SACRED HEART COLLEGE (AUTONOMOUS), THEVARA, KOCHI, KERALA, 682013

CURRICULUM AND SYLLABI

CHOICE BASED CREDIT SEMESTER SYSTEM (CBCSS-UG)

UNDERGRADUATE PROGRAMME
IN
ZOOLOGY

(INTRODUCED FROM 2015 ADMISSION ONWARDS)

BOARD OF STUDIES IN ZOOLOGY
Sacred Heart College(Autonomous), Thevara, Kochi-13

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The BOS meeting held on 20/03/15, Friday at 3.00 PM in the department discussed and aproved the final revised syllabus for the BSc Zoology core and complimentary programes wef 2015- 2016 admisions.

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CURRICULUM

1.1 SCOPE 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.

1.2 Learning Outcomes/Attributes

The graduate of a B.Sc. Zoology programme should be able to

1. Become conscious and aware of the animal diversity
2. Appreciate the role of animal diversity in the sustenance of nature
3. Identify the animals around them
4. Understand and appreciate various physiological and biochemical changes in the human body
5. Identify various potential risk factors to health of humans
6. Analyze the positive and negative impacts of environment on our lives
7. Conscientise the impact of human interference with nature
8. Develop respect for nature and a positive attitude towards protection of our environment.
9. Understand and differentiate various genetic abnormalities

10. Understand and appreciate the role and importance of different environmental conservation programmes

11. Become aware of animals beneficial to humans

12. Understand and appreciate the possibilities of genetic engineering for human welfare.

13. Develop scientific skills in apiculture, aquaculture, poultry, sericulture and vermiculture.

14. Understand, experience and appreciate basic life skills and develop brotherhood attitudes

15. Develop skills in independent research.

16. Develop skills in scientific presentations.

17. Develop skills in effective communication and expression.

18. Develop skills in applying the tools of information technology for all activities related to zoology

19. Become an ambassador of love towards animals

1.3 DEFINITION.

1.3.1. ***'Programme'*** means a three year programme of study and examinations spread over six semesters, according to the regulations of the respective programme, thesuccessful completion of which would lead to the award of a degree.

1.3.2. ***'Semester'*** means a term consisting of a minimum of **450** contact hours distributed over 90 working days, inclusive of examination days, within **18** five-day academic weeks.

1.3.3. 'Academic Week' is a unit of five working days in which distribution of work is organized

from day-one today-five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

1.3.4 '*Academic Week'* is a unit of five working days in which distribution of work is organized from day-one today-five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

1.3.5.*'Common Course I'* means a course that comes under the category of courses for English and***'Common Course II'*** means additional language, a selection of both is compulsory for all students undergoing undergraduate programmes.

1.3.6. ***'Core course'*** means a course in the subject of specialization within a degree programme.

1.3.7. ***'Complementary Course'*** means a course which would enrich the study of core courses.

1.3.8. ***'Open course'*** means a course outside the field of his/her specialization, which can be opted by a student.

1.3.9. ***'Additional core course'***means a compulsory course for all under graduate students (as per the UGC directive) to enrich their general awareness.

1.3.10. ***'Additional Course'*** is acourse registered by a student over and above the minimum required courses.

1.3.11. ***'Credit'*** is the numerical value assigned to a course according to the relative importance of the content of the syllabus of the programme**.**

1.3.12. ***'Additional credit'*** is the numerical value assigned to Club activities, Social service, Internship etc. which is not added with the total academic credits of the students.

1.3.13. '***Internship'*** is job training for professional careers.

1.3.14.*'College Co-ordinator'* is a teacher nominated by the College Principal to co-ordinate the continuous evaluation undertaken by various departments within the college.

1.3.15. ***'Department'*** means any teaching department in a college.

1.3.16.*'Parent Department'* means the department which offers core courses within a degree programme.

1.3.17. **'*Department Council*'** means the body of all teachers of a department in a college.

1.3.18.'*Department Co-ordinator*' is a teacher nominated by a Department Council to co-ordinate the continuous evaluation undertaken in that department.

1.3.19. '*Faculty Advisor*' means a teacher from the parent department nominated by the Department Council, who will advise the student in the choice of his/her courses and other academic matters.

1.3.20. Grace Marks shall be awarded to candidates as per the University Orders issued from time to time.

1.3.21. 'Grade' means a letter symbol (e.g., A, B, C, etc.), which indicates the broad level of performance of a student in a course/ semester/programme.

1.3.22. **'Grade point'**(GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

Words and expressions used and not defined in this regulation shall have the same meaning assignedto them in the Act andStatutes.

1.4. DURATION

The duration of U.G. programmes shall be ***6 semesters***

The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March.**

A student may be permitted to complete the Programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

1.5. REGISTRATION

The strength of students for each course shall remain as per existing regulations, except in case of open courses for which there shall be aminimum of 15 and maximum of 75 students per batch, subject to a marginal increase of 10. For non-core compulsory courses the student strength shall be decided by the Academic Council of the College from time to time.

Those students who possess the required minimum attendance and progress during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next semester.

1.6.SCHEME AND COURSES

The U.G. programmes shall include (a) Common courses I & II, (b) Core courses, (c) Complementary Courses, (d) Open Course (e) Additional core course. (f) Study tour (g) Internship for English copy editor.

I) Additional credit components

(a) Talent & career club activity (optional)

(b) Social service (mandatory)

(c) Internship for Commerce, Communication and Computer applications (mandatory).

(d) Internship (desirable for other programmes).

1.7. PROGRAMME STRUCTURE FOR MODEL-I

A	Programme Duration	6 Semesters
B	Minimum credits required from common courses	38
C	Minimum credits required from Core + complementar vocational* courses including Project	79
D	Minimum credits required from Open course	03
E	Additional core course (Environmental studies)	04
	Total Credits required for successful completion of programme	124
F	Club activity (desirable)	01
G	Social service (mandatory)	01
H	Internship (desirable)	02
I	Minimum attendance required	75%

1.8. EXAMINATIONS.

The evaluation of each course shall contain two parts:

(i) CONTINUOUS INTERNAL ASSESSMENT (CIA)

(ii) END-SEMESTER EXAMINATION (ESE)

The internal to external assessment ratio shall be 1:3, for both courses with or without practical. There shall be a maximum of 75 marks for external evaluation and maximum of 25 marks for internal evaluation.

1.9. Computation of Grade and Grade points.

For all courses (theory & practical), grades are given on a 07-point scale based on the total percentage of marks. ***(CIA+ESE)*** as given below

Percentage of Marks	**Grade**	**Grade Point**
90 and above	A+ - Outstanding	10
80-89	A - Excellent	9
70-79	B - Very Good	8
60-69	C - Good	7
50-59	D - Satisfactory	6
40-49	E - Adequate	5
Below 40	F - Failure	0

Note: Decimal are to be rounded to the next whole number

1.9.1 Computation of SGPA

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses and the sum of the number of credits of all the courses undergone by a student in a semester.

SGPA (Si) = $\sum(C_i \times G_i) / \sum C_i$

Where$C_i$is the number of credits of the ith course and $G_i$is the grade point scored by the student in the ith course.

1.9.2 Computation ofCGPA

i. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = $\sum(Ci \times Si) / \sum Ci$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Note: The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts

i. Computation of SGPA and CGPA

Illustration for **SGPA**

Course	**Cr**	**Grade lette**	**Grade poir**	**Credit Point** (Credit x G
Course 1	3	B	8	3 X 8 = 24
Course 2	4	C	7	4 X 7 = 28
Course 3	3	D	6	3 X 6 = 18
Course 4	3	A^+	10	3 X 10 = 30
Course 5	3	E	5	3 X 5 = 15
Course 6	4	D	6	4 X 6 = 24
	20			139

Thus, **SGPA =139/20 =6.95**

Illustration for **CGPA**

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**
Credit : 20 SGPA:6.9	Credit : 22 SGPA:7.8	Credit : 25 SG 5.6	Credit : 26 SGPA:6.0
Semester 5	**Semester 6**		
Credit : 26 SGPA:6.3	Credit : 25 SGPA: 8.0		

Thus, **CGPA =** $\frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144}$ = **6.73**

Grades for the different semesters and overall programme are given based

On the corresponding SGPA/ CGPA as shown below:

SGPA/*CGPA*	**Grade**
Above 9	***A+ - Outstanding***
Above 8, but below or equal to 9	***A - Excellent***
Above 7, but below or equal to 8	***B -Very Good***
Above 6, but below or equal to 7	***C – Good***
Above 5, but below or equal to 6	***D – Satisfactory***
Above 4, but below or equal to 5	***E – Adequate***
4 or below	***F – Failure***

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a course.

For a pass in a programme, a separate minimum of Grade E is required for all the individual courses. If a candidate secures **F** Grade for any one of the courses offered in a Semester/Programme only **F** grade will be awarded for that Semester/Programme until he/she improves this to **E** grade or above within the permitted period. Candidate secure **E** grade and above will be eligible for higher studies.

1.10. Detailed Distribution of Courses

Choice-based Credit and Semester System: B.Sc. (Zoology) Programme

Semester	Course Title	Hrs/ We	Credits
I	English I	5	4
	English Common I	4	3
	Second Language I	4	4
	Core Course 1 Animal Diversity - Non Chordata I	2	2
	Core Course 1 Practical Animal Diversity - Non Chordata I	2	1
	1st Complementary Course Chemistry I/Biochemistry	2	2
	1st Complementary Course Chemistry Practicals I	2	1
	2nd Complementary Course Botany I	2	2
	2nd Complementary Course Botany Practicals I	2	1
	To	**25 hrs**	**20**
	Course Title	**Hrs/ We**	**Credits**
II	English II	5	4
	English Common II	4	3
	Second Language II	4	4
	Core Course 2 Animal Diversity - Non Chordata II	2	2
	Core Course 2 Practical Animal Diversity - Non Chordata II	2	1
	1st Complementary Course Chemistry II/Biochemistr	2	2
	1st Complementary Course Practicals II	2	1
	2nd Complementary Course Botany II	2	2
	2nd Complementary Course Practicals II	2	1
	Additional Core Course (Environmental Studies)	4	4
	To	**29 hrs**	**24**
	Course Title	**Hrs/ We**	**Credits**
III	English III	5	4
	Second Language Common I	5	4
	Core Course 3 Animal Diversity - Chordata	3	3
	Core Course 3 Practical Animal Diversity - Chordata	2	1
	1st Complementary Course III Chemistry III/Biochemistry III	3	3
	1st Complementary Course III Practicals III	2	1
	2nd Complementary Course III Botany III	3	3
	2nd Complementary Course III Practicals III	2	1
	To	**25 hrs**	**20**
	Course Title	**Hrs/ We**	**Credits**
	English IV	5	4
	Second language Common II	5	4
	Core Course 4 Applied Zoology	3	3

