- Basic knowledge on the living world, plant and animal kingdom
- Knowledge on biodiversity and its conservation
- Knowledge on biological classification and representative organism of major taxa

PART I: BIODIVERSITY**(26 Hrs)****Module I – Introduction to Biodiversity****(2 hrs)**

Definition

Historical perspective

Concepts –

Nature – environment – biodiversity

Scope and importance

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Thomas AP.,(Editor) 2009 Biodiversity,Scope and Challenges- Green Leaf Publications Kottayam

Wilson E.O., 1988 (Editor). *Biodiversity*. National Academy press, Washington DC, USA.

Module II – Levels of biodiversity (5 hrs)

Genetic, Species, Ecosystem
 Domesticated, Microbial diversity
 Distribution of biodiversity on earth
 Tropical, temperate and polar
 Landscapes and interactions
 Biodiversity hotspots

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future*. W.W. Norton & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Wilson E.O., 1988 (Editor). *Biodiversity*. National Academy press, Washington DC, USA.

Module III – Values of biodiversity (4 hrs)

Direct use value
 Indirect use value
 Non use value
 Ecosystem services

Core Readings

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future*. W.W. Norton & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-858.

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Module IV – Threats to biodiversity (5 hrs)

Types of threats

Habitat loss, man- wildlife conflict (with case studies)

Invasive species

Pollution

Over exploitation and human population

Climate change

Core Readings

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA.

Module V – Biodiversity conservation and management (6 hrs)

Conservation strategies

In situ, ex situ

National parks, Sanctuaries and Biosphere reserves

International efforts

Convention on Biological Diversity (CBD)

IUCN- WCMC, UNEP

Legal measures

Wild life Protection Act, 1972

The Environment Protection Act, 1986

Forest (Conservation) Act1980, 1988

Biodiversity Act 2002

Biodiversity rule 2004

National biodiversity action plan

People's participation – Peoples biodiversity register (PBR)

Local initiatives

Core Readings

A.P.Thomas(Editor)2009 Biodiversity –Scope&Challenges .Green leaf publications .Kottayam

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press, Cambridge, UK.

Chapman J.L. & M.J. Reiss 2006 *Ecology, Principles and Applications*. Second Edition Cambridge University Press.

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington DC, USA

Module VI – Biodiversity estimation – tools and techniques (4 hrs)

Sampling techniques -

 Quadrat

 Line transect

Measurements

 Density

 Abundance

 Frequency

Biodiversity indices – concepts

 Shannon-Weiner, Simpson

Core Readings

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing, MA, USA.

PART II – MODERN TAXONOMY (10 hrs)

Module VII – Taxonomical Principles (6 hrs)

Brief history

Concepts and definition

Approaches of taxonomy

Molecular taxonomy

Importance of classification

Phylogeny and Taxonomy– Tree of Life, bar coding of life

Zoological nomenclature

 International Code of Zoological Nomenclature (ICZN)

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH
Pub.Co, New Delhi.

Module VIII – Tools and techniques (4 hrs)

Identification Keys

Dichotomous keys (Single access key)

Polytomous key

Multi access key

Advantages and disadvantages

Core Readings

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH
Pub.Co, New Delhi.

Selected Further Readings

Andrew S. Pullin 2002. *Conservation Biology*. Cambridge University Press,
Cambridge, UK.

Anne E. Magurran 2004. *Measuring Biological Diversity* .Blackwell Publishing,
MA, USA.

Chapman J.L. & M.J. Reiss 2006 Ecology, Principles and Applications. Sec
Edition Cambridge University Press.

Daily,G.C. (Ed.), 1997.*Nature's Services : Societal Dependence on Natural
Ecosystems*. Island Press, Washington D C.

Forman, R.T and M. Gordaon. 1986. *Landscape Ecology*. John Wiley & Sons, NY,
USA.

Kapoor ,V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH
Pub.Co, New Delhi

Karunakaran, C.K. 2003. Politics of vanishing forests in Kerala. Kerala Sastra
Sahitya Parishat, Thiruvananthapuram.

Land resource based perspective plan for 2020 AD. Kerala State Land Use Board,
Thiruvananthapuram

Myers, Norman.1984. *The Primary Source: Tropical Forests and Our Future*.
W.W. Norton & Company, NY.

Myers,N., Mittermiere,R.A., Mittermeier,C.G., Dea Fonseca,G.A.B and J.Kent.
2000. Biodiversity hotspots for conservation priorities. *Nature*, 403:853-
858.

Nair, K.N.S and Parameswaran,P.1976. *Keralathinte Sampath (Wealth of
Kerala)*. Kerala Sastra Sahithya Parishad, Trivandrum, Kerala.

Nair, M.P., Pushpangathan, P., Rajasekharan, S.,Narayanan Nair.K. and Dan
Mathew. “*Jaivavaividhyam*” (Biodiversity). State Institute of Languages,
Thiruvananthapuram

State of the Environment Report, Kerala. (Annual Publication), Kerala State
Council for Science, Technology and Environment, Thiruvananthapuram

Supriyo Chakraborty.2004 *Biodiversity*. Pointer Publishers, Jaipur, India.

Thomas A.P.,(Editor) 2009 Biodiversity scope & challenges. Green Leaf
publications Kottayam

Wilson E.O., 1988 (Editor).*Biodiversity*. National Academy press, Washington
DC, USA.

Web Resources

<http://www.ncbi.nlm.gov>.

<http://tolweb.org>

<http://www.biosis.org>

<http://ucmp.berkeley.edu>

<http://species.enviroweb.org>

<http://iczn.org>

<http://www.unep.org>

<http://www.iucn.org>

<http://www.cbd.org>

ZY2B02U [P] Practical 2
BIODIVERSITY AND MODERN SYSTEMATICS

36 hrs
Credit 1

1. Quadrature study
2. Transect study
3. Sampling
4. Species area curve
5. Identification using keys
 - Insect
 - Fish
 - Snake
6. Taxa, identification techniques
 - Bird body parts
 - Butterfly/ dragonfly body parts and venation
7. Simple identification of any 20 animals (local – represent all taxa)
 - Common name and scientific name
8. Field study (compulsory)
 - Visit to two important areas of biodiversity
 - Report on local biodiversity conservation efforts
 - Eg. Sacred grooves, medicinal plant garden

Report should be submitted by each student

SEMESTER III**ZY3B03U CORE COURSE 3****ANIMAL DIVERSITY- NON CHORDATA****Objectives**

54 hrs. Credits 3

1. To study the scientific classification of invertebrate fauna.
2. To learn the physiological and anatomical peculiarities of some invertebrate phyla through type study.
3. To learn the evolutionary significance of various invertebrate fauna
4. To stimulate the curiosity in living things around them.

MODULE I**Introduction: Briefly mention the following****(2 hrs)**

Classification – Keys and Principles.

Nomenclature (Uninomial, Binomial, & Trinomial), Law of Priority.

Two kingdom and Five kingdom classification.

Symmetry - Asymmetry, Spherical, Radial, Biradial and Bilateral

Coelom – Acoelomates, Pseudocoelomates and Eucoelomates

Schizocoelom, Enterocoelom., Protostomia and Deuterostomia

Kingdom Protista Type: Paramecium**(10hrs)**

Salient features and classification up to phyla

- | | |
|----------------------------|----------------|
| 1. Phylum Rhizopoda | : Amoeba |
| 2. Phylum Actinopoda | : Actinophrys |
| 3. Phylum Dinoflagellata | : Noctiluca |
| 4. Phylum Parabasalia | : Trychonympha |
| 5. Phylum Metamonada | : Giardia |
| 6. Phylum Kinetoplasta | : Trypanosoma |
| 7. Phylum Euglenophyta | : Euglena |
| 8. Phylum Cryptophyta | : Cryptomonas |
| 9. Phylum Opalinata | : Opalina |
| 10. Phylum Bacillariophyta | : Diatoms |
| 11. Phylum Chlorophyta | : Volvox |

12. Phylum Choanoflagellata : Proterospongia
 13. Phylum Ciliophora : Paramecium
 14. Phylum Sporozoa : Plasmodium
 15. Phylum Microsporidia : Nosema
 16. Phylum Rhodophyta : Red Alga

(Mention any five general characters for each phylum. Detailed accounts of examples are not necessary.)

General Topics : (1) Parasitic Protozoans (2). Life cycle of Plasmodium

Kingdom Animalia Outline classification of Kingdom Animalia. (1hr)

Three branches - Mesozoa, parazoa, Eumetazoa.

Core Readings

Dhami.P.S. and Dhami J.K. 1979 Invertebrate Zoology. R. Chand and Co. Delhi.
 Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

MODULE II

Mesozoa - Eg. Rhopalura.