IV	Core Course 4 Practical Applied Zoology	2	1
	1st Complementary Course IV Chemistry IV/ Biochemistry IV	3	3
	1stComplementary Course IV Chem. Practicals.	2	1
	2nd Complementary Course IV Botany IV	3	3
	2nd Complementary Course IV Botany Practicals.	2	1
	To	**25 hrs**	**20**
	Course Title	**Hrs/ We**	**Credits**
V	Core Course 5 Cell Biology and Molecular Biology	3	3
	Core Course 6 Environmental Biology, Toxicology ar Disaster management	3	3
	Core Course 7 Evolution, Zoogeography and Etholog	3	3
	Core Course 8 Biochemistry, Human Physiology and Endocrinology	3	4
	Core Course Practicals (Core 5, 6, 7 &8)	8	4
	Core Course Field Study , Study tour and Group activ (Credit 1 in 6th semester with investigatory project a visit to research institutes.)	1	
	Open Course (For other streams) Human Genetics, Nutrition, Community health and Sanitation	4	3
	To	**25 hrs**	**20**
	Course Title	**Hrs/ We**	**Credits**
VI	Core Course 9 Reproductive and Developmental Biology	3	3
	Core Course 10 Genetics and Biotechnology	3	3
	Core Course 11 Microbiology and Immunology	3	3
	Core Course 12 – General informatics, Bioinformatic Biostatistics and Research Methodology	3	3
	Core Course Elective- Nutrition, Community Health, and Sanitation	4	3
	Core Course Practicals (9,10,11 & 12)	8	4
	Project work & Field Visit/Study Tour, Visit to resear institutes , Group activity	1	1
	To	**25 hrs**	**20**

Total credits for core and complementary - 79
Additional core course 4
Open - 3

86

Total credits for English and second language-	**38**

Total	**124**

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 Field Study and Group activity	16 1	8
Sixth semester	16	8
Project work (in 6th semester), Visit to research institutes	1	

RECORDS

1. Animal Diversity - Non-Chordata I
2. Animal Diversity - Non-Chordata II
3. Animal Diversity - Chordata
4. Applied Zoology
5. Cell Biology and Molecular Biology
6. Environmental Biology, Toxicology and Disaster Management
7. Evolution, Zoogeography and Ethology
8. Biochemistry, Human Physiology and Endocrinology
9. Reproductive and Developmental Biology
10. Genetics and Biotechnology
11. Microbiology and Immunology
12. Computer Application, Bioinformatics, Biostatistics and Research Methodology

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 semes	Code	Name of core course	Hrs	Inst Hrs/wk	Cred
1	15U1CRZOO01	Animal Diversity - Non-Chordata I	36	2	2
1	15U2PRZOO01	Practical 1 -Animal Diversity - Non-Chordata I& II (examination only in second semester)	36	2	1
2	15U2CRZOO02	Animal Diversity - Non-Chordata II	36	2	2
2	15U2PRZOO01	Practical 1 -Animal Diversity - Non-Chordata I& II	36	2	1
3	15U3CRZOO03	Animal Diversity - Chordata	54	3	3
3	15U4PRZOO02	Practical 2-Animal Diversity - Chordata Applied Zoology (examination only in fourth semester)	36	2	1
4	15U4CRZOO04	Applied Zoology	54	3	3
4	15U4PRZOO02	Practical 2-Animal Diversity - Chordata Applied Zoology	36	2	1
5	15U5CRZOO05	Cell Biology and Molecular Biology	54	3	3
5	15U5CRZOO06	Environmental Biology, Toxicology an Disaster Management	54	3	3
5	15U5CRZOO07	Evolution, Zoogeography and Ethology	54	3	3
5	15U5CRZOO08	Biochemistry, Human Physiology and Endocrinology	54	3	3
5	15U6PRZOO03	Practical3 – Environmental Biology, Toxicology, Disaster Management, Evolution, Zoogeography and Etholog (Examination only in sixth semester)	36+36	2+2	1+
5	15U6PRZOO04	Practical 4 – Cell Biology, Molecular Biology, Genetics & Biotechnology (Examination only in sixth semester)	36	2	1
5	15U6PRZOO05	Practical 5 - Biochemistry, Human Physiology, Endocrinology, Reproduct Biology & Developmental Biology (Examination only in sixth semester)	36	2	1
6	15U6CRZOO09	Reproductive and Developmental Biol	54	3	3
6	15U6CRZOO10	Genetics and Biotechnology	54	3	3
6	15U6CRZOO11	Microbiology and Immunology	54	3	3
6	15U6CRZOO12	General informatics Bioinformatics an Biostatistics	54	3	3

6	15U6CRZOO13	Nutrition, community health and Sanitation	72	4	3
5	15U6PRZOO04	Practical 4 – Cell Biology, Molecular Biology, Genetics & Biotechnology	36	2	1
5	15U6PRZOO05	Practical 5 - Biochemistry, Human Physiology, Endocrinology, Reproduct and Developmental Biology	36	2	1
6	15U6PRZOO06	Practical 6- Microbiology, Immunolog Computer application, Bio informatics Bio statistics and Research Methodolo	36+36	2+2	1+
Proje 6	15U6PRZOO13	Project and Viva (6th Semester) Visit to research institutes (6th Semest Study tour/Field study , Group activity (5th Semester)	18 18	1 1	 1
ADDITIONAL CORE COURSE					
IInd Semes	15U2ARENV1	Environmental Studies	72	4	4
OPEN COURSE FOR OTHER STREAMS					
Vth Semes	15U5OCZOO1	Human Genetics, Nutrition, Communit health and Sanitation	72	4	3

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.

COMPLEMENTARY ZOOLOGY COURSES FOR BSc. BOTANY					
Semeste	15U1CPZOO1	Animal Diversity – Non-Chordata	36	2	2
	15U2PCZOO1	Practical - Animal Diversity – Non-Chordata & Chordata (Examination only second semester)	36	2	1
Semeste	15U2CPZOO2	Animal Diversity –Chordata	36	2	2
	15U2PCZOO1	Practical - Animal Diversity – Non-Chordata & Chordata	36	2	1
Semeste	15U3CPZOO3	Human Physiology and Immunology	54	3	3
	15U4PCZOO2	Practical 2 - Human Physiology, Immunology & Applied Zoology (Examination only in the fourth semeste	36	2	1
Semeste	15 U4CPZOO4	Applied Zoology (Aquaculture, Sericultu Vermiculture and Apiculture)	54	3	3
	15U4PCZOO2	Practical 2 - Human Physiology, Immunology & Applied Zoology	36	2	1

1.11. MARKS DISTRIBUTION FOR END-SEMESTER EXAMINATION (ESE) AND CONTINUOUS INTERNAL ASSESSMENT (CIA)

Marks distribution for ESE and CIA and the components for CIA with their marks are shown below:

a) Marks of theory - **ESE** : 60

b) Marks of theory - **CIA**: 20

All the three components of the CIAare mandatory. For common course English in I Semester, internal oral examination shall be conducted instead of test paper.

Components of CIA	**MARKS**
Attendance	**5**
Seminar/Assignment (Written assignments, preparation of mod charts, posters etc., field survey, field work and other innova programmes)	**5**
Test papers-2	**10**
Total	**20**

c) Marks of Practical - ESE: 15+15=30 (only in even semesters)

d) Marks of Practial - CIA: 5+5=10 (odd and even semesters)

Components of Practical-Continuous internal assessment	**Marks**
Attendance	**2**
Record	**2**
Viva/Model Exam	**1**
Total	**5**

Percentage of attendance for Practical	**Marks**
Above 85 %	**2**
75-85	**1**
<75	**0**

Project Evaluation: (Max. marks100)

Components of Project-Evaluation	Marks
Dissertation (External)	**50**
Internal Evalutation	**25**
Viva-Voce (External)	**25**
Total	**100**

Attendance Evaluation: Theory CIA:

% of attendance	Marks
90 and above	**5**
85 – 89	**4**
80-84	**3**
76-79	**2**
75	**1**

(Decimals are to be rounded to the next higher whole number)

Pattern of questions for ESE for theory papers with practical

Total no. of question	Number of questions to b answered	Marks of each question	Total marks
8	8	1	**8**
8	6	2	**12**
6	4	5	**20**
4	2	10	**20**
26	**20**		**60**

1.12. CONDONATION OF SHORTAGE OF ATTENDANCE

Candidate can seek condonation of shortage of attendance only once in a 2 year course and twice in other courses of longer duration. Following are the rules regarding attendance requirement:-

1. Every candidate is to secure 75% attendance of the total duration of the course.

2. A candidate having a shortage of 10% can apply for condonation of shortage in prescribed form on genuine grounds. Condonation of shortage of attendance if any should be obtained at least 7 days before the commencement of the concerned semester examination.

3. It shall be the discretion of the Principal to consider such applications and condone the shortage

on the merit of each case in consultation with the concerned course teacher and HoD.

4. Unless the shortage of attendance is condoned, a candidate is not eligible to appear for the examination.

1.13. Grievance Redressal Mechanism

In order to address the grievance of students regarding Continuous internal assessment (CIA) a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1:

At the level of the concerned course teacher

Level 2:

At the level of a department committee consisting of the Head of the Department,acoordinator of internal assessment for each programme nominated by the HoD and the course teacher concerned.

Level 3:

A committee with the Principal as Chairman, Dean of concerned Faculty, HOD of concerned department and one member of the Academic council nominated by the principal every year as members.

2

SYLLABUS

B.Sc. ZOOLOGY Core Course

SEMESTER I

15U1CRZOO01 Core Course I

Animal Diversity - Non Chordata I

36 hrs

Credits 2

Course Code	15U1CRZOO01
Title of the course	Animal Diversity - Non Chordata I
Semester in which the course is to be taugh	1
No. of credits	2
No. of contact hours	36

Objectives

1. To make aware of the basic philosophy of science, its history, concepts and scope
2. To develop proper scientific mind, culture and work habits
3. To study the scientific classification invertebrate fauna

Pre-requisite:

- Basic knowledge on various sciences and definitions of scientific terms
- An awareness on basic classification of animals

PART – I BIOLOGY - THE LIFE SCIENCE

Module I. What is Biology? 2 hrs

History of Biology(Brief)

Branches of biology and its scopes.

What is science? Method of science.

Core Readings

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

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

Ervin Schrodinger 1944. What is life? Mind and Matter. Cambridge College 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.: College of Chicago Press, Chicago, IL

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

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

Module II.

Symmetry and Coelom **1 hr**

Symmetry - Asymmetry, Spherical, Radial, Biradial and Bilateral
Coelom – Acoelomates, Pseudocoelomates and Eucoelomates
Schizocoelom, Enterocoelom., Protostomia and Deuterostomia

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. Taxonomy **7 hrs**

Principles of taxonomy.

Nomenclature.

Zoological nomenclature.(ICZN)

Law of Priority.(Brief)

Homonymy and Synonymy. (Brief)

Classification – Keys and principles

Two kingdom and Five kingdom classification.

Concepts and definition of classification.

Approches of taxonomy.

Modern trends in taxonomy. (Molecular taxonomy)

Phylogeny and taxonomy.

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 :Kingdom Protista

Type: Paramecium **14hrs**

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

Module V :Kingdom Animalia **1hr**

Outline classification of Kingdom Animalia.

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.

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

MODULE VI **3 hrs**

Mesozoa - Eg. Rhopalura.

Phylum Porifera.

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 **7 hrs**

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 VII

Phylum Ctenophora. **1 hr**

Eg. Pleurobrachia.

Core Readings

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

15U2PRZOO01 Practical 1

Animal diversity – Non Chordata I

36 hours

Credit 1

1. Study of simple and compound light microscopes
2. Camera Lucida (Demonstration)
3. Simple identification. (Minimum10 specimens. All specimens by their generic names and 50% of these by their species name.)
4. Sceintific drawing. (Minimum 5 specimens)
5. Anatomy – Study of section (Hydra)
6. Study of larval forms. (Minimum four)
7. Insect identification using key. (Up to Order)

SEMESTER II

15U2CRZOO02 Core Course 2

ANIMAL DIVERSITY – Non Chordata II

36 hrs

Credits 2

Course Code	15U2CRZOO02
Title of the course	Animal Diversity - Non Chordata II
Semester in which the course is to be taugh	2
No. of credits	2
No. of contact hours	36

Objectives:

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

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

Module I

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).

Module II

Phylum Aschelminthes. **2 hrs** Eg. Enterobius.

General Topic-

Pathogenic nematodes.

Module III

Phylum Annelida **7 hrs**

Classification upto classes.

Class I- Archiannelida Eg. Polygordius

Class II – Polychaeta Eg. Chaetopterus

ClassIII- Oligochaeta Eg. Megascolex.

Class IV - Hirudinea Eg. Ozobranchus

Type - Earthworm

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

Phylum Arthropoda **12 hrs**

Type: Panaeus

Classification upto classes.

Divided into 4 subphyla.

1. Sub Phylum - Trilobitomorpha

Class - Trilobita (mention salient features).

2. Sub Phylum- Onychophora

Class – Onychophora . Eg. Peripatus (Mention its affinities).

3. Sub Phylum- Mandibulata

Class I – Crustacea Eg. Sacculina

Class II- Chilopoda Eg. Centipede

Class III – Diplopoda Eg. Millipede

Class IV - Insecta Eg. Dragon fly

4. 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 **5 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

Ciass VI- Cephalopoda Eg. Sepia

General Topic-

Pearl formation and culture

Module VI

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

Brief account on larval forms.

General Topics

1. Water vascular system.

Module VII

Minor Phyla **2 hrs**

1.General account and examples

Module VIII

Phylum Hemichordata (1 hr)

Eg. Balanoglossus (Affinities)

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.

Selected Further Readings

Anderson D.T. 2001Invertebrate Zoology Sec Edition Oxford College 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.

15U2PRZOO01: Practical 1

Animal Diversity - Non Chordata II

36 hrs Credit 1

1. **Anatomy:-**

Study of sections. (Any two)

A. Ascaris

B. Earthworm

C. Fasciola

2. **Dissections**

A. Prawn - Nervous system

B. Cockroach - Nervous system

3. **Mounting:-**

A. Cockroach - Salivary glands

B. Mouth parts - Plant bug/House fly/Mosquito/Cockroach/Honey bee (Any Two)

C. Prawn appendages.

D. Earthworm setae

4. **General identification**

A. Minimum twenty specimens. (Taxonomic classification and Ecological/Morphological/Evolutionary/Economic importance)

SEMESTER III

15U3CRZOO03: CORE COURSE 3

ANIMAL DIVERSITY – CHORDATA

54 Hrs

3 Credits

Course Code	15U3CRZOO03
Title of the course	Animal Diversity - Chordata
Semester in which the course is to be taugh	3
No. of credits	3
No. of contact hours	54

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 **3Hrs**

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

Class II Cyclostomata Eg: Petromyzon

Division 2 – Gnathostomata **10 Hrs**

Super class Pisces

Class: Chondrichthyes

Sub class - Elasmobranchi Eg: Narcine

Sub class Holocephali Eg: Chimaera

Class: Osteichthyes

Sub class – Choanichthyes

Order 1 Crossopterigii Eg: Latimeria

Order 2 Dipnoi Eg: Lepidosiren

Sub class: - Actinopterygii

Super order 1. Chondrostei Eg: Acipencer

Super order 2. Holostei Eg: Amia

Super order 3. Teleostei Eg: Sardine

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 **18Hrs**

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.

15U4PRZOO02: PRACTICAL 2

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/Virtual lab/models may be used for study.

1. Frog Viscera

2. Frog Digestive System

3. Frog Arterial System

4. Frog 9^{th}& 1^{st} 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 IV

15U4CRZOO04 CORE COURSE 4

APPLIED ZOOLOGY

3hrs/week

54 hrs

Credits 3

Course Code	15U4CRZOO04
Title of the course	Applied Zoology
Semester in which the course is to be taugh	4
No. of credits	3
No. of contact hours	54

OBJECTIVES

Equip the students interested in the applied branches of zoology with skills and knowledge which can lead to self employment opportunities.

Module 1: Aquaculture **24 hrs**

Traditional methods of aquaculture, Advantages and salient features of aquaculture Types of aquaculture, Biotic and abiotic factors of water, Importance of Alga in aquaculture, Common Cultivable fishes of Kerala Economic importance and morphology of culturable species *Catla,Rohu,Mrigal, Cyprinus carpio,Etroplus,& Tila*

.

Penaeus indicus,P.monodon,Perna viridis/Perna indicus,Pinctada fucata.

Pond culture (Construction and maintenance) Brief Description of Carp culture Composite fish culture. Integrated Fish Culture, Induced breeding in fishes, Importa Fish Diseases. Fish preservation and processing

Aquarium management, Setting up of an Aquarium, Biological filter and Aeration . Common species of Aquarium fishes.

Prawn culture, Mussel culture , Pearl culture

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Module 2 Sericulture **12 hrs**

Four species of silkworms, Life history of silkworms, Silkworm Rearing Techniques. Diseases and Pests of silkworms. Mounting of worms. Harvesting and stiffling of cocoons. Silkworm diseases. Preventive and control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

eran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Module 3 Vermiculture **6 hrs**

Species of Earthworms suitable for vermiculture. Reproduction and Life Cycle . Physi and Chemical effects of Vermiculture, Vermicomposting, Site Selection, Cement pit Soil pit . Preparation of pit. Maintenance and Monitoring

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

araman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

Module 4 Apiculture **12 hrs**

Species of Honey bees. Organization of honeybee colony. Bee keeping methods and equipments Apiary management and maintenance. Bee pasturage, Byproducts of honey bees and their uses. Diseases and pests of honey bees, control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Selected Further Readings

Alikunhi, K.h., Fish Cluture in India (ICAR, New Delhi)

Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Director. Zoological Survey of India, 1994, earthworms Resources and Vermiculture

Edwards, C.A. & Lafty, J.R. 1972 Biology of Earthworms (Chapman and Hall Led. London)

Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)

Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)

Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board Bangalore)

Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)

Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.

Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum)

Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms

Padmanabha Aiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13-76 An Account of the Oligochacta of the Travancore

Shiggene, K., 1969, Problems in Prawn Culture (American publ. Co., New Delhi)

Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Andhra Pradesh Agricultural University, Hydrabad)

Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi)

Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)

Singh, V.P.P. and Ramachandran, V., 1985 Freshwater Fish Culture (ICAR, New Delhi)

Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Ullal, S. R. and Narasimahanna, M.N., Handbook of Practical Sericulture (Central Silk Board Bombay.)

Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

15U4PRZOO02: PRACTICAL 2

APPLIED ZOOLOGY

hrs/week

1 credit

36 hrs

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

a. Economic importance and morphology of culturable species

(Catla, Rohu, Mrigal ,Grass carp, Common carp, , Etroplus

Tilapia)

Penaeus indicus,/P.monodon,/ Macrobrachium

Perna viridis/P.indicus

Pinctada fucata

b. 2 species of earthworms used in Vermiculture

c. Two species of honey bees

d. Silkworm. Cocoon/Adult

2. Castes of bees

3. Bee keeping equipments Beehive, Smoker, honey extractor

4. Beeswax, Honey, Silk, Vermicompost (Identification-Uses)

5. Chandrike used in sericulture

6. Fish diseases (any 2diagrams/specimens)

7. Fish Parasite (any one)

8. Fish – Gut content analysis to determine feeding habits.

9. Internship for a period of one week. (Optional)

SEMESTER V

15U5CRZOO05: CORE COURSE 5

CELL BIOLOGY AND MOLECULAR BIOLOGY

54 Hrs

Credits 3

Course Code	15U5CRZOO05
Title of the course	Cell Biology and Molecular BIology
Semester in which the course is to be taugh	5
No. of credits	3
No. of contact hours	54

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

s 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)

S. C. (1998) Cell Biology,Tata Mc.Graw Hill Publishing Co. NewDelhi

Module V Cell Division **3 Hrs**

Cell cycle - G_1, S, G_2 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)

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

Module VI Cell Communication **3 Hrs**

Cell signalling - Signalling molelcules (neuro- transmitters, hormones, growth factors, cytokines, vitamin A and D derivatives) Role of cyclic AMP

Core Readings

Karp. G., 1996 *Cell and Moecular 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 & 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

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

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

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

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

ıtte J Avers. (1986) Molecular Cell Biology. The Benjamin / Cummings Publishing Company I

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

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

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

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

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

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

tadtman & P. Boon Chock. (2000) Current Topics in Cellular Regulation. Academic Press

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

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

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

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

arnell. (1998) Molecular Biology. Scientific American Books Inc.

1996) Cell and Molecular Biology: Concepts and Experiments John Wiley and Sons m, New Yc

Kimball J.W. 1984 Cell Biology (Addison - Wesley Pub. Co.)

Kwang W Jeon. (1997) A Survey of Cell Biology. Academic Press

N. Jones & Dennis Chapman. (1991) Micelles, Monolayers and Biomembranes. John Willey
Sons Inc. Publication

T.A. Michael, E.R. and Toya S.K. (1975) Electron Microscopy and Cell Structure. Cambridge
University Press

n J.M. (1991) The Biology of the Cell Cycle, Cambridge University Press

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

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

unn & Dobzhanasky. (1991) Principles of Genetics. T.M.H. New Delhi.

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

G. Schultz. (2002) Basic Principles of Membrane Transport. Cambridge University Press

L Wolfe. (1981) Biology of the Cell. Wadsworth Publishing Co. Inc.

Metz and Young (1983) Cytology and Cytogenetics (Macmillan and Co. Ltd.)

M,Lilly Chacko,Abraham Samuel and Punnen Kurian 2011 Cell and Molecular Biology The Fundamentals -Green leaf publications TIES Kottayam

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

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

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

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

& Daphne. (2008) Biochemistry & Molecular Biology. Oxford University Press

15U6PRZOO04: PRACTICAL 4

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

15U5CRZOO06: CORE COURSE 6

ENVIRONMENTAL BIOLOGY, TOXICOLOGY AND

DISASTER MANAGEMENT

54 hrs

Credits 3

Course Code	15U5CRZOO06
Title of the course	Enviornmental Biology, Toxicology and Disat Management
Semester in which the course is to be taugh	5
No. of credits	3
No. of contact hours	54

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

Afflatoxin

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., Pandy S.N. 2009Essential 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

15U6PRZOO03: PRACTICAL 3

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

15U5CRZOO07: CORE COURSE 7

EVOLUTION, ZOOGEOGRAPHY AND ETHOLOGY

54 hrs

Credits 3

Course Code	15U5CRZOO07
Title of the course	Evolution, Zoogeography and Ethology
Semester in which the course is to be taugh	5
No. of credits	3
No. of contact hours	54

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, NewYork (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 Hrs 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, Evalution 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 Zoogegraphy.* 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, NewYork

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 Hrs 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.

15U6PRZOO03: PRACTICAL 3

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

15U5CRZOO08: CORE COURSE 8

BIOCHEMISTRY, HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

54 hrs

Credits 4

Course Code	15U5CRZOO08
Title of the course	Biochemistry, Human Phusiology and Endocrinology
Semester in which the course is to be taugh	5
No. of credits	4
No. of contact hours	54

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 vitamines

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 StallSchana.

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

Eckert & Randall : Animal Physiology, Mechanism & Adaptations , CBS pub, N. 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

15U6PRZOO05:PRACTICAL 5

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

15U6CRZOO09: Core course 9

REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

54 hrs

Credits 3

Course Code	15U6CRZOO09
Title of the course	Reproductive and Devolepmental Biology
Semester in which the course is to be taugh	6
No. of credits	3
No. of contact hours	54

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 I **10 hrs**

Introduction

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

Gametogenesis.