Phylum Porifera. (3 hrs)

Classification upto classes.

Class I- Calcarea. Eg. Sycon., Class II – Hexactinellida . Eg. Euplectella.

Class III – Demospongia Eg. Cliona.

General Topics

1. Reproduction in sponges 2. Canal system in sponges.

Phylum Coelenterata Type: Obelia (6hrs)

Classification upto classes.

Class I - Hydrozoa Eg. Halistemma. Class II – Scyphozoa Eg.

Rhizostoma. Class III- Anthozoa Eg. Fungia.

General Topics: Coral and coral reefs with special reference to conservation of reef fauna.

2. Polymorphism in Coelenterates

Core Readings

Zoological Society of Kerala Study material. *Animal Diversity* 2002.

Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

MODULE III

Phylum Ctenophora. (1 hr)

Eg. Pleurobrachia.

Phylum Platyhelminthes (3hrs)

Classification upto classes.

Class I - Turbellaria. Eg. Planaria.

Class II – Trematoda Eg. Fasciola

Class III- Cestoda Eg. *Taenia saginata*.

General Topics-

1. Life history of *Fasciola hepatica*.

2. Platyhelminth parasites of Man and Dog (*Schistosoma*, *Taenia solium*, *Echinococcus*).

Phylum Nematoda (3hrs)

Class phasmidia Eg. Enterobius, Ascaris

Class Aphasmidia Eg. Trichinella

General Topic-

Pathogenic nematodes. (*Wuchereria bancrofti*, *Ancylostoma duodenale*, *Trichinella*).

Phylum Annelida (2 hrs)

Classification upto classes.

Class I- Archannelida Eg. Polygordius

Class II – Polychaeta Eg. Chaetopterus

ClassIII- Oligochaeta Eg. Megascolex.

Class IV - Hirudinomorpha Eg. Ozobranchus, Hirudinaria

Core Readings

Zoological Society of Kerala Study material. *Animal Diversity* 2002.

Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

MODULE IV**(12 hrs)****Phylum- Onychophora**

Eg. Peripatus (Mention its affinities).

Phylum Arthropoda**Type: Panaeus**

Classification upto classes.

Divided into 3 subphyla.

1. Sub Phylum - Trilobitomorpha

Class - Trilobita (mention salient features).

2. Sub Phylum- Mandibulata

Class I – Crustacea Eg. Sacculina

Class II- Chilopoda Eg. Centipede (Scolopendra)

Class III – Symphyla Eg. Scutigera

Class IV – Diplopoda Eg. Millipede (Spirostreptus)

Class V - Insecta Eg. Dragon fly

Class VI – Pauropoda Eg. Pauropus

3. Sub Phylum - Chelicerata

Class - Merostomata Eg. Limulus

Class II – Arachnida Eg. Scorpion

General Topics

1. Vectorial Arthropods
2. Larval forms of Penaeus

Core Readings

Zoological Society of Kerala Study material. *Animal Diversity* 2002.

Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

MODULE V**Phylum Mollusca****(4 hrs)**

Classification upto classes

Class I- Monoplacophora Eg. Neopilina

Class II- Amphineura	Eg. Chiton
Class III- Gastropoda	Eg. Aplysia
Class IV- Scaphopoda	Eg. Dentalium
Class V- Pelecypoda	Eg. Pinctada
Class VI- Cephalopoda	Eg. Sepia

General Topic-

Pearl formation and culture

Phylum Echinodermata (4 hrs)

Classification upto classes

Class I- Asteroidea	Eg. Astropecten
Class II- Ophiuroidea	Eg. Ophiothrix
Class III- Echinoidea	Eg. Echinus
Class IV- Holothuroidea	Eg. Holothuria
Class V – Crinoidea	Eg. Antedon

General Topics

1. Water vascular system.
2. Larval forms of Echinoderms

Minor Phyla (2 hrs)

1. Chaetognatha Eg. Sagitta
2. Sipunculida Eg. Sipunculus
3. Rotifera Eg. Brachionus

Phylum Hemichordata (1 hr)

Eg. Balanoglossus

Core Readings

Zoological Society of Kerala Study material. *Animal Diversity* 2002 & 2010
 Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume 1. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Selected Further Readings

Anderson D.T. 2001 Invertebrate Zoology Sec Edition Oxford University Press
 Barnes R.D. 1987. Invertebrate Zoology. W. B. Saunders. New York.

Dhami.P.S. and Dhami J.K. 1979 Invertebrate Zoology. R. Chand and Co. New Delhi.

Ekambaranatha Ayyar M. 1990. A Manual of Zoology. Volume i. Invertebrate part I and part II. S. Viswanathan Printers & Publishers. Pvt. Ltd.

Hyman L. H. The Invertebrate Volumes. Mc Graw Hill.

Jordan. E. L., and Verma P.S. 2000. Invertebrate zoology. S. Chand and Co. Ltd., New Delhi.

Kotpal R. L, Agarval S. K. and R. P. Khetharpal 2002. Modern Textbook of Zoology.

Kotpal.R. L., 1988-92 (All series). Rastogi Publishers, Meerut.

Parker & Haswell. Textbook of Zoology. Invertebrate . Vol. I 7th Edition.

Thomas A.P (Editor) 2009 Invertebrata .Green leaf publications Kottayam

ZY3B03U [P] Practical 3
ANIMAL DIVERSITY- NON CHORDATA

36 hrs.

Credit 1

Scientific Drawing:-

Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.

Anatomy:-

Study of sections. (Any two)

1. Hydra.
2. Ascaris
3. Earthworm
4. Fasciola

Dissections

1. Prawn - Nervous system
2. Cockroach - Nervous system

Mounting:-

1. Nereis - Parapodia
2. Cockroach - Salivary glands
3. Mouth parts –Plant bug/ House fly / Mosquito. (Any Two)
4. Prawn appendages.

Identification:-

General identification- The students are expected to identify the following Phylum –wise number of animals by their generic names and 20% of these by their specific names. Protista -2, Porifera-1, Coelenterata-2, Platyhelminthes-1, Annelida-2, Arthropoda-3, Mollusca- 2, Echinodermata-2

Taxonomic identification with key:-

Identification of insects up to the level of order.

SEMESTER IV

ZY4B04U CORE COURSE 4
ANIMAL DIVERSITY – CHORDATA

54 Hrs
3 Credits

Objectives

1. To make the student observe the diversity in chordates and their systematic position.
2. To make them aware of the economic importance of some classes.

MODULE I**Introduction****(1 Hr)****Phylum Chordata - General classification**

(Classification up to order – Sub phylum, Super class, Class, Subclass, Order)

1. Sub phylum : Urochordata (3 Hrs)

Class I Larvacea Eg. Oikopleura

Class II Ascidiacea Eg: Ascidia (Mention Retrogressive
Metamorphosis)

Class III Thaliacea Eg: Doliolum

2. Sub phylum: Cephalochordata (2 Hrs)

Example - **Amphioxus**

Core Readings

Ekambaranatha Iyer 2000 A Manual of Zoology Vol. II .S. Viswanathan and Co.

Young J.Z, 1981, The Life of Vertebrates Oxford University Press.

Young J.Z. 2006 The life of Vertebrates Oxford University Press (Third Ed.)

India Ed.

MODULE II**3. Sub phylum:Vertebrata****4. Division 1 – Agnatha (2 Hrs)**

Class I	Ostracodermi	Eg: Cephalaspis
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Class II	Cyclostomata	Eg: Petromyzon
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Division 2 – Gnathostomata (10 Hrs)**Super class Pisces****Class: Chondrichthyes**

Sub class - Elasmobranchi	Eg: Narcine
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Sub class Holocephali	Eg: Chimaera
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Class: Osteichthyes

Sub class – Choanichthyes

Order 1 Crossopterigii	Eg: Latimeria
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Order 2 Dipnoi	Eg: Lepidosiren
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Sub class: - Actinopterygii

Super order 1. Chondrostei	Eg: Acipenser
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Super order 2. Holostei	Eg: Amia
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Super order 3. Teleostei	Eg: Sardine
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General topics

1. Accessory respiratory organs in fish.
2. Parental care in fishes.
3. Scales in fishes.
4. Migration in fishes
5. Common culture fishes of Kerala
6. Lung fishes

Core Readings

- Ekambaranatha Iyer 2000 A Manual of Zoology Vol. !!.S. Viswanathan and Co.
 Young J.Z. 2006 The life of Vertebrates Oxford University Press (Third Ed.)
 India Ed.

Jhingran 1977, Fish and Fisheries of India, Hindustan Publishing Co.