Spermatogenesis (brief account), Structure of sperm, different types. Oogenesis (brief account), significance of gemetogenesis

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.

Fertilization

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

Module II **12 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 clevage (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.

Module III **4 hrs**

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).

Module IV **4 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.

Module V **10 hrs**

Human development

Human reproductive organs (brief account only)

Sexual cycle

Estrus cycle (non-primate) and menstrual cycle (primate cycle). Hormonal control of menstrual cycle. Gametes, Blastocyst, Morula, Implantation, foetal membranes and placenta formation. 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.

Module VI **2 hrs**

Embryonic development of Drosophila

Early embryonic development (brief account only), control of genes over developmental process

Module VII **2 hrs**

Experimental embryology.

Spemann's constriction experiments, Organizer and embryonic induction.

Module VIII **4 hrs**

Applications of embryology

Contraception & birth control, Abortion – biological aspects, Assisted fertilization, Invitro fertilization (test tube baby), Embryo transfer technology, Amniocentesis, Cloning, Stem cells (Totipotency, Pleuripotency, Unipotency) and stem cell research. Ethical issues related to embryological experiments.

Module IX **2 hrs**

Regeneration in animals - General survey of regeneration among animals, different types of regeneration, limb regeneration in amphibia.

Module X **4 hrs**

Teratology / Dysmorphology.

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

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).

Core Readings

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

Dutta 2007 Obstrestics , Church Livingston 17 Ed

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 17th Ed.

Majumdar N. N - Vetebrate 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

Selected Further Readings

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

Berry A. K - An introduction to embryology.

Gibbs (2006). Practical guide to developmental biology.

Gilbert S. F - Developmental biology

Harrison , Harriosns Book of Internal Medicine Chruch Livingston 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 Computated Approaches, Ane Book 2004

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

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

Web Resources

www.Wikipedia.com. (Module IV)

www.medpedia.com. (Module IV)

15U6PRZOO05: PRACTICAL 5

REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

36 hrs

Credit 1

Practical

1. Development of Frog - cleavage stages, blastula, gastrula, neurula, tadpole (Charts/ permanent slides may be used for study).

2. Development of Chick - primitive streak stage, 24th hour, 33 hour and 48 hour chick embryo (Charts/ permanent slides may be used for study)

3. Development of Drosophila - Study the developmental stages and the life cycle from fruit fly stock culture

4. Mammalian development - Sections of Testis and Ovary (Mammalian), Study of placenta- pig and man

5. Study of the following embryological techniques - Amniocentesis, Embryo transfer, IVF, cloning (models/charts/ pictures may be used)

6. Candling of chick egg.

7. Study of male and female reproductive system of a teleost fish/cockroach (Dissect and display, sketch and label)

SEMESTER VI

15U6CRZOO10: CORE COURSE 10

GENETICS AND BIOTECHNOLOGY

54 hrs

Credits 3

Course Code	15U6CRZOO10
Title of the course	Genetics and Biotechnology
Semester in which the course is to be taugh	6
No. of credits	3
No. of contact hours	54

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 **2hrs**

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 **5 hrs**

Interaction of genes: Allelic and non Allelic. Allelic- incomplete dominance Co-dominance Non allelic interactions, – complementary, 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 **3 hrs**

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 **3 hrs**

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

Module V **5 hrs**

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

Modle VI **2 hrs**

Extra nuclear inheritance (Cytoplasmic inheritance Characteristics: Organella DNA (Mitochondrial and plastid DNA) Kappa particles in paramecium.

Core Readings

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

Module VII **5 hrs**

Bacterial genetics: Bacterial genome Recombination in Bacteria – 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 **9 hrs**

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 Cridu chat syndrome) Sex chromosomal anomalies (Klinefelter's syndrome, and Turners 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.

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 **20 hrs**

Module IX **1 hr**

Definition and scope of Biotechnology

Core Readings

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

Module X **6 hrs**

Basic aspects of Genetic Engineering.

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 XI **5 hrs**

General Techniques in Biotechnology.

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

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

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, Camebridge University Press. Chapter -5

Veer Bala Rastogi – Fundamental of Mol. Biology Ane students Education 2008 Chapter 16 p. 379-424.

Module XII **5 hrs**

Practical Applications of Biotechnology (Brief account only)

Bioremediation.

Tissue culture – Principle and uses

Technology of mammalian and plant cell culture.

Single cell protein (SCP) The economic implications of SCP. Biotechnology and Medicine:

Gene therapy

Stem cell therapy

Monoclonal antibodies,

Pharmaceuticals and Biopharmaceuticals -Hormones(insulin, somatostatin, interferon, Lymphokines , Cytokines) Antibiotics, Vaccines .

Biotechnology in agriculture and forestry – Microbial insecticides, Resistance of plants to weedicides, insect pest and microbial diseases. Production of transgenic plants .

Animal biotechnology – Genetic Engineering for transgenic animals.

Fermentation technology in food and beverages

Core Readings

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

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Singh B. D Biotechnology 2002, Kalyan Publishers New Delhi

Module XIII **3 hrs**

Problems in Biotechnology

Hazards of genetic engineering Problems of biologically active biotechnology products.Problems of biotechnological inventions:Patenting and Patent protection – Trade secrets Plant breeder's rights. Biowar and biopiracy

Core Readings

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Singh B.D. Biotechnology 2002, Kalyan Publishers Nw Delhi.

Selected Further Readings

Bala Subramanian D., C.F & Bryle & K. Dharmarajan J. Green Kunthala Jayaraman, Concept in Biotechnology. University Press 2007

Benjamin Lewin 2004 Gene VIII Oxford University Press

Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford)

C.W. Fox, J.B. Wolf Evolutionary Genetics Concept of Case Studies, Oxford university Press 2006

Colin Ratledge & Bijorn Kristiansen, Basic Biotechnology 3 rd ed. Cambridge University (2008)

De Robertis E.D. and De. Robertis E.M. 1987 cell & Molecular Biology (Lea & Febya / Info- Med)

Desmand S.T. Nicholi An introduction to Genetic Engineering Cambridge Sec, Ed. 2007.

Frank H, Stephenson Calculation for Molecular Biology and Biotechnology . Academic press 2006

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

Gerhard Fuchs. Biotechnology & in Corporative Perspective. Study in global Competition series, Ane Book 2003

Jan Vijay Aging of the Genome The dual role of DNA in life and Deaths. Oxford university Press 2008

Janarthanan S & Vincent S., Practical Biotechnology, Method of Protocols. University Press . 2007

John E. Smith Biotechnology Cambridge Low priced ed. (Third Ed) 2005

Madingan , Martinko and Parker 2002, Biology of Microorganisms , Brock Eighth Ed. Prentice Hall

Powar. C.B. 1983. Cell biology (Himalaya Publishing company)

Prave D. Faustu and Sitting W and Subasten D.A (Eds) 1987 Fundamentals of Biotechnology (VCH publishers. Germany)

R.C. Sobte and Suparna. S. Pachauri. Essentials of Biotechnology Ane Book Pvt. Ltd. 2009

Singh B.D. Biotechnology 2002, Kalyan Publishers New Delhi.

Sinnat Dunn & Dobzhansky 1959. Principles of Genetics (T.M.H. New Delhi)

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

Strickberger W.M. 1990. Genetics (Mac Millan Publishing Co.)

Sudha Gangal Biotechnology Principles And & practice of Animal Tissue culture, Universities Press 2007

Susantha Gosnalibke – Merged Evolution (Long term implication of Biotechnology and Information Technology) Gordon & Breech Pub. 2005

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.

15U6PRZOO04:PRACTICAL 4

GENETICS AND BIOTECHNOLOGY

36 hrs

Credit 1

1. Genetic problems – (Problems from each type)

(a) Mono and Dihybrid ratio (b) Back cross (c) Multiple alleles.

2. Study of barr body in human buccal epithelium.

3. Study through photographs of the Karyotype- Turner's Syndrome , Klinefelters and Down's Syndrome.

4. Study of the karyotype and idiogram from the given photograph of somatic metaphase chromosome-(Human)

5.Sexing of Drosophila melanogaster

6.Isolation of DNA (Demonstration)

7. Study of Polymerase Chain Reaction (Demonstration)

8. Western blotting of proteins from SDS-polyacrylamide gel (Demonstration)

9. Southern blotting of DNA fragments from agarosegel (Demonstration)

10. Northern Blotting of RNA molecules (Demonstration)

(Students are expected to visit the near by research institution / Biotechnology departments/ research centre, and see the demonstration of practicals 5, 6 7, and 8,/Video showif they do not have such facility in their institution)

Core Reading

S. Janardhanan and Vincent S.2008 *Practical Biotechnology Methods and protocols* Cambridge University Press.

SEMESTER VI

15U6CRZOO11: CORE COURSE 11

MICROBIOLOGY AND IMMUNOLOGY

54 hrs

Credits 3

Course Code	15U6CRZOO11
Title of the course	Microbiolgy and Immunology
Semester in which the course is to be taugh	6
No. of credits	3
No. of contact hours	54

Objectives of the course

1. To inspire the students in learning the frontier areas of biological sciences
2. To make them aware of the pathogens , health related problems, their origin and treatment.
3. To equip the students with the knowledge of modern developments and recent trends in biological sciences

PART I MICROBIOLOGY

Module1 Introduction and Scope of Microbiology

Outline classification of bacteria, fungi, viruses,

Core Readings

ker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunoloy, Study Material Series published by Zoological Society of Kerala

narayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

ı Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi 2009

Module 2 Methods in Microbiology

Sterilization and disinfection. Different methods, physical and chemical. Sterilization by moist and dry heat, by filtration, by irradiation, preparation of culture media (aerobic and anaerobic cultivation) Selective media, enrichmen

media and differential media, Plating techniques and isolation of pure colonies culture preservation techniques – refrigeration, deep freezing, freezing under liquid nitrogen and lyophilization.

Core Readings

er, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunoloy, Study Material Series published by Zoological Society of Kerala Chapter 5 p. 107-13

narayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi 2009

Module 3 Morphology and fine structure of bacteria, size, shape and arrangements. Flagella, Pili, Capsule, cell wall and its composition, Cytoplasmic membrane, protoplast, spheroplast, , nuclear material , cell inclusions, Bacterial spores

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunolog Study Material Series published by Zoological Society of Kerala Chapter 1 p. 1

narayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi 2009

Module 4 Bacterial Growth, Effect of various factors on bacterial growth. cell division., Nutritional requirements.Enumeration of bacteria ;Total count & viable count Bacterial growth curve

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Stu Material Series published by Zoological Society of Kerala Chapter 3

narayan R & C.K. Jayaram Paniker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi 2009

Module 5 Basic Virology

Viruses -Structure of Viruses Human, Animal, Plant and Bacterial Viruses. Replication of viruses, cultivation of animal and plant viruses. Viral assay

Core Readings

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunolog Study Material Series published by Zoological Society of Kerala Chapter 2

narayan R & C.K. Jayaram Paniker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi 2009

Module 6 **Infections**

Types, Primary and secondary infections. Cross infection , nosocomial infectio Infection, endogenous and exogenous infections, different sources of infectio contagious diseases (Epidemic, endemic and pandemic) modes of transmissio diseases (by food, water, air, vectors, and carriers. Mention different types of carriers, healthy carriers, convalescent carriers, temporary and chronic carrier contact carriers, paradoxical carriers , bacteraemia, Septicaemia

Core Readings

anarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunoloy, Stud Material Series published by Zoological Society of Kerala Chapter 8.

., Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasid Bhenot Publications

Module 7 Diseases caused by different pathogens, epidemiology, symptomology, principles of laboratory diagnosis of Bacterial,viral and fungal diseases: A brie study of two examples from each category bacterial:Tuberculosis & Typhoid

Viral : Infuenza & Polio

Fungal: Dermatophytoses & Candidiasis

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Stuc
Material Series published by Zoological Society of Kerala Chapter 7
narayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient
Longman Private Ltd.
ı Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editi
2009

PART II IMMUNOLOGY

Module 8 Introduction to immunology

Types of immunity, innate immunity, Mechanism of innate immunity (eg. Barri Phagocytosis, inflammation.) acquired - passive & active Vaccines types vaccines , live, killed , toxoids,recombinant DNA

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material Series published by Zoological Society of Kerala Chapter 1
Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 9 Antigens Antibodies Complements

Types of Antigens, haptens, antigenic determinants. Basic structure immunoglobulins. Different classes of immunoglobulins and functi Complement system, biological effects of complements- a brief study

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material Series published by Zoological Society of Kerala Chapter 4
Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 10 Antigen-antibody reactions, Precipitation test, Agglutination Test, Clin applications of antigen antibody reaction : Eg: Widal , VDRL , HIV test (ELI Complement fixation test, Coombs test

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material Series published by Zoological Society of Kerala
Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 11 Immune Response system

Primary and secondary lymphoid organs. Cells of the immune system Leucocytes, Lymphocytes T & B cells, Macrophages, Plasma cells, Memory ce MHC Antibody synthesis, primary and secondary responses, Monoclo antibodies – Hybridoma technology , uses,.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St Material Series published by Zoological Society of Kerala Chapter 10.

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 12 Immunopathology- immune disorders

(Hypersensitivity, autoimmunity and immunodeficiency)

Different types of hypersensitivity reactions -

Abrief study on anaphylaxis, atopy, , serum sickness and delayed hypersensitivity

Autoimmunity, mechanisms of autoimmunization

A brief study on autoimmune diseases eg. Lymphadenoid goiter,thyrotoxicosis rheumatoid arthritis and systemic lupus erythematosis

Transplantation Immunity - Graft rejection , major histocompatibility, Hun leukocyte antigen system - (HLA) immuno -suppression Immunohaematolo Immunology of blood transfusion, Erythroblastosis foetalis.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St Material Series published by Zoological Society of Kerala

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Selected Further Readings

Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Colemen: 2002 Fundamentals of Immunology

Darla J. Wise & Gordon R. Carter: 2004:Immunology A Comprehensive Review Iowa state University Press. A Blackwell science company,

Hans G. Sch Legal General Microbiology Seventh Ed. Cambridge Low Price Ed.

Helen Hapel, Maused Harney Siraj Misbah and Next Snowden: 2006 Essentials of Clinical Immunology Fifth Ed. Blackwell Publishing Company,

Heritage, J ., E.G.V. Evaus & R.A.Killungten 2007: Introductory Microbiology Cambridge University Press

Ivan Roitt: 2002 Essentials of Immunology ELBS.

K. Park, Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications

Kanika Sharema. Manual of Microbiology tools techniques 2nd Ed. Ane's student Editions 2009

Keith Wilson and John Walker, 2009, Principles and Techniques of Biochemistry and Molecular Biology Sixth Ed. Cambridge University Press

Mangi, E.M.T El. C.F.A Bryca, A.L Demain, A.K. Allman Fermentation Microbiology & Biotechnology Sec. Ed. Taylor Framics London New York 2006

Michael J. Pelczar ECS,Chan & Noel. R. Kreig, Microbiology, Tata McGraw Hill 5th ed. 1996.

Monica Cheesbrough: Laboratory Manual for Tropical Countries. Vol.II Microbiology, ELBS – Cambridge Ed. 1986.

Panicker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala.

Prakesh Arora M. Anes Illustrated Dictionary of Immunology, Ane Book India. 2002

Prescott. Microbiology 2nd edition

15U6PRZOO06: Practical 06

MICROBIOLOGY AND IMMUNOLOGY

36 hrs

Credit 1

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Working and use in Microbiology lab.
2. Cleaning and sterilization of glasswares
3. Preparation of solid and liquid media for microbial cultures. (Ingredients, pH and method of preparation)(Demonstration)
   (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar
   (b) Liquid Media (1) Nutrient broth (2) Peptone water.
   (c) Semi solid agar
   (d) Firm agar
4. Culture methods (Demonstration)
   (a) Streak plate technique and isolation of pure colonies.
   (b) Lawn culture (c) Stab culture
   (d) Pour plate culture
   (e) Liquid culture
5. Serial dilution and Standard Plate Count (SPC) calculation of C fu /ml in well water sample (demonstration).
6. Examination of microbes in living condition
   (a) Wet mount
   (b) Hanging drop method for demonstrating motility of bacteria.
7. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
8. Antibiotic sensitivity test (demonstration).
9. Preparation of a fungal smear – Lactophenol cottonblue staining and mounting
10. Determination of ABO blood groups and Rh factor (Antigen –antibody Reaction)
11. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man.

SEMESTER VI

15U6CRZOO12: CORE COURSE 12

GENERAL INFORMATICS, BIOINFORMATICS, BIOSTATISTICS AND RESEARCH METHODOLOGY

54 hrs

Credits 3

Course Code	**15U6CRZOO12**
Title of the course	General Informatics, Bioinformatics a Biostatistics and Research Methodol
Semester in which the course is to be taugh	6
No. of credits	3
No. of contact hours	54

Objectives of the course

1. To inspire the students in learning the frontier areas of biological sciences
2. To update and expand basic informatics skills and attitudes relevant to the emerging knowledge of society and also to equip the students to effectively utilize the digital knowledge resources in learning.
3. To equip the students with the knowledge of modern developments and recent trends in biological sciences
4. To familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences

Pre-requisite:

- An awareness on role of research in science

Part I GENERAL INFORMATICS 6 hrs

Module 1. Introduction 2 hrs

Microprocessors – RAM, ROM, EPROM, Memory systems, input, output devices. Disk operating systems, booting, formatting.

Core Readings

Sinha, Pradeep K. and Sinha, Priti. [2003], *Computer Fundamentals – concepts systems and applications,* Third Edition, BPB publications, New Delhi.

Module 2. Operating systems: 4hrs

DOS, Windows, Linux (only basics), MS Office (MS word, Excel, Access and PowerPoint) computer programming, Networking (LAN, WAN), Internet, World Wide Web, Databases and information retrieval.

New technology in Internet

Core Readings

Gupta, Vikas [2002], *Comdex –computer course kit,* Eight Edition, Dramtech, New Delhi.

Part II BIOINFORMATICS 18 hours

Module 3 6 hrs

Definition, Nature & Scope of Bioinformatics - Contrast between Bioinformatics and Computational Biology; Key Bio-sequences in Molecular Biology - DNA, RNA and Amino-acid sequences -Popular Databases in Bioinformatics - NCBI, DDJB, PDB, OMIM; BLAST & FASTA sequence file formats, Approach of Comparative Biology based on sequence comparison - The basic idea of sequence comparison (algorithms not required) - idea of scoring matrices

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003
2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Further Readings:

1. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.
2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
3. Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Module 4 **6 hrs.**

The Blast search engine - important features - Idea of Multiple sequence alignment – Proteomics: Basic ideas of Protein Structure prediction- Concept of Homology Modeling- Idea of Molecular Phylogenetics - advantages and computational procedure (only description of use of a package such as Phylip)-

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003

2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.

3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Selected further Readings

1.Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.

2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.

3. Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Module 5 **6 hrs.**

Basic concepts of computer Aided Drug Discovery- General description of drug discovery pipeline- concept of Personalized medicine; Bioinformatics tools: (i)Molecular Visualization Software - Rasmol (Basic features only) - (ii) ORF finding (iii) gene finding, (iii) BLAST (iv) Hydrophobicity Prediction (v) Single Nucleotide Polymorphism (SNP) prediction using GENSNIP

Core Readings

1. Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003

2. Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.

3. Rastogi et. al., Bioinformatics: Methods and Applications, Prentice Hall of India.

Slected further Readings

1. Introduction to Bioinformatics, Arthur M. Lesk, OXFORD publishers.

2. D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.

3. Xiong, Jin. [2006], *Essential Bioinformatics,* Cambridge University Press, New York.

Module 6 Future Prospects: 2 hrs.

1. Human brain Project
2. Computer simulation and visualization of molecular structure
3. Protein structure prediction.

Core Readings

Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics Basics applications in biological science and medicine,* CRC Press, Washington, D.C.

Part III BIOSTATISTICS Total- 18 hrs.

Module7. Sample & Sampling techniques 2 hrs

Collection of data, Classification of data, Frequency distribution tables, Graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves.

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 8. Measures of Central Tendency 3hrs

Mean, Median, Mode (Direct method only)

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 9. Measures of dispersion 4 hrs

Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits).

Core Readings

Dutta, Naren. [2002], *Fundamental of Biostatistics- Practical Approach,* Kanishka Publishers, New Delhi.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 10. Probability Distributions 3 hrs

Normal, Binomial, Poisson distribution (Brief description only)

Core Readings

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 11. Correlation 4 hrs

Definition, Types of correlation.

Core Readings

Campbell, R.C. [2005], *Statistics for Biologists, Cambridge Universtiy Press,* New York.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Module 12.Test of Hypothesis and Test of Significance 2 hrs

Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis. Chi- square test.

Core Readings

Campbell, R.C. [2005], *Statistics for Biologists, Cambridge Universtiy Press,* New York.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Selected Further Readings

Campell, R. 1990. Statistics for biologists. CBS Publishers and distributors.

Chavali. L.N. 2009 Bioinformatics & Bioprogramming in Cambridge University press

David. G. Kleinbaum and Mitchel Klein 2009 Survival analysis Statistics for Biology & Health 2nd .Ed. Springer International ed.

Jin Xiang 2008 Essential Bioinformatics 1st Ed. Cambridge University Press.

Khan and Khanum, 1990 Fundamentals of biostatistics

Neil C.Jones and Pavel A.Pevzner. 2004An introduction to Bioinformatics Algorithms. Ane Book Pvt Ltd.

Nikolay Kolchamvov and Ralf Hofestaedt-2008 Bioinformatics of Genome Regulation and structure. Springer international Ed.

Norman T.J. Bailey Statistical methods in biology 2007 Cambridge University press.

Paul.G. Hegg's and Teresa .K. Altwood- 2005., Bioinformatics and Molecular Evolution Blackwell publishers.

Pennington S.R. and M.J.Dunn.Proteomics.2005 Ane Books.

Rastogi, V.B .2009. Fundamentals of Biostatistics, Ane Books Pvt. Ltd. New Delhi.

Warren J.Ewens, Gregory .R.Grant. 2008. Statistical methods in Bioinformatics an Introduction

Part IV RESEARCH METHODOLOGY Total- 12 hrs.

Module I. Tools and Techniques in Biological Research 7 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, Polorization 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 II. Research Methodology **4 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 III. 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 Schimidt – 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, ILMarie, 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. Experinmental 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

15U6PRZOO06: Practical 06

General informatics, Bioinformatics, Biostatistics and Research Methodology

36 hrs

Credit 1

1. MS Word: Mail merge—Preparing mark sheet of students
2. MS Excel : To create mean and median
3. MS Access: To create grade of students
4. Internet: Access a web page on any biological topic.
5. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
6. Range and standard deviation for a biological data
7. Correlation using any biological data.
8. Download a specified sequence from NCBI and search with it in BLAST and report results with comments.
9. Download molecular structure data files of DNA, Sugar, Water etc and inspect them through Rasmol. .
10. Download a specified DNA sequence from NCBI and identify ORF & genes, if any, in it.
11. Download a specified AA sequence from NCBI and plot its hydrophobicity profile.