MODULE III

Super class: Tetrapoda (10 Hrs)

Class Amphibia

Type Frog

Order I Anura

Eg: Hyla

Order II Urodela

Eg: Amblystoma (Mention
axolotl larva and neotony)

Order III Apoda

Eg: Ichthyophis.

Class Reptilia (4 Hrs)

Sub class I: Anapsida

Order Chelonia

Eg: Chelone

Sub class II: Parapsida

Eg: Ichthyosaurus

Sub class III: Diapsida

Order I Rhynchocephalia

Eg: Sphenodon

Order II Squamata

Eg: Chamaleon

Sub class IV: Synapsida

Eg: Cynognathus

General topic

Identification of poisonous and non poisonous snakes

Class Aves 4 Hrs

Sub class I: Archeornithes

Eg: Archaeopteryx (Affinities)

Sub class II: Neornithes

Super order I: Palaeognathe

Eg: Struthio

Super order II: Neognathe Eg; Brahminy kite

General topics

1. Migrations in birds
2. Flight adaptations in birds

Core Readings

Jordan E L and .P.S. Verma, 2002 Chordate Zoology S. Chand and Co. New Delhi.

Ekambaranatha Iyer 2000 A Manual of Zoology Vol.II S. Viswanathan and Co.

MODULE IV**Class Mammalia****(18 Hrs)****Type: Rabbit**

Sub class I: Prototheria	Eg: Echidna
Sub class II: Metatheria	Eg: Macropus
Sub class III: Eutheria	
Order 1. Insectivora	Eg: Talpa
Order 2 Dermoptera	Eg: Galeopithecus
Order 3. Chiroptera	Eg: Pteropus
Order 4. Primates	Eg: Loris
Order 5 Carnivora	Eg: Panthera
Order 6 Edentata	Eg: Armadillo
Order 7 Pholibota	Eg: Manis
Order 8 Proboscidea	Eg: Elephas
Order 9 Hydracoidea	Eg: Procavia
Order 10 Sirenia	Eg: Dugong
Order 11 Perissodactyla	Eg: Zebra
Order 12 Artiodactyla	Eg: Cameleus
Order 13 Lagomorpha	Eg: Oryctolagus
Order 14 Rodentia	Eg: Porcupine
Order 15 Tubulidentata	Eg: Orycteropus
Order 16 Cetacea	Eg: Delphinus

General topics

1. Dentition in Mammals
2. Aquatic Mammals

Core Readings

Jordan E L and .P.S. Verma, 2002 Chordate Zoology S. Chand and Co. New Delhi.

Ekambaranatha Iyer 2000 A Manual of Zoology Vol. !!.S. Viswanathan and Co.

Thomas A P (Editor) 2010 Chordata .Green leaf publications Kottayam

Zoological Society of Kerala Study material. *Animal Diversity* 2002&2011

Selected Further Readings

Ekambaranatha Iyer 2000 A Manual of Zoology Vol. !!.S. Viswanathan and Co.

Jhingran 1977, Fish and Fisheries of India, Hindustan Publishing Co.

Jordan E L and .P.S. Verma, 2002 Chordate Zoology S. Chand and Co. New
Delhi.

Kotpal R.L. 2000, Modern Text Book of zoology, Vertebrates, Rastogi
Publications, Meerut.

Nigam and Sobti 2000, Functional Organization of Chordates. Shoban Lal Nagin
Chand and Co. New Delhi.

Young J.Z, 1981, The Life of Vertebrates Oxford University Press.

Young J.Z. 2006 The life of Vertebrates Oxford University Press (Third Ed.)
India Ed.

**ZY4B04U [P] PRACTICAL 4
ANIMAL DIVERSITY CHORDATA**

36hrs

Credit 1

1. Morphology: Scientific Drawing

Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes

2. Dissections

Frog: Photographs/diagrams/one dissected & preserved specimen each/models may be used for study.

1. Frog Viscera
2. Frog Digestive System
3. Frog Arterial System
4. Frog 9th & 1st Spinal nerve
5. Frog Sciatic Plexus
6. Frog Brain

Mounting of placoid scales/cycloid/ctenoid scales

3. Osteology

Frog vertebrae

Pectoral and pelvic girdles of Frog and Rabbit

Skull of Rabbit (Diastema -dentition)

Turtle – plastron and carapace

4. Study of sections.

Amphioxus T. S. through pharynx/T.S. through intestine

5. Identification:-

General identification-

Identify all the animals by their generic names and 25 % of them by their specific names.

Protochordata-1, Pisces-4, Amphibia-3, Reptilia- 4, Aves-1,
Mammalia-2.

7. Taxonomic identification with key:-

- i) Identification of fishes up to the level of order.
- ii) Identification of snakes up to family.

SEMESTER V
ZY5B05U CORE COURSE 5
CELL BIOLOGY AND MOLECULAR BIOLOGY

54 Hrs

Credits 3

Objectives:

1. To emphasize the central role of Cell biology and Molecular biology, being the most developing areas of biological science.
2. To make aware of different cell organelles, their structure and role in living organisms.
3. To introduce the nature of genetic materials at molecular level, their expression and regulation.
4. To develop critical thinking, skill and research aptitudes.

PART I - CELL BIOLOGY (27 Hrs)**Module I History of cell and molecular biology (2 hrs)**

Cell theory, Prokaryotes, Eukaryotes, Actinomycetes, Mycoplasmas, Virus, Virion and Viroids, Prions,

Core Readings**Thomas AP (Editor)2011 Cell&Molecular Biology T**

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 1

Zoological Society of Kerala Study material. 2008. *Microbiology and Immunology* Chapter – 1

Module II Cell membrane & Permeability (6 hrs)

Molecular models of cell membrane

(Sandwich model, Unit membrane model, Fluid mosaic model)

Modifications of plasma membrane. (Microvilli, tight junction, gap junction, desmosomes)

Cell permeability - Diffusion, Osmosis, Passive transport, Active transport, Cell coat and Cell recognition.

Core Readings

Thomas AP(Editor) 2011 Cell &Molecular Biology The Fundamentals. Green leaf publications .TIES Kottayam.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Gupta M.L. & M.L. Gangir. (1998) Cell Biology. Agrobotanica

James Darnell. (1998) Molecular Biology. Scientific American Books Inc.

Module III Ultrastructure of Cytoplasm (7 hrs)

Cytoskeleton - Microtubules, microfilaments, intermediate filaments.

Endoplasmic reticulum - Structure and functions

Ribosomes (Prokaryotic and Eukaryotic)

Golgi complex - Structure and functions.

Lysosomes - Polymorphism - GERL concept, functions

Mitochondria - Structure and functions

Symbiont hypothesis.

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Module IV Nucleus (6 hrs)

Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus Chromosomes – Structure; Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 4

Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)

Rastogi S. C. (1998) Cell Biology, Tata Mc.Graw Hill Publishing Co.
New Delhi

Module V Cell Division (3 Hrs.)

Cell cycle - G₁, S, G₂ and M phases

Mitosis and Meiosis

Core Readings

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 6

Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)

Rastogi S. C. (1998) Cell Biology. Tata Mc.Graw Hill Publishing Co., New Delhi

Module VI Cell Communication (3 Hrs.)

Cell signalling - Signalling molecules (neuro- transmitters, hormones, growth factors, cytokines, vitamin A and D derivatives)

Role of cyclic AMP

Core Readings

Karp. G., 1996 *Cell and Molecular Biology, Concepts and Experiments*
John Wiley and Sons New York.

PART II - MOLECULAR BIOLOGY 27 Hrs.

Module VII Nature of Genetic Materials (7 Hrs)

Discovery of DNA as genetic material – Griffith's transformation experiments. Hershey Chase Experiment of Bacteriophage infection Structure and types of DNA & RNA . DNA replication. Modern concept of gene (Cistron, muton, recon, viral genes). Prokaryotic genome, Eukaryotic genome, Brief account of the following-- Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons

Core Readings

Thomas AP (Editors)2011 Cell&Molecular Biology The Fundamentals.Green leaf publicationsTIES Kottayam

Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ane's Books, India Chapter -5 pp. 124-138.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 9

Module VIII Gene Expressions (12 hrs)

Central Dogma of molecular biology, One gene-one enzyme hypothesis, One gene-one polypeptide hypothesis. Characteristics of genetic code, Contributions of Hargobind Khorana. Protein synthesis-Transcription (Prokaryotic and eukaryotic), Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Core Readings

Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ane's Books, India Chapter -12 pp. 282-292, Chapter 13, pp293-318.

Sobti R.C. & G. Obe. (2000) Eukaryotic Chromosomes. Narosa Publishing House.

Taylor D.J. Green N.P.O and stout Biological Science 2009 3rd edition Chapter 23 pp.802-807.