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12. Download and study at least two samples of genome sequences.
13. Spotters—copies of genome sequences and proteins.
14. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.
15. Micrometry –calibration and measurement of microscopic objects –low power
16. Paper chromatography
17. Instrumentation – demonstration (write notes on principle, equipment and its use)

pH Meter

Colorimeter/ Spectrophotometer

Centrifuge

Electrophoresis

Model questions of Bioinformatics (Theory and Practicals)

1. Define bioinformatics. How is it different from computational biology?
2. Explain one standard file format for bio-sequences.
3. Explain important features of NCBI or PDB.
4. How does bioinformatics help comparative biology?
5. Explain how two DNA fragments ATTT and TTT can be compared?
6. What are scoring matrices? Why is it essential in sequence comparison?
7. Explain important features of BLAST.
8. What is multiple sequence alignment? Where is it useful?
9. What is the need for protein structure prediction?
10. Explain the concept of homology modeling.
11. Compare molecular phylogenetics with traditional phylogenetics.
12. Explain the process of Tree construction using molecular phylogenetics software.
13. Explain the basic drug discovery pipeline.
14. Explain the features of Rasmol.

SEMESTER VI

15U6CRZOO13: ELECTIVE PAPER

NUTRITION, COMMUNITY HEALTH AND SANITATION

72 hrs 4 hrs/week

Credits 4

Course Code	15U6CRZOO13
Title of the course	Nutrition, Community Health and Sanitation
Semester in which the course is to be taugh	6
No. of credits	4
No. of contact hours	72

Objectives of the Course

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

Course outline

PART – I NUTRITION AND COMMUNITY HEALTH **36 hrs**

Module -I Definition and Meaning of Health **10 hrs**

Dimensions and Determination of Health

Physical Activity and Health benefits

Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skele and Muscular

Programmes on Community health promotion (Individual, Family and Socie

Dangers of alcoholic and drug abuse, medico-legal implications

Core Readings

Tomas D, Insel , Paul M and Roth Walt (2005) Fit and Well. New York; Mc Graw Hill Inc

berg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health a Fitness , London Allyn and Bacon Inc.

anders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

C. Health Education and Hygiene. Published by Prakashan Kendra, Lucknow

Module II Nutrition and Health **10 hrs**

Concept of Food and Nutrition, Balanced diet

Vitamins, Malnutrition, Deficiency Disease

Determining Caloric intake and expenditure

Obesity, causes and preventing measures – role of Diet and exercise, BMI

Core Readings

K Park, (2008) Park's Text Book of Preventive and Social Mediine 18th Edition. Banarasidass Bhenot Publication

anders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

Module III Safety Education and Health Promotion Principles of Accident prevention, Hea **10 hrs**

and Safety in daily life. Health and Safety at work. First aid and emergency ca

Common injuries and their management. Modern life style and hypokine diseases. Diabetes, Cardiovascular diseases, Diet & Cancer - Prevention a Management, Ageing, Theories of Ageing. Cellular changes with ageing.

Core Readings

an Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

anders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

Module IV Life Skills Education **6 hrs**

Physical activity, emotional adjustment and well being, Yoga, Meditation and Relaxation, Psychoneuroimmunology

Core Readings

Edlen Gordon Janes and Barttlet. Human Genatics a modern Synthesis. Publish by Boston. P 39, 266-270

PART II COMMUNITY HEALTH AND SANITATION **36 hrs**

Module V Public health and water quality. Prevention of Water borne diseases. Pota **12 hrs**
water quality monitoring and waste water management. Faecal bacteriae a
pathogenic microorganisms transmitted by water. Cholera and Typh
Determination of sanitary quality of drinking water, water purification techniq
– Methods of waste water treatment and disposal Physical and Biolog
treatment – Anaerobic digesting system
Septic tank method, Aerobic process – Oxidation ponds, trickling filters, activa
sludge processes – Vermi composting a method of solid waste management

Core Readings

r M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

a Cheesbrough, Laboratory Manual for Tropical Counties Vol.II LBS.

Module VI Public Health and Food borne diseases. Their preventive measures. Food **12 hrs**
poisoning caused by toxins produced by microbes eg Staphylococcal food
poisoning, Botulism, Salmonellosis. Food infection caused by growth of
microorganisms in the human body after the contaminated food has been eat
Eg Food Infection hepatitis (hepatitis A)

Core Readings

r M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

er S, Franis G And Abraham g. (2008) Microbiology & Immunology. Zoological Society Study Material Series. Published by Zoological Society of Kerala.

Module VII Public health and diseases **12 hrs**
Emerging pathogens and diseases - Swine Flue (H1N1), Bird Flue (H5N1), SARS
Anthrax, Reemerging pathogens and diseases –TB, Chikungunya)
Vector borne (mosquito) diseases and their control measures (Chikungun
Malaria, Filariasis and Dengu fever)
Mosquito eradication

Leptospirosis and preventive measures – Rodent control measures. Cancer – Ty of cancers, Carcinogens, Causes of Cancer, Morphological Structural Biochem & behavioural changes of cancer cells

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell Biology Genetics Biotechnology published by Zoological Society of Kerala.

K Park, (2008) Park's Text Book of Preventive and Social Medicine

Selected Further Readings

Fashey, Tomas D, Insel, Paul M and Roth Walt (2005) Fit and Well. New York; Mc Graw Hill Inc

Greenberg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health and Fitness , London Allyn and Bacon Inc.

Edlen Gordon Janes and Barttlet. Human Genatics a modern Synthesis. Published by Boston.

Monica Cheesbrough, Laboratory Manual for Tropical Countries Vol.II LBS.

Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

Pelczar M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications)

Rai. B.C. Health Education and Hygiene. Published by Prakashan Kendra, Lucknow

Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

ADDITIONAL CORE COURSE

SEMESTER II

15U2ARENV1: ENVIRONMENTAL STUDES

Module 1: The multidisciplinary nature of environmental studies

Definition, scope and importance **2 Hrs**

Need for public awareness

Module 2: Natural resources:

Renewable and non-renewable resources:

a. Forest resources: Use of over exploitation, deforestation, case studies. Timber, mining, dams and their effects on forests and tribal people.

b. Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems

c. Mineral resources: Use of exploitation and environmental effects of extracting and using mineral resources, case studies.

d. Food resources: World food problems, changes caused by agriculture and overgrazing, effect of modern agricultural fertilizers- pesticides, water logging, salinity, case studies.

e. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

Case studies

f. Land resources: Land as a resources, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources
- Equitable use of resources for sustainable lifestyles

8 Hrs

Module 3: Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem

- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction , types, characteristic features, structure and function of the following ecosystem:-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

6 Hrs

Module 4: Biodiversity and its conservation

- Introduction- definition: genetic, species and ecosystem diversity
- Biographical classification of India
- Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, national and local level
- India as mega-diversity nation
- Hot-spots of biodiversity
- Threats of biodiversity: : habitat lose, poaching of wildlife, man- wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

8 Hrs

Module 5: Environmental Pollution

Definition

- Causes, effects and control measures of:

a. Air Pollution

b. Water pollution

c. Soil pollution

d. Marine pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear pollution

- Solid waste management: Causes, effects and control measures of urban and industrial wastes
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

8 Hrs

Module 6: Social Issues and the Environment

- From unsustainable to sustainable development
- Urban problem relate to energy
- Water conservation, rain water harvesting, water shed management
- Resettlement and rehabilitation of people, its problem and concerns

Case studies

- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Case studies

- Wasteland reclamation
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control Pollution) Act

- Water (prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Module 7: Human Population and the Environment

- Population growth, variation among nations
- Population exploitation- Family welfare programme
- Environment and Human health
- Human rights
- Value education
- HIV/AIDS
- Women and child welfare
- Role of information technology in environment and human health
- Case studies. **6 Hrs**

Field work

- Visit to a local area to document environmental assets- river/forest/grassland/hill/ mountains.
- Visit to a local polluted site urban/rural/industrial/agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystem, pond, river, hill slopes etc.
- Each student has to submit a field report on any one of the above topics which forms the basis for evaluation of field work for 25 marks.

Reference

1. Agarwal, K.C.2001 Environmental Biology. NidhiPubl.Ltd.Bikaner.
2. BharuchaErach, The Biodiversity of India. Mapin Publication Pvt.Ltd, Ahamadabad-380013, India , Email: mapin@iccnel.net (R)
3. Brunner R.C, 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p

4. Clark R.S, Marine Pollution, Clanderson Press Oxford (TB)

5. Cunningham, W.P.Cooper, T.H.Gorhani,E& Hepworth, M.T.2001, Environmental Encyclopedia, JaicoPubl House, Mumbai, 1196p

6. De A.K, Environmental Chemistry, Wiley Eastern Ltd.

7. Down to Erath, Centre for Science and Environment (R)

8. Gleick, H.P.1993. Water in crisis, Pacific Institute for studies in Dev, environment & Security. Stockolmenv. Institute. Oxford Univ. Press.473p

9. Hawkins R.E, Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

10. Heywood, V.H & Watson , R.T. 1995, Global Biodiversity Assessment, Cambridge Univ.Press1140p

11. Jadhav, H &Bhosale, V.M,1995, Environmental Protection and Laws.Himalaya Pub House, Delhi284p

12. Mckinney, M.L &schoch R.M. 1996. Environmental Science system & Solutions, Web enhanced edition , 639p

13. Mhaskar A.K, Matter Hazardous, Tecno-Science publication(TB)

14. Miller T.G. Jr., Enviromental Science, Wadsworth Publicating Co. (TB)

15. Odum, E.P. 1971. Fundamentals of ecology. W.B. Saunders Co. USA, 574p

16. Rao M.N &Datta, A.K.1987, Waste Water treaement, Ofxord& IBH Publ, Co. Pvt.Ltd.345p

17. Sharma B.K.2001. Environmental Chemistry. Goel Publ. House, Meerut

18. Survey of the Environment. The Hindu (M)

19. Townsend C, Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

20. Trivedi R.K, Handbook of Environemental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)

21. Trivedi R.K and P.K Goel , Introduction to air pollution, Techno-Science Publication (TB)

22. Wagner K.D, 1998. Environmental Management. W.B Saunders Co. Phi;Adelphia, USA 499p

(M) Magazine

(R) Reference

(TB) Textbook

3

SYLLABUS OF

ZOOLOGY FOR COMPLEMENTARY COURSE (B.Sc. BOTANY PROGRAMME)

SEMESTER I

15U1CPZOO1: Animal Diversity – Non Chordata

2 hrs/week 36/hrs Credit – 2

Course Code	**15U1CPZOO1**
Title of the course	Animal Diversity - Non Chordata
Semester in which the course is to be taugh	1
No. of credits	2
No. of contact hours	36

Objectives

1. To acquire knowledge on the taxonomic status of various Invertebrate animals and animal groups.
2. To familiarize the students with the diverse group of organisms around us.
3. To develop an aptitude for understanding nature and its rich bio-diversity.

Module 1

General Introduction **1 hr**

5 Kingdom classification, Classification in general

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications. Zoological Society of Kerala

Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 2

Kingdom Protista **7 hrs**

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.)

Pathogenic protista –Plasmodium, Entamoeba.

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)
Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 3

Mesozoa – eg. Rhopalura (mention 5 salient features) **2 hrs**

Parazoa

Phylum Porifera – eg Leucosolenia

Phylum Placozoa –e g. Trycoplax adherens.