Module IX Gene regulations (8 hrs)

Prokaryotic (inducible, repressible systems), Operon concept -Lac operon and Tryptophan operon. Brief account of Eukaryotic gene regulation, Definitions- Global control – Stimulon and modulon, Catabolite repression (Glucose effect).

Core Readings

Madigan, Martinko and Parker 2002. *Biology of Microorganisms 8th edition Prentice Hall, Chapter 7 pages 226-245.*

Veer Bala Rastogi. (2008). *Fundamentals of Molecular Biology*, Ane's Books, India Chapter 15, pp343--378.

Zoological Society of Kerala Study material. 2002. *Cell Biology, Genetics and Biotechnology* Chapter – 9

Selected Further Readings

Ariel G Loewy Philip Sickevitz, John R. Menninger and Jonathan A.N. Gallants
(1991) Cell structure and function. Saunder's College Publication

Arthur & Tania. (1991) DNA Replication. W.H. Freeman & Co. New York.

Arthur M Lesk. (1990) Introduction to Genomics. Oxford University Press

Carraway K.L. & C.A.C. Carraway. (2002) Cyto skeleton signalling, Oxford
University Press

Charlotte J Avers. (1986) Molecular Cell Biology. The Benjamin / Cummings
Publishing Company Inc.

Cohn N.S. 1979 Elements of Cytology (Freeman Book Company).

Daniel & Elizabeth. (1996) Genetics-Principle and Analysis. Jones & Bartlett
Publishers

David A Micklos & Greg A Freyer. (2006) DNA Science. Cold Spring Harbor
Laboratory Press

David Latchman. (2006) Gene Regulation. London Unwin Hyman

David M. J. Lilley. (2003) DNA-Protein Structural Interactions. Frontiers in
Molecular Biology.

De- Robertis E.D. and De Robertis Jr.E.M.F (2002) Cell and Molecular Biology
(Lea & Febiger/Info-Med)

Earl R Stadtman & P. Boon Chock. (2000) Current Topics in Cellular Regulation.
Academic Press

Edwards & Hassall. Mc.Graw Hill Publishing Co.Ltd., U.K.

Finean & Michell. (1998) Membrane Structure. Holland Bio-Medical Press,
Netherland.

Gardner E.J. and Snustand D.P. Principles of Genetics. John Wiley & Sons, New
York.

Gupta M.L. & M.L. Gangir. (1998) Cell Biology. Agrobotanica

James Darnell. (1998) Molecular Biology. Scientific American Books Inc.

- Karp G. (1996) Cell and Molecular Biology: Concepts and Experiments John Wiley and Sons m, New York
- Kimball J.W. 1984 Cell Biology (Addison - Wesley Pub. Co.)
- Kwang W Jeon. (1997) A Survey of Cell Biology. Academic Press
- Malcolm N. Jones & Dennis Chapman. (1991) Micelles, Monolayers and Biomembranes. John Willey & Sons Inc. Publication
- Michael T.A. Michael, E.R. and Toya S.K. (1975) Electron Microscopy and Cell Structure. Cambridge University Press
- Mitchison J.M. (1991) The Biology of the Cell Cycle, Cambridge University Press
- Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)
- Rastogi S. C. (1998) Cell Biology. Tata Mc.Graw Hill Publishing Co., New Delhi
- Sinnot Dunn & Dobzhanasky. (1991) Principles of Genetics. T.M.H. New Delhi.
- Sobti R.C. & G. Obe. (2000) Eukaryotic Chromosomes. Narosa Publishing House.
- Stanley G. Schultz. (2002) Basic Principles of Membrane Transport. Cambridge University Press
- Stephen L Wolfe. (1981) Biology of the Cell. Wadsworth Publishing Co. Inc.
- Swanson Metz and Young (1983) Cytology and Cytogenetics (Macmillan and Co. Ltd.)
- Samuel J M,Lilly Chacko,Abraham Samuel and Punnen Kurian 2011 Cell and Molecular Biology The Fundamentals -Green leaf publications TIES Kottayam

Varma P.S. and Agarwal V.K. (1988) Cytology (S.Chand & Co., New Delhi)

Varma P.S. and Agerwal V.K. (2008) Genetics (S.Chand & Co., New Delhi)

Veer Bala Rastogi. (2008). Fundamental of Molecular Biology, Ani Books, India

West I.C. (2002) Biochemistry of membrane transport. Chapman & Hall, London

William & Daphne. (2008) Biochemistry & Molecular Biology. Oxford

University Press

ZY5B05U [P] PRACTICAL 5
CELL BIOLOGY AND MOLECULAR BIOLOGY

36 hrs

Credit 1

1. Squash preparation of onion root tip for mitotic stages
2. Mounting of polytene chromosome (Drosophila/Chironomous.) Demonstration
3. Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)
4. Identification of meiotic stages (slide/figure)
5. Identification of cell organelles
6. Models (DNA, DNA replication, RNA – Different types.)
7. Preparation of temporary whole mount.
8. Preparation of permanent whole mount (demonstration)
9. Preparation of human blood smear and identification of Leucocytes

SEMESTER V**ZY5B06U CORE COURSE 6
ENVIRONMENTAL BIOLOGY, TOXICOLOGY AND
DISASTER MANAGEMENT**

54 hrs

Credits 3

Objectives

- To impart basic knowledge on ecosystems and their functioning
- To learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures
- To study toxicants, their impacts on human health and environment and remedial measures
- To create awareness about disasters, prevention and mitigation measures

Pre-requisite:

- Basic knowledge on ecosystem, food chain, food web and energy flow
- General awareness on pollution and their impacts

PART I: ENVIRONMENTAL BIOLOGY (44 Hrs)**Module I – Introduction (2 hrs)**

History, development

Scope, branches

Core Readings

Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission

Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.

Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders College Publishing, Philadelphia.

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Module II – Ecosystems (20 hrs)

Concept, classification

Terrestrial ecosystem

Abiotic/ biotic components (Brief description only)

Interactions

Classification (Types)

Forest

Desert

Grassland

Causes of land degradation with special reference to Kerala

Freshwater ecosystem

Physico chemical nature (Brief description only)

Types

Lentic

Lotic

Ground water

Threat to freshwater resources of Kerala

Watershed management

Marine ecosystem

Physico chemical nature (Brief description only)

Intertidal zone

Rocky shore

Muddy shore

Sandy shore

Coral reefs

Open sea

Pelagic realm

Benthic realm

Wetland and mangroves

Estuaries

Convention on wetlands (Ramsar, 1971)

Ramsar sites in Kerala –threats and conservation aspects

Core Readings

Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission

Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.

Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders College Publishing, Philadelphia.

Rajagopalan, R. 2005. *Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala.

Module III – Man and Environment

(8 hrs)

Natural resources

Introduction (concept)

Energy resources

Conventional

Non conventional

Inexhaustible

Energy conservation measures

Core Readings

Andrew S. Pullin 2002 *Conservation Biology*. Cambridge University Press, Cambridge, UK

Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission

Kaufman G.Donald and Cecilia M. Franz. 2000. *Biosphere 2000 Protecting Our Global Environment*. Kendall/Hunt Publishing Company. Iowa, US

Module IV – Global environmental changes (9 hrs)

Global warming
Green house effect
Ozone depletion
Climate change (Brief description only)
Definition- recent developments
Kyoto protocol
IPCC/UNFCC
Carbon credit
Carbon sequestration
Carbon trading

Core Readings

Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission

Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.

Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Module V – Municipal Solid Waste (3 hrs)

Plastic pollution
Types of plastics
Problems of plastics
Management strategies

Biowastes and their management. –aerobic and anaerobic systems.

e-waste

Major types and sources

Toxic ingredients

Effects on environment and human health (Brief description only)

Management strategies

Core Readings

Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.

Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders College Publishing, Philadelphia.

Module V – Local environmental issues (2 hrs)

Impact of tourism on ecology

Landscape changes

Core Readings

Santra, S.C. 1994. *Ecology Basic and Applied*. M.D. Publications Pvt. Ltd. New Delhi.

PART II. DISASTER MANAGEMENT AND TOXICOLOGY (10 Hrs)

Module VI – Disaster Management (5 hrs)

Definition

Classification

Natural

Anthropogenic

Hybrid

Earthquake

Landslide

Flood

Drought

Cyclone

Tsunami
Mitigation measures

Core Readings

Singh, S.R., 2008 *Disaster Management*. A.P.H Publishers

Module VII: Toxicology

5 hrs

Definition
History of toxicology
Classification – occurrence/ source
Role of toxicology
Toxicants of biological origin
Aflatoxin
Botulinum toxin
Heavy metal toxicants
Food additives

Core Readings

Stiling Peter, 2002. *Ecology: Theories and applications*. Prentice Hall of India Pvt. Ltd. New Delhi

Pandey Kamleshwar , J.P.Shukla and S.P.Trivedi.2005. *Fundamentals of Toxicology*. New Central Book Agency (P) Ltd. Kolkata, India

Rajagopalan,R. 2005.*Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.

Selected Further Readings

Ahuwalie V.K., Sunita Malhotra, 2009 *Environmental science*, Ane Books Pvt. Ltd.

- Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues . International students edition Sec. edition Oxford University Press.
- Andrew S. Pullin 2002 *Conservation Biology*. Cambridge University Press, Cambridge, UK
- Banerjee, L.K., Sastry, A.R.K. and Nayar, M.P. 1989. Mangroves in India: Identification manual. Botanical Survey of India.
- Bharucha, E. 2005. *Textbook of Environmental Studies for Undergraduate Courses*. University Grants commission
- Erach Bharucha 2008 (UGC). Test Book of Environmental Studies of Undergraduate course. University Press
- Kaufman G.Donald and Cecilia M. Franz. 2000. *Biosphere 2000 Protecting Our Global Environment*. Kendall/Hunt Publishing Company. Iowa, US
- Miller, Tyler. G. (Jr) 2005. *Essentials of Ecology*. Thomson Brooks/cole.
- Misra S.P., Pandey S.N. 2009 *Essential Environmental Students* , Ane books Pvt. Ltd.
- Nambiar, K.R. 2008. *Textbook of Environmental Studies (For Undergraduate Courses as per the UGC Model Syllabus)*. Scitech Publications (India) Pvt. Ltd. Chennai, India.
- Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders College Publishing, Philadelphia.
- Pandey Kamleshwar , J.P.Shukla and S.P.Trivedi.2005. *Fundamentals of Toxicology*. New Central Book Agency (P) Ltd. Kolkata, India
- Rajagopalan,R. 2005. *Environmental Studies from Crisis to Cure*. Oxford University Press, New Delhi.
- Robert May & Angela Mc Lean 2007 *Theoretical Ecology. Principles and Application* , Oxford University press (India Ed.)
- Santra ,S.C. 1994. *Ecology Basic and Applied*. M.D. Publications Pvt. Ltd. New Delhi.
- Sharma, P.D. 2007. *Ecology and Environment*. Rastogi Publishers

Stern, Nicholas. 2006. *The Economics of Climate Change: The Stern Review*,
Cambridge University Press, Cambridge, UK.

Stiling Peter, 2002. *Ecology: Theories and applications*. Prentice Hall of India
pvt. Ltd. New Delhi

ZY5B06U [P] PRACTICAL 6
ENVIRONMENTAL BIOLOGY, TOXICOLOGY & DISASTER
MANAGEMENT

36 hrs

Credit 1

1. Estimation of dissolved oxygen
2. Estimation of dissolved carbon dioxide
3. Estimation of Soil Organic Carbon(Demonstration only)
4. Plankton count
5. Identification of freshwater/ marine plankton
6. Extraction of soil organisms(Demonstration only)
7. Identification of minerals and rocks
8. Sechi disc, Plankton Net
9. Compulsory Field Study report on one Terrestrial/Marine/Fresh water ecosystem

SEMESTER V**ZY5B07U CORE COURSE 7
EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY****54 hrs****Credits 3****Objectives:**

- To acquire knowledge about the evolutionary history of earth (living and non living)
- To learn various tools and techniques for evolutionary studies
- To study the distribution of animals on earth, its pattern, evolution and causative factors
- To impart basic knowledge on animal behavioural patterns and their role

Prerequisite:

- Basic knowledge on principles of inheritance and variation
- Knowledge on molecular basis of inheritance
- Basic understanding on the mechanism and factors affecting evolution
- Knowledge on origin and evolution of man, Evidences of Evolution.

PART I – EVOLUTION (30 hrs)**Module I – Origin of life (5 hrs)**

Introduction

Origin of universe

Chemical evolution

Miller-Urey experiment

Haldane and Oparin theory

Module II – Theories of organic evolution (7 hrs)

Lamarckism

Critical analysis of Lamarck's propositions

Weisman's germplasm theory

Mutation theory.

Darwinism.

Critical analysis of Darwinism

Modern Synthetic theory(Neo Darwinism)

Neutral theory of molecular evolution

Module III – Population genetics and evolution (6 hrs)

Genetic basis of variation

Hardy Weinberg equilibrium

Change in gene frequencies

Factors affecting gene frequencies (brief account only)

Module IV – Evolution above species level (8 hrs)

Adaptive radiation

Microevolution

Macroevolution

Evolution of horse

Mega evolution

Punctuated equilibrium

Speciation -Phyletic and True- Sympatric and Allopatric.

Evolution of horse.

Module V – Geological time scale (4 hrs)

Geological dating with radioactive elements

Mass extinction

Core Readings (Modules 1-5)

Barnes, C.W. 1988. *Earth, Time and Life*. John Wiley & Sons, New York (Module 2 & 3)

Bendall, D. S. (ed.) 1983. *Evolution from Molecules to Man*. Cambridge University Press, U.K. (Module 2, 3 and 5)

Bull J.J and H.A. Wichman. 2001. Applied Evolution. *Annu. Rev. Ecol. Syst.* 32:183-217 (Visit the Annual Reviews home page at www.AnnulReviews.org.)

Chattopadhyay Sajib. 2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd. Kolkata, India.

- Goodwin,B. 1996. *How the Leopard Changed its Spots: The Evolution of Complexity*. Simon &Schuster, NY,USA. (Module 4 & 5)
- Jerry A.Coyne and H.Allen Orr.2004. *Speciation*. Sinauer Associates (Module 4)
- Rob Desalle and Ian Tattersall 2008.*Human Origins: What Bones and Genomes Tell Us about Ourselves*. Texas A&M University Press, USA. (Module 3 & 4)
- Sean B. Carroll and David M. Kingsley .2005 *Evolution: Constant Change and Common Threads*. Holiday Lectures on Science. Webcast or DVD available at www.hhmi.org/biointeractive/evolution. (Module 3 & 4)
- Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston. (Module 1-5)
- Verma P.S. and Agarwal V.K 2007 *Cell biology, Genetics, Molecular Biology, Evaluation and Ecology*, S. Chand & Company New Delhi (Moldule 1-5)

PART II – ZOOGEOGRAPHY AND ETHOLOGY (24 hrs)

Module VI – Zoogeography: Introduction (5 hrs)

Origin of oceans and continents

Platetectonics – continental drift

Zoogeographical realms

Insular fauna-Continental Islands eg Medagascar.

Oceanic Islands eg Galapagoes.

Biogeography of India – with special reference to Western Ghats

Module VII – Animal distribution (5 hrs)

Types and means of animal distribution

Barriers in animal distribution.

Core Readings

Zoogeography

- Andrews. M.I and Joy, K.P. 2003. *Environmental biology, evolution, ethology and Zoogeography*. St.Mary's press and book dept. (Module Vi, VII, VIII and IX)
- Briggs, J.C. 1996. *Global Biogeography*. Elsevier Publishers. (Module VI and VII).

- Chandran, Subash M .D.1997. On the ecological history of the Western Ghats.
Current Science, Vol.73, No.2.146-155.
- Chundamannil , Mammen.1993. *History of Forest management in Kerala*. Report number 89. Kerala Forest Research Institute, Peechi, India.
- Daniels, R.J.R and J.Vencatesan .2008. *Western Ghats Biodiversity.People.Conservation*. Rupa &Co.New Delhi.India.
- Mani, M.S. 1974.*Ecology and Biogeography of India*. Dr. W. Junk b..v. Publishers , The Hague.
- Nair, C.S.1991. *The Southern Western Ghats : A Biodiversity Conservation Plan*. INTACH, New Delhi.
- Ramesh,B.R and Rajan Gurukkal., 2007.*Forest Landscapes of the Southern Western Ghats, India Biodiversity, Human Ecology and management Strategies*. French Institute of Pondicherry, India.
- Tiwari, S. 1985. *Readings in Indian Zoogeography*, (Module VI)

Module VIII – Ethology (1 hr)

Definition

History and scope of ethology

Module IX – Learning and imprinting (8 hrs)

Types of learning with examples

Experiments by K. Lorenz

Module X – Ethology of man (5 hrs)

Sociobiology and evolution of human behaviour

Primates and human socio groups

Human pheromones

Core Readings

Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press..NJ,USA. (Module 10)

David McFarland. 1999. *Animal Behaviour*. Pearson Education Ltd . Essex, England. (Module 8 and 9)