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd
Vijayakumaran Nair, Jayakumar J & Paul P I (2007)
Protista & Animal Diversity Academica Publications.
Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological
Society of Kerala.

Module 4

Phylum : Coelenterata **3hrs**

Salient features, Classification up to classes

Hydrozoa – Physalia

Scyphozoa – Aurelia

Anthozoa – Adamsia

Corals and coral reefs.

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd
Vijayakumaran Nair, Jayakumar J & Paul P I (2007)
Protista & Animal Diversity Academica Publications.
Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological
Society of Kerala.

Module 5

Phylum - Platyhelminthes **2 hrs**

Salient features, classification upto classes

Turbellaria – Planaria

Trematoda – Fasciola

Cestoda – Taenia solium

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological

Society of Kerala.

Module 6

Phylum Nematoda **2 hrs**

Salient features, classification up to classes

Phasmidia - Wuchereria

Aphasmidia – Trichinella

Module 7

Phylum - Annelida **2 hrs**

Salient features, classification upto classes

Polychaeta, - Nereis

Oligochaeta – Earthworm – Pheretima

Hirudinomorpha – Hirudinaria

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological

Society of Kerala.

Module 8

Phylum Arthropoda **10 hrs**

Salient features

Type - Prawn - Penaeus

Classification upto classes

Subphylum Chelicerata

Class 1. Merostoma – Limulus

2. Arachinida – Spider

3. Pycnogonida – Nymphon

Subphylum Mandibulata

Class 1. Crustacea – Daphnia

2. Chilopoda - Centepede

3. Symphyla - Scutigerella

4. Diplopoda - Millipede

5. Pauropoda - Pauropus

6. Insecta - Butterfly

(Detailed account of examples are not necessary)

Phylum Onychophora – eg. Peripatus (Mention its affinities)

Insect pests

Pests of coconut – *Oryctes rhinoceros*, *Rhynchophorus ferrugineus, Nephantis serinopa*, *Eriophid mite*

Pests of paddy – *Leptocorisa acuta, Spodoptera mauritius*

Pests of stored grains - *Trogoderma granarium*, *Tribolium castaneum, Sitophilu oryzae*

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala.Animal Diversity (2002). Published by Zoological Society of Kerala.

Module: - 9

Phylum – Mollusca **3 hrs**

Salient features and classification upto classes

Apalcophora – Neomenia

Monoplacophora – Neopalina

Bivalvia – Perna

Polyplacophora – Chiton

Gastropoda – Xancus

Cephalopoda – Sepia

Scaphopoda – Dentalium

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P

I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological

Society of Kerala.

Module 10

Phylum - Echinodermata **3 hrs**

Salient features , classification upto classes

Class 1. Asteroidea – Astropecten

2. Ophiuroidea - Ophiothrix
3. Echinoidea – Echinus
4. Holothuroidea – Cucumaria
5. Crinoidea – Antedon

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P

I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications. Zoological Society of Kerala

Animal Diversity (2002). Published by Zoological Society of Kerala.

Module 11

Phylum Hemichordata **1 hr**

Salient features eg: Balanoglossus

Core Readings

Ekambaranatha Ayyer M (1990) A Manual of Zoology, Volume 1. Invertebrate P
I and Part II S Viswanathan printers 7 Publishers Pvt.Ltd

Vijayakumaran Nair, Jayakumar J & Paul P I (2007)

Protista & Animal Diversity Academica Publications.

Zoological Society of Kerala. Animal Diversity (2002). Published by Zoological Society of Kerala.

Selected Further Readings

Barnes, R.D. , 1987. Invertebrate Zoology (W.B. Saunders, New York).

Barrington, E.J.W., 1967. Invertebrate Structure and function (ELBS and Nelson , London).

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

Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Invertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

Groove, A.J. and Newell, G.E. 1974. Animal Biology – Indian Reprint (University Book Stall, New Delhi).

Hyman, L.H. The Invertebrate vols. (McGraw-Hill) 1942. Comparative vertebrate Anatomy (The University of Chicago Press).

James R.D. (1987). Invertebrate Zoology, W.B. Saunders, New York.

Kapoor V.C. (1994). Theory and Practice of Animal Taxonomy.

Kapoor, V.C. 1994. Theory and Practice of Animal Taxonomy (Oxford and IBH Publishing Co., New Delhi.)

Kotpal R.L. Agarwal S.K. and R.P. Khetharpal (2002). Modern Text Book of Zoology.

Parker T.J and Haswell W.A. (1962). Text Book of Zoology Vol. I. Invertebrate (ELBS & Macmillan, London).

Marshall, A.J. and Williams, W.D. 1972. Text Book of Zoology Vol. Invertebrates (ELBS and Macmillan, London).

Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi.)

Nair, K.K. Ananthakrishnan, T.N. David, B.V. 1976. General and Applied Entomology (T.M.H. New Delhi).

Practicals

15U2PCZOO1: ANIMAL DIVERSITY – NON CHORDATA

2 hr/week,

36 hrs

Credit – 1

1. Scientific drawing - 5 specimens
2. Simple identification – 25 invertebrates (Out of which 15 by their scientific names)
3. T.S - Earthworm, T.S Fasciola
4. Dissection - Prawn Nervous system
5. Dissection - Cockroach Nervous system
6. Mounting – Prawn Appendages
7. Mounting – Cockroach Mouth parts

SEMESTER II

15U2CPZOO2 - ANIMAL DIVERSITY – CHORDATA

36 hrs

Credits 2

Course Code	**15U2CPZOO2**
Title of the course	Animal Diversity - Chordata
Semester in which the course is to be taugh	2
No. of credits	2
No. of contact hours	36

Objectives

1. To acquire knowledge on the taxonomic status of the various vertebrate animals and animal groups.
2. To familiarise the students with the diverse groups of organisms around us.
3. To develop an aptitude for understanding nature and its rich biodiversity.

Module I **7hrs**

Phylum Chordata

General characters of the Phylum Chordata

Classification upto classes

Sub phylum I Urochordata

General characters

Class 1 Larvacea eg . Oikopleura

2. Ascidiacea eg. Ascidia

3. Thaliacea eg. Salpa

Subphylum II Cephalochordata

General characters eg. Brachiostoma

Subphylum III Vertebrata

General characters

Division I Agnatha

General characters

Class 1 Cyclostomata eg. Petreromyzon

Class 2 Ostracodemi eg. Cephalapis

Division 2 Gnathostomata

General characters

Super class Pisces and Super class Tetrapoda

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Module II **3 hrs**

Super class Pisces

General characters

Class 1. Chondrichthyes eg. Narcine

Class 2. Osteichthyes eg. Latimeria

Accessory respiratory organs in fishes.

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Module III **16 hrs**

Super Class Tetrapoda

General characters

Class : Amphibia General characters

Type : *Rana hexadactyla*

Order I. Urodela eg. Amblystoma

II. Anura eg. Bufo

III . Apoda eg. Icthyophis

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Module IV Class Reptilia **4 hrs**

General characters

Sub class I: Anapsida Eg. Chelone

Sub class II Diapsida Eg. Chameleon

Subclass III Parapsida eg. Icthyosaurus

Poisonous and non-poisonous snakes of India

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Module V Class Aves **3 hrs**

General characters

Sub class I : Archeornithes Eg: Archaeopteryx

Sub class II. Neornithes Eg: Struthio

Flight adaptations of birds

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Module VI Class – Mammalia **3 hrs**

General characters

Sub class I Prototheria eg. Echidna

Sub Class II Metatheria eg. Macropus

Sub class III Eutheria eg. Elephas

Aquatic mammals

Core Readings

Animal Diversity (2002). Zoological Society Of Kerala Study Material Series.

Published by Zoological Society of Kerala

)eranatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and

Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Selected Further Readings

Deoras, P.J. 1981. Snakes of India (National Book Trust of India.)

Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.

Groove, A.J. and Newell, G.E. 1974. Animal Biology - Indian Reprint Universal Book Stall, New Delhi.

Induchoodan, 1986, Kweralathile Pakshikal (Kerala Sahitya Academy, Trichur).

Kapoor, V.C. 1994, Theory and Practice of Animal Taxonomy (Oxford and IBM Publishing Co. New Delhi.

Lagler, K.F. , Bardach, J.E. , Miller, R.R. Passino, D.R.M. 1977 Ichthyology (John Wiley and Sons).

Mayer, E. 1980. Principles of Systematic Zoology (Tata McGraw Hill Publishing Co. New Delhi.

Newman, H.H. 1939. Phylum Chordata, (Macmillan Pub. Co. New York)

Nigam H.C. 1978 , Zoology of Chordata (S. Chand and Co. New Delhi).

Parker, T.J. and Haswell W.A. 1962. Text Book of Zoology Col. II Vertebrates (ELBS and Macmillan , London).

Parter S.H. 1971. The Book of Indian Animals (Bombay Natural History Society).

Salim Ali, 1969. Birds of Kerala (Oxford University Press).

Sinha A.K. , Adhikari S. Ganguly, B.B. 1988. Biology of Animals Vol. II (New Central Book Agency, Calcutta.)

Whitaker, R. 1978 Common Indian Snakes – A field Guide Macmillan and Co. of India Ltd.)

Young J.Z. 1981. The life of Vertebrate s (Oxford University Press).

Young J.Z. Life of mammals) Oxford University Press).

Practicals

15U2PCZOO1 - ANIMAL DIVERSITY – CHORDATA

2 hrs/week 36 hrs **Credit I**

1. Morphology

Scientific drawing – 5 specimens of chordates

2. Simple identification of 10 chordates (Out of which 5 by their scientific names)
3. Osteology – Vertebrae and girdles of Frog
4. Snake identification - 3 poisonous and

   3 non poisonous with key

5. Mounting of placoid scales of shark
6. Dissections:

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

   1. Frog – Viscera
   2. Frog – Digestive System
   3. Frog – Arterial System
   4. Frog – Sciatic plexus
   5. Frog – Brain

SEMESTER III

15U3CPZOO3- HUMAN PHYSIOLOGY AND IMMUNOLOGY

3 hrs/week 54 hrs Credits 3

Course Code	15U3CPZOO3
Title of the course	Human Physiology and Immunology
Semester in which the course is to be taugh	3
No. of credits	3
No. of contact hours	54

Objectives

- To inspire the students in learning the frontier areas of biological sciences
- To appreciate the correlation between structure and function of organisms
- To make them aware of the health related problems, their origin and treatment.

Part I HUMAN PHYSIOLOGY **36 hrs**

Module 1 : Nutrition **3 hrs**

Malnutrition disorders, Vitamin deficiencies, and mineral deficiencies (Iron, Calcium and Iodine)

Core Readings

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

rosser & Brown 2006 : Comparative Animal Physiology

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

Module 2: Respiration **5 hrs**

Transport of O_2 and CO_2 in blood, respiratory disorders – Dyspnoea, Hypoxia, Asphy: Hypo and Hypercapnia, CO poisoning, smoking and its physiological effects.

Core Readings

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

Module 3: Circulation **7 hrs**

Blood – Composition and function, Brief account of mechanism of blood clotting; Disorders of blood clotting – Haemophilia, cerebral and pulmonary thrombosis, Cerebral haemorrhage, Blood pressure and factors controlling it; electrocardiogram, Cardiovascular disorders – Arteriosclerosis, Myocardial infraction, Angiogram and Angioplasty.