Dawkins, M.S. 1995.*Unravelling Animal Behaviour*. Harlow:Longman. (Module 8, 9 and 10)

- Dunbar,R. 1988. *Primate Social Systems*.Croom Helm,London. (Module 10 & 11)
- Manning Aubrey and Marian Stamp Dawkins 1998. *An Introduction to Animal Behaviour*.Cambridge University Press,UK. (Module 8, 9 & 10)
- Paul W. Sherman and John Alcock.,2001 Exploring Animal Behaviour- Readings from American Scientist 3rd Edn. Sinauer Associates Inc. MA,USA. (Module 10 & 11)
- Wilson, E.O. 1975. Sociobiology. Harvard University Press, Cambridge, Mass. USA. (Module 9)
- Zoological Society of Kerala Study material. 2002. *Environmental Biology and Ethology* Published by Zoological Society of Kerala (Module 6, 7, 8 & 9)

Selected Further Readings

Evolution

- Barnes, C.W. 1988. *Earth, Time and Life*. John Wiley & Sons, New York
- Bendall , D. S. (ed.)1983.*Evolution from Molecules to Man*. Cambridge University Press,U.K.
- Bull J.J and H.A.Wichman.2001.Applied Evolution. *Annu.Rev.Ecol.Syst.* 32:183-217 (Visit the Annual Reviews home page at www.AnnulReviews.org.)
- Chattopadhyay Sajib.2002. *Life Origin, Evolution and Adaptation*. Books and Allied (P) Ltd.Kolkata,India.
- Goodwin,B. 1996. *How the Leopard Changed its Spots: The Evolution of Complexity*. Simon & Schuster, NY,USA.
- Jerry A.Coyne and H.Allen Orr.2004. *Speciation*. Sinauer Associates
- Rob Desalle and Ian Tattersall 2008.*Human Origins: What Bones and Genomes Tell Us about Ourselves*. Texas A&M University Press, USA.
- Sean B. Carroll and David M. Kingsley .2005 *Evolution: Constant Change and Common Threads*. Holiday Lectures on Science. Webcast or DVD available at www.hhmi.org/biointeractive/evolution.
- Strickberger, M.W.2000. *Evolution*. Jones and Bartlett, Boston.

Ethology

- Bonner, J.T. 1980. *The Evolution of Culture in Animals*. Princeton University Press.NJ, USA.

- David McFarland. 1999. *Animal Behaviour*. Pearson Education Ltd. Essex, England.
- Dawkins, M.S. 1995. *Unravelling Animal Behaviour*. Harlow: Longman.
- Dunbar, R. 1988. *Primate Social Systems*. Croom Helm, London.
- Manning Aubrey and Marian Stamp Dawkins 1998. *An Introduction to Animal Behaviour*. Cambridge University Press, UK.
- Paul W. Sherman and John Alcock., 2001 *Exploring Animal Behaviour- Readings from American Scientist* 3rd Edn. Sinauer Associates Inc. MA, USA.
- Thomas A P (Editor) 2011 *Evolution, Zoogeography and Ethology*. Green leaf publications TIES Kottayam.
- Wilson, E.O. 1975. *Sociobiology*. Harvard University Press, Cambridge, Mass. USA.

ZY5B07U [P] PRACTICAL 7
EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY

36 hrs
Credit 1

1. Identification of Zoogeographical realms using map
2. Study on endemic species of each realm
3. Identification of different stages of horse evolution
4. Study on Homology / Analogy
5. Study on connecting links
6. Pheromone traps
7. Skinner box/T Maze
8. Identification of behaviour showing pictures
9. Experiment to demonstrate phototaxis using *Drosophila*/House fly
10. Experiment to demonstrate chemotaxis using *Drosophila*/House fly

SEMESTER V

ZY5B08U CORE COURSE 8

BIOCHEMISTRY, PHYSIOLOGY AND ENDOCRINOLOGY

54 hrs

Credits 3

Objectives:

1. This course will provide students with a deep knowledge in biochemistry, physiology and endocrinology.
2. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism.
3. Explaining various aspects of physiological activities of animals with special reference to humans.
4. Students will acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates.
5. By the end of the course, students should be familiar with hormonal regulation of physiological systems in several invertebrate and vertebrate systems.
6. This also will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
7. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

Part I. BIOCHEMISTRY**18 Hours****Module 1 - GENERAL BIOCHEMISTRY, BIOELEMENTS AND BIOMOLECULES****4 hrs**

Carbohydrates, protein and lipids – structure of basic compounds, classifications with examples and its biological importance.

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Module -2 METABOLISM**9 hrs**

Carbohydrate metabolism- Glycolysis, glycogenolysis, gluconeogenesis, glycolysis –citric acid cycle, ATP synthesis, Hexose, monophosphate shunt

Lipid metabolism- Biosynthesis and oxidation of fatty acids- Beta oxidation, Physiologically important compounds synthesized from cholesterol.

Protein metabolism- Deamination, transamination, transmethylation, decarboxylation, ornithine cycle.

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Module 3- ENZYMES**4 hrs**

Chemical nature of enzymes, mechanism of enzyme action, factors influencing enzyme action (temperature, pH, enzyme concentration, substrate concentration), enzyme activation, enzyme inhibition, allosteric enzyme, isoenzymes, co-enzyme.

Core Readings

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Part II. HUMAN PHYSIOLOGY**26 Hrs****Module 4- NUTRITION****5 hrs**

Nutrients,classification,RDA,Balanced diet.

Antioxidants and functions, Mineral metabolism,Role of Ca,Fe,Na,K,andP.

Role of vitamins

Food adulteration, Defects of modern food habits (importance of fibers in food), weight control, nutrition during pregnancy, breast feeding, anorexia, acidity and

ulcers, flatulence, fasting and its significance, malfunctions of gastro intestinal tract.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.718-833

Prosser & Brown 2006 : Comparative Animal Physiology

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 5 -RESPIRATION

5 hrs

Gas transport, Factors affecting transport of respiratory gases through blood, oxy-hemoglobin curve, Bohr effect, reverse Bohr effect, Haldane effect, neural (voluntary and automatic) and chemical control (mention the role of carotid and aortic bodies) of respiration, smoking and its physiological effects, carbon monoxide poisoning, oxygen toxicity, nitrogen narcosis, dysbarism, oxygen therapy, artificial respiration, respiratory disorders –hypoxia, hypocapnia, hypercapnia, asphyxia.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp432-509 Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 6–CIRCULATION

4 hrs

Cerebral circulation, blood brain barrier and cerebrospinal fluid, Haemo dynamic principles, formation and fate of blood cells, Blood composition ,blood clotting mechanism – intrinsic and extrinsic pathways, clotting factors, anticoagulants, blood transfusion (safety and security problems), mention haemostasis, haemolysis, jaundice, thrombosis, ESR.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.144-262, 382-429, 711-715.

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 7 –EXCRETION

4 hrs

Urea cycle (in detail), renal handling of individual substances eg. glucose, sodium, urea, water, factors affecting GFR, concept of plasma clearance, acid base balance and homeostasis, kidney disorders – acute renal failure, chronic renal failure-glomerular nephritis, pyelonephritis, nephrotic syndrome and kidney stones.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.264-379

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 8-MUSCLE PHYSIOLOGY

3hrs

Ultra structure of striated muscle.Mechanism of muscle

contraction.Biochemistry of muscle contraction,isotonic and isometric contraction.

Electrical, chemical and morphological changes and ionic fluxes during contraction of striated muscle fibre, Cori cycle, electrophysiology of muscle, threshold and spike potentials, simple muscle twitch, whole muscle contraction, isotonic and isometric contraction, latent and refractory periods, summation, beneficial effect, superposition curve, tetanus, tonus, staircase phenomenon, fatigue, oxygen debt, rigor mortis.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.52-86

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 9 –NEUROPHYSIOLOGY

3 hrs,

Synaptic transmission & properties of synapses, neurotransmitters, role of dopamine and serotonin. EEG, memory, short term and long term sleep, dream, Neural disorders- dyslexia, Parkinson's disease, epilepsy, Alzheimer's disease, schizophrenia.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.512-715

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 10 -SPORTS PHYSIOLOGY**2hrs**

Muscular, Respiratory and cardiovascular changes during exercise, dope test, drug abuse.

Significance of exercise in body fitness. (Guyton pp 968-978)

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.968-978

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Part III ENDOCRINOLOGY**11 hrs****Module 11****5 hrs**

Hormones as messengers, classification and types of hormones. General principles of hormone action, Concept of hormone receptors, hormonal control of homeostasis.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.836-966

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module 12**6 hrs**

Secretion, Regulation, Functions and Disorders of hormones of Hypothalamus, Hypophysis, Pineal, Thyroid, Parathyroid, Thymus, Islets of Langerhans, Adrenal, Gonads, Placenta, Gastro intestinal hormones.

Core Readings

Guyton 2002: Text Book of Medical Physiology Saunders pp.836-966

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Selected Further Readings**Human Physiology**

Best and Taylor: Physiological basis of Medical practice

Chakrabarti, Ghosh &: Human Physiology, the New Book Stall Schana.

Chatterjee C.C.: Human Physiology, Vol I & II Medical Allied Agency

Eckert & Randall : Animal Physiology, Mechanism and Adaptations , CBS publishers, New Delhi.

Ganong W F : Review of Medical Physiology, Mc Graw Hill, New Delhi.

Guyton : Text Book of Medical Physiology Saunders

Joshi : Nutrition and Dietetics , Tata Mc. Graw Hill

Knut Schmidt Nilesen 2007 Animal Physiology – Adaptation and environment.
Cambridge University press 5 th ed.

Mackenna & Callander : Illustrated Physiology, Churchill Livingstone

Powar Human Physiology

Prosser & Brown : Comparative Animal Physiology

Sarada Subramanyam & K. Madhavankutty : Textbook of human physiology, S. Chand & Co Ltd, New Delhi.

Endocrinology

Barrington, E.J.W. General and Comparative Endocrinology, Oxford, Clarendon Press.

Bentley, P.J.Comparative Vertebrate Endocrinology, Cambridge University Press.

David O. Norris Vertebrate Endocrinology 3th Edition,

Gorbman ,A *et. al.* Comparative endocrinology, John Wiley & Sons.

Hadley, M.E. 2000. Endocrinology, 5th ed. Prentice Hall, Upper Saddle River, NJ.

Martin, C.R. Endocrine Physiology, Oxford University Press

Norris, D.O. 1997. Vertebrate Endocrinology, 3rd ed. Academic Press, Sand Diego, CA.

Williams, R.H. Textbook of Endocrinology, W.B. Saunders

Biochemistry

Ackerman E, Biophysical Science, Prentice Hall Inc.

Awapara J, Introduction to Biological chemistry, Prentice-Hall of India

Cohn E E and Stumpf P K, outlines of Biochemistry, Wiley Eastern

Foster, R.L. Nature of Enzymology

Garett and Grisham. Biochemistry.

Harper's Illustrated Biochemistry, 27th Ed, Mc Graw Hill

Lehninger, Biochemistry , Kalyani Publications

Lodish et. al. Molecular Cell Biology

Rangnatha Rao K, Text Book of Biochemistry, Prentice-Hall of India

Roy K N, A Text Book of Biophysics, New Central Book Agency

Stryer, Biochemistry, W.H Freeman and Co., Newyork

Voet, D. and J.G. Voet. Biochemistry. J. Wiley & Sons

ZY5B08U [P] PRACTICAL 8
BIOCHEMISTRY HUMAN PHYSIOLOGY AND
ENDOCRINOLOGY

36 hrs
Credit 1

PHYSIOLOGY

- 1) Determination of haemoglobin content of blood
- 2) Total RBC count using Haemocytometer
- 3) Total WBC count using Haemocytometer
- 4) Estimation of PCV
- 5) Effect of hypertonic, hypotonic and isotonic solutions on the diameter of RBC.
- 6) Instruments: Kymograph, Sphygmomanometer and Stethoscope (principle and use) Measurement of blood pressure using a sphygmomanometer (demonstration)

ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca & Corpora allata (Demonstration)
2. Human hormonal disorders (Diagrams/Photographs)

BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.

SEMESTER VI**ZY6B09U Core course 9****REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY****54 hrs****Credits 3****Objectives**

1. This will provide a basic understanding of the experimental methods and designs that can be used for further study and research.
2. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in the biological/physiological sciences and health-related fields, and will contribute to the critical societal goal of a scientifically literate citizenry.

Module 1**10 hrs****Introduction**

Scope of developmental biology, definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman)

Reproductive Organs and Gametogenesis.

Human reproductive organs and gametogenesis (brief account) significance.

Egg types.

Classification of eggs, based on the amount, distribution and position of yolk. Mosaic, regulative and cleidoic eggs. Influence of yolk on development. Polarity, symmetry and egg content.

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle.

Fertilization

Approach and binding of spermatozoa, activation of the egg, amphimixis. Parthenogenesis (brief account) natural and artificial. Arrhenotoky, Thelytoky, Obligatory and Facultative

Significance

Core Readings

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vertebrate embryology

Vijayakumarn Nair K. and P. V George. A manual of developmental biology, Continental publications, Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module II**18 hrs****Cleavage**

Types, planes of cleavage (radial and spiral with examples) Cell lineage (brief account). Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and superficial). Patterns of cleavage (radial, bilateral and rotative). Influence of yolk on cleavage.

Blastulation

Blastula formation, Types of blastula (coeloblastula, stereoblastula, Discoblastula, Blastocyst with examples).

Fate maps

Concept of fate maps, construction of fate maps. (artificial and natural). A typical vertebrate fate maps. Significance of fate map.

Gastrulation

Definition, Morphogenetic cell movements (brief account). Epiboly, Emboly (invagination, involution, delamination, convergence, divergence infiltration). Concept of germ layers (brief account) and its derivatives.

Cell differentiation and gene action—with special reference to Drosophila.

Totipotency, Pleuripotency, Unipotency of embryonic cells. Determination and differentiation in embryonic development, Gene action, control of gene expression. (brief accounts)

EMBRYOLOGY OF FROG - Gametes, Fertilization, cleavage, blastulation, fate map, gastrulation, notogenesis, neurulation, development of nervous system and sense organs (eye only) Metamorphosis (brief account only)

Core Readings

Balinsky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vertebrate embryology

Vijayakumarn Nair K. and P. V George. A manual of developmental biology, Continental publications, Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module III**18 hrs****Embryology of chick**

Structure of egg, fertilization, cleavage, blastulation, gastrulation. Mention brief account of 18 hour chick embryo and 24 hour chick embryo. Extra embryonic membranes in chick.

Human development

Blastocyst, foetal membranes and placenta. Types of placenta (brief account). Classification of placenta based on

Nature of contact.

Mode of implantation.

Histological intimacy of foetal and maternal tissue.

Functions of placenta.

Experimental embryology.

Spemann's constriction experiments, Organizer and embryonic induction. In vitro fertilization (test tube baby) Amniocentesis, Embryo transfer technology, Cloning, Stem cell research.

General Topics

1. Regeneration in animals
2. Placentation in mammals and their significance.
3. Human intervention in reproduction- contraception & birth control, Abortion – biological aspects, Ethical issues, Infertility, IVF, GIFT, & ZIFT (Intra fallopian transfer gamete/zygote)

Core Readings

Taylor D J, Green NPO & G W Stout. Biological Science (2008) third edition. Cambridge university press. Ref pp 748 biology 755

Balnisky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Majumdar N. N - Vertebrate embryology

Vijayakumarn Nair K.and P. V George. A manual of developmental biology, Continental publications , Trivandrum

Zoological Society of Kerala, Study material 2002. *Biochemistry, Physiology and Developmental Biology* Published by Zoological Society of Kerala

Module IV

8 hrs

Teratology / Dymorphology.

Definition, Teratogen / Teratogenic agents. Ionizing radiation, infection (herpes virus, parvo virus-B 19, rubella virus, syphilis, cytomegalovirus , toxoplasmosis).

Developmental defects

Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR)

Congenital abnormalities (birth defects)

Structural defects (malformation, deformation, disruption) functional defects. (inborn errors of metabolism, mental retardation).

Causes of malformation. (brief accounts.)

Genetic disorders (single gene defects)

Chromosome aberration, aneuploidy (numerical abnormalities.

Structural abnormalities (deletion, insertion and re-arrangements)

Chromosomal mosaicisms

Environmental factors. (external factors)

Chemicals, drugs, hormones and vitamins.

Multifactorial and idiopathic disorders

Core Readings

Dutta 2007 Obstetrics , Church Livingstone 17 Ed

Harrison , Harrison's Book of Internal Medicine Church Livingstone 17th Ed.

Selected Further Readings

Balinsky B.I 1981 An Introduction to Embryology, W.B. Saunders and Co.

Berrill, N.J and Kars G. 1986. Developmental biology, Mc Graw Hills

Berry A. K - An introduction to embryology.

Dutta 2007 Obstetrics , Church Livingstone 17 Ed

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harrison's Book of Internal Medicine Church Livingstone 17th Ed.

Jain P. C - Elements of developmental biology.

John Rigo Fundamental Genetics Cambridge University Press. 2009

Julio Collado Vides & Relf Hofestadt Gene Regulation and Metabolism Post
genomic Computed Approaches, Ane Book 2004

Majumdar N. N - Vertebrate embryology

Melissa A – Gibbs, A practical Guide to Developmental Biology, Oxford
university press (Int. student edition) 2006

Pattern M.B. and Carlson B.C. 1974 Foundations of Embryology, TMH, New
Delhi.

Sobte R.C., Sharma V.L. Essentials of Modern Biology Press Book India 2008

Vijayakumarn Nair K.and P. V George. A manual of developmental biology,
Continental publications , Trivandrum.

Werne A Muller. Dev. Biology, Springer Verlag New York 2008

Arora M.P. Embryology. Himalaya Publishing House (Module I, Module II,
Module III)

Suresh.C. Goel. *Principles of Animal Developmental Biology*. Himalaya
Publishing House.

Arumugam. N. *Text Book of Embryology*. Saras Publication. (module I, Module II, Module III)

Sastry & Shukal. *Developmental biology*. Rastogi publications (Module I, Module II, Module III)

Web Resources

www.Wikipedia.com. (Module IV)

www.medpedia.com. (Module IV)

ZY6B09U [P] PRACTICAL 9
REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

36 hrs

Credit 1

Practical

Model/Chart/ Slide/ specimen may be used for items 1 to 5

1. Embryological studies- Blastula (frog, chick)
2. Embryo transfer, cloning, gastrula (frog, chick)
3. Amniocentesis
4. Study of placenta- pig and man
5. 18 hour, 24 hour, 33 hour and 48 hour chick embryo (18-48 hrs, any four slides).
6. Candling method.
7. Vital staining- (chick embryo)-{Has to be done by every student.}
- 8.GSI.Gonado Somatic Index(Demonstration only)
- 9.Study of male and female reproductive system of a teleost fish/cockroach
(Dissect and display,sketch and label)

SEMESTER VI**ZY6B10U CORE COURSE 10
GENETICS AND BIOTECHNOLOGY****54 hrs****Credits 3****Objectives of the Course**

1. To emphasize the central role that genetics and biotechnology plays in the life of all organisms.
2. To introduce the student to some of the present and future applications of bio-sciences
3. To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

Part I GENETICS

34 hrs

Module -I Introduction: Scope and importance of genetics, Brief explanation of the following terms- gene, alleles, genotype, phenotype, genome, homozygous and heterozygous, wild type and mutant alleles, dominant and recessive traits, test cross and back cross, reciprocal cross, Mendelism – Mendel's laws, Mendelian traits in man Chromosome theory of heredity.

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 1 &2.

Module –II **Interaction of genes:** Allelic and non Allelic. Allelic- incomplete dominance Co-dominance Non allelic interactions, – complementary 5 hrs

supplementary, epistasis – dominant (feather colour in fowl) and recessive (coat colour in mice) Polygenes (Skin colour inheritance in man) pleiotropism, modifying genes, lethal genes (Brief account with one example each) Multiple alleles(eg) Coat Colour in rabbits. Man ABO blood group Rh factor, Blood group and its inheritance (Genetic problems related to this topic are included in practicals)

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 3 &4.

Module-III Linkage and recombination of genes based on Morgan's work in *Drosophila* (Complete and incomplete linkage) .Linkage map Chromosome mapping ./.

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology Chapter 5

Module IV Sex determination: Chromosome theory of sex determination (sex chromosomes and autosomes) chromosomal mechanism (XX-XO, XX-XY, ZW-ZZ) Barr bodies and Lyon hypotheses : Sex determination in man- role of Y chromosome. Sex determination in honey bees. Genic balance theory. *Drosophila*- intersex, gynandromorphs. Hormonal Influence on sex determination Environmental influence - Hermaphroditism

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology
Genetics and Biotechnology Chapter 6

5hrs

Module V Mutations, Types of Mutations. Germinal, Sex linked mutations.
Chromosomal mutations - structural and numerical changes. Gene
mutation (point mutation) Molecular basis of gene mutations –
tautomerism- Induced mutations Physical and chemical mutagens

Core Readings

Zoological Society of Kerala Study material 2002. Cell Biology
Genetics and Biotechnology

Gardner E.J. & Snustand D.P 1984. *Principles of Genetics* (John
Wiley & Sons) New York

Module VI Extra nuclear inheritance (Cytoplasmic inheritance Characteristics: 2hrs
Organelle DNA (Mitochondrial and plastid DNA) Kappa particles
in paramecium.

Core Readings

Vijayakumaran Nair 2006, *Genetics and Molecular Biology*.
Continental Publications, Trivandrum.

Module **Bacterial genetics**; Bacterial genome Recombination in Bacteria – 5hrs
VII Bacterial transformation. Transduction, conjugation F mediated sex
duction. Resistance transfer factor (RTF) Mechanism of drug
resistance in bacteria Transposable genetic elements in bacteria,
basic components and mechanisms of transposition in bacteria.

Core Readings

Panicker S. Abraham G and Francis G. 2008. *Microbiology and Immunology* Published by Zoological Society of Kerala Chapter 10

Ananthanarayanan & Jayaram Panicker, 2006. *A textbook of Microbiology*. Orient Longman pvt. Ltd.

Module VIII	<p>Human Genetics: Karyotyping- Normal human chromosome complement. Pedigree Analysis Aneuploidy and Non disjunction. Genetic disorders in Man. Chromosomal anomalies Autosomal (eg. Down syndrome, Edward's syndrome and Cri du chat syndrome) Sex chromosomal anomalies (Klinefelter's syndrome, and Turner's syndrome) Single gene disorders Gene mutation and disorders (Brief mention) Autosomal single gene disorders (Sickle cell anaemia, brachydactyly; inborn errors of metabolism such as phenyle ketonuria, alkaptonuria). Sex linked inheritance. Definition - characteristics criss-cross inheritance. Haemophilia and colour blindness. Pseudoautosomal genes (incompletely sex-linked genes and holandric genes. Multifactorial disorders - Polygenic traits - Cleft lip and cleft palate. Sex limited and sex influenced traits in man with examples. Prenatal Diagnosis (Amniocentesis) and choriovillus sampling - Ultrasound scanning and Fetoscopy. Genetic counselling, Eugenics and Euthenics.</p>	9hrs
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Core Readings

Stern C. 1973. Principles of Human Genetics (W.H. Freeman and

Co.)

Veer Bala Rastogi – Fundamental of Mol. Biology Ane students
Education 2008

Verma P.S. and Agarwal V.K. 1988 Genetics (S. Chand and Co.
New Delhi)

Winchester A.M. 1966. Genetics (Oxford & IBH Publications.

Part II BIOTECHNOLOGY 20hrs

Module IX Definition and scope of Biotechnology (1 hr)

Core Readings

Sudha Gangal- Principles & Practice of Animal Tissue Culture.
University Press. Pp- 128-135

Module X Basic aspects of Genetic Engineering. (6hrs)

Tools-Enzymes-Restriction enzymes and DNA ligases.

Vectors-Plasmids and Phage vectors.

Isolation of gene/DNA.

Techniques-Production of recombinant DNA.Briefly mention

rDNAtransfer and screening methods.Cloning in host cells.Virus
mediated gene transfer,DNA mediated gene transfer.

Module X1 General Techniques in Biotechnology. (5 hrs)

Techniques in gene cloning;PCR technique and DNA
Amplification.

Blotting Techniques- Southern Blotting

Northern Blotting

Western Blotting

.Identification of DNA, mRNA, and Protein.

DNA hybridization, Fluorescence *insitu* Hybridization (FISH), Colony hybridization.

DNA finger printing and its applications.

RFLP- markers Applications. Gene libraries, Genomic and cDNA libraries Human DNA library, Construction of genomic library and cDNA library.

Stem cell cultures, Therapeutic cloning, human ES cell cultures, Human EG cell cultures and Human EC cell cultures, Potential uses of stem cells. Animal cell and tissue culture.

Core Readings

Sobti & Sharma 2008 *Essentials of Modern Biology* Ane's Student Edition Chapter 2 p. 89

Zoological Society of Kerala Study material 2002. Cell Biology Genetics and Biotechnology , Published by Zoological Society of Kerala

Wilson & Walker 2008 *Biochemistry and Molecular Biology* 6th edition, Cambridge University Press. Chapter -5

Core Readings

John Ringo 2009 *Fundamental Genetics* Cambridge University Press, Chapter 29.

Sobti & Sharma 2008 *Essentials of Modern Biology* Ane's Student Edition Chapter 2 p. 89