Core Readings

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

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

Module 4 Excretion **6 hrs**

Structure of human nephrone, composition of urine – normal and abnormal constituents, urine formation (ultra filtration , selective reabsorption, tubular secret and counter current mechanism); Hormonal control of renal function, Kidney disorders – myeleonephritis, glomerular nephritis, nephrotic syndrome, Dialysis

Core Readings

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

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

Module 5 Neurophysiology **6 hrs**

Structure of typical neuron, myelenated and non myelenated nerve fibres; Nerve impulse – initiation and propagation of nerve impulse, All or none law, Saltatory conduction, Synaptic transmission, Neurotransmitters, Brian waves, Electroencephalogram, Neural disorders – Parkinson's disease, Epilepsy, Alzheimier' syndrome, Dyslexia.

Core Readings

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

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

Module 6 Muscle Physiology **4 hrs**

Striated, Non striated and Cardiac muscle, Ultra structure of striated muscle fibre, Mechanism of muscle contraction, Threshold and spike potential, Fatigue, O_2 dept, Rigor mortis.

Core Readings

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

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

Module 7 Endocrinology **5 hrs**

Endocrine glands and their hormones, mode of action (in brief) , Hypothalamus, Pituitary , Thyroid, Parathyroid, Thymus , Islets of Langerhands, Adrenal, Testis and ovary , Hormonal disorders.

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

Part II IMMUNOLOGY **18 hrs**

Module 8 **3 hrs**

Introduction to immunology

Types of immunity, innate immunity , acquired, passive , active

Mechanism of innate immunity (eg. Barriers , phagocytosis , inflammation)

Complement System, biological effects of complements.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St Material Series published by Zoological Society of Kerala Chapter 1

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 9 **5 hrs**

Antigens and antibodies

Types of antigens , haptens, antigenic determinants.

Basic structure of immunoglobulins , Different classes of immunoglobulins and functions.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material Series published by Zoological Society of Kerala Chapter 4

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 10 **5 hrs**

Antigen antibody reactions

Precipitation test, agglutination test ,

Clinical applications of antigen antibody reaction, Widal, VDRL, HIV test (ELISA),

Complement Fixation Test, and Coombs test.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material; Zoological Society of Kerala

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Module 11 **5 hrs**

(Brief accounts of the followings)

Immune response system

Primary and secondary lymphoid organs,

Cells of Immune system – Leucocytes, lymphocytes, T&B cells, Macrophages, Plasma
cells , Memory cells, MHC, Antibody synthesis, Monoclonal antibodies, Hybridoma
technology

Immune disorders – hypersensitivity, Auto immunity & Immunodeficiency, AIDS,

Vaccines - Major types of vaccines (BCG, DPT, Polio vaccine and TAB vaccines). Rece
trends in vaccine preparation.

Core Readings

cker, S. Francis G., and Abraham G.K. 2008 , Microbiology and Immunology, St
Material Series published by Zoological Society of Kerala Chapter 10.

Ivan Roitt, 2002 *Essentials of Immunology ELBS*

Sobha & Sharma (2008) Essentials of Modern Biology One's Student edition PP 463-
468.

Selected Further Readings

Anthanarayan R & C.K. Jayaram Panicker. Textbook of Microbiology (2008) Orient Longman Private Ltd.

Colemen: Fundamentals of Immunology

Guyton, Medical Physiology

Ivan Roitt: Essentials of Immunology ELBS.

Madhavankutty, Medical Physiology

Mahupathra, Human Physiology, Current Books

Michael J. Pelczar ECS,Chan & Noel. R. Kreig, Microbiology, Tata McGraw Hill 5th ed. 1996.

Michael J. Gibuay, Ian A. Macdonald and Helen M. Roche, Nutrition and Metabolism.

Monica Cheesbrough: Laboratory Manual for Tropical Countries. Vol.II Microbiology, ELBS – Cambridge Ed. 1986.

Paniker S., Francis G. and Abraham G.K 2008, Microbiology and Immunology, Study Material Series published by Zoological Society of Kerala.

Park, K. Park's Text Book of Preventive and Social Medicine – 2002, 17t Ed. Banarasidass Bhenot Publications

Prosser and Brown, Comparative Animal Physiology

Sebastian Prof. M.M., Animal Physiology

William S Hoar, Animal Physiology.

Practicals

15U4PCZOO2: HUMAN PHYSIOLOGY AND IMMUNOLOGY

2Hrs/Week 36Hrs Credit 1

1. Preparation of Human Blood smear & identification of leucocytes
2. Qualitative analysis of Reducing Sugar, Protein and Lipid
3. Acion of Salivary amylase on Starch (Demonstration Only)
4. Estimation of Haemoglobin (Demonstration only)
5. Identification of human blood groups, A, AB, B and O, Rh factor
6. Instruments (Principle & use)– Sphygmomanometer , Stethoscope , Measurement o blood pressure using Sphygmomanometer (demonstration)

SEMESTER IV

15U4CPZOO4 - APPLIED ZOOLOGY (AQUACULTURE, SERICULTURE, VERMICULTURE, APICULTURE)

3hrs/week 54 hrs Credits 3

Course Code	15U4CPZOO4
Title of the course	Applied Zoology (Aquaculture, Sericultu Vermiculture, Apiculture)
Semester in which the course is to be taugh	4
No. of credits	3
No. of contact hours	54

OBJECTIVES

Equip the students interested in the applied branches of zoology with skills and knowledge which can lead to self employment opportunities.

Module 1: Aquaculture **24 hrs**

Traditional methods of aquaculture, Advantages and salient features of aquaculture Types of aquaculture, Biotic and abiotic factors of water, Importance of Alga in aquaculture, Common Cultivable fishes of Kerala Economic importance and morphology of culturable species *Catla,Rohu,Mrigal, Cyprinus carpio,Etroplus,& Tila*

.

Penaeus indicus,P.monodon,Perna viridis/Perna indicus,Pinctada fucata.

Pond culture (Construction and maintenance) Brief Description of Carp culture Composite fish culture. Integrated Fish Culture, Induced breeding in fishes, Importa Fish Diseases. Fish preservation and processing

Aquarium management, Setting up of an Aquarium, Biological filter and Aeration . Common species of Aquarium fishes.

Prawn culture, Mussel culture , Pearl culture

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

Module 2 Sericulture **12 hrs**

Four species of silkworms, Life history of silkworms, Silkworm Rearing Techniques. Diseases and Pests of silkworms. Mounting of worms. Harvesting and stiffling of cocoons. Silkworm diseases. Preventive and control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

eran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Module 3 Vermiculture **6 hrs**

Species of Earthworms suitable for vermiculture. Reproduction and Life Cycle . Physi and Chemical effects of Vermiculture, Vermicomposting, Site Selection, Cement pit Soil pit . Preparation of pit. Maintenance and Monitoring

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

araman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

Module 4 Apiculture **12 hrs**

Species of Honey bees. Organization of honeybee colony. Bee keeping methods and equipments Apiary management and maintenance. Bee pasturage, Byproducts of honey bees and their uses. Diseases and pests of honey bees, control measures.

Core Readings:

Applied Zoology; (2002) Published by Zoological Society Of Kerala

G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Selected Further Readings

Alikunhi, K.h., Fish Cluture in India (ICAR, New Delhi)

Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Director. Zoological Survey of India, 1994, earthworms Resources and Vermiculture

Edwards, C.A. & Lafty, J.R. 1972 Biology of Earthworms (Chapman and Hall Led. London)

Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)

Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)

Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board Bangalore)

Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)

Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.

Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum)

Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms

Padmanabha Aiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13-76 An Account of the Oligochacta of the Travancore

Shiggene, K., 1969, Problems in Prawn Culture (American publ. Co., New Delhi)

Shukla G.S., & Updhyay V.B., Economic Zoology (Rastogi Publ. Meerut)

Andhra Pradesh Agricultural University, Hydrabad)

Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi)

Singh, S., 1962 Bee keeping in India (ICAR, New Delhi)

Singh, V.P.P. and Ramachandran, V., 1985 Freshwater Fish Culture (ICAR, New Delhi)

Sudheeran, M.S. & John P.C., 1989 Economic Zoology (Prathibha Publ., Kottayam)

Ullal, S. R. and Narasimahanna, M.N., Handbook of Practical Sericulture (Central Silk Board Bombay.)

Venkitaraman, P.R., 1983, Text Book of Economic Zoology (Sudarsana Publ. Cochin)

Practicals

15U4PCZOO2 - APPLIED ZOOLOGY

2 hrs/week 1 credit **36 hrs**

1. General Identification, Economic importance, Morphology, scientific names and common names of the following

a. Economic importance and morphology of culturable species
(Catla, Rohu, Mrigal ,Grass carp, Common carp, , Etroplus
Tilapia)
Penaeus indicus,/P.monodon,
Perna viridis/P.indicus
Pinctada fucata

b. 2 species of earthworms used in Vermiculture

c. Two species of honey bees

d. Silkworm. Cocoon/Adult

2. Castes of bees
3. Bee keeping equipments Beehive, Smoker, honey extractor
4. Beeswax, Honey, Silk, Vermicompost (Identification-Uses)
5. Chandrika /Natrika used in sericulture
6. Fish diseases (any 2diagrams/specimens)
7. Fish Parasite (any one)

4

SYLLABUS OF ZOOLOGY

OPEN COURSE FOR OTHER STREAMS

4

SEMESTER V

OPEN COURSE FOR OTHER STREAMS

15U5OCZOO1: HUMAN GENETICS, NUTRITION, COMMUNITY HEALTH AND SANITATION

72 hrs 4hrs/Week Credits 3

Course Code	**15U5OCZOO1**
Title of the course	Human Genetics, Nutrition, Community He and Sanitation
Semester in which the course is to be taugh	5
No. of credits	3
No. of contact hours	72

Objectives of the Course

- To develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
- To emphasize the central role that biological sciences plays in the life of all organisms.

To introduce the student to some of the present and future applications of bio-sciences

- **PART I HUMAN GENETICS** **18 hrs**

Module I Human normal chromosome complement. Genetic disorders in m **9 hrs**
Chromosomal anomalies. Eg. Down Syndrome and Cridu chat syndrome. chromosomal anomalies – Syndromes- Klinefelters Syndrome and Turr Syndrome. Single gene mutation disorders- Eg. Sickle Cell anaemia. Polygen Cleft lip and palate. Sex linked inheritance – Haemophilia and Colour blindn Pre – natal Diagnosis (Amniocentesis, and Chorionic Villus Sampling) Ultra sou scanning and Fetoscopy Genetic Counselling. Eugenics and Euthenics.

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetic Biotechnology published by Zoological Society of Kerala.

Module II — Human blood groups and their inheritance pattern. Rh factor Blood transfus **9 hrs**
– Universal Donor, Universal recipient – Importance of Blood donation.
DNA finger printing and applications – Probing for criminals – Method to resc paternity and maternity disputes.
Causes of human infertility – a brief account. Human genome project – a b account.

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetic Biotechnology published by Zoological Society of Kerala.

PART – II NUTRITION AND COMMUNITY HEALTH **18 hrs**

Module -III — Definition and Meaning of Health **5 hrs**
Dimensions and Determination of Health
Physical Activity and Health benefits
Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skel and Muscular
Programmes on Community health promotion (Individual, Family and Socie
Dangers of alcoholic and drug abuse, medico-legal implications

Core Readings

, Tomas D, Insel , Paul M and Roth Walt (2005) Fit and Well. New York; Mc Gr Hill Inc

berg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health a Fitness , London Allyn and Bacon Inc.

anders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

Rai. B.C. Health Education and Hygiene. Published by Prakashan Kendra, Luckn

Module IV — Nutrition and Health **5 hrs**
Concept of Food and Nutrition, Balanced diet
Vitamins, Malnutrition, Deficiency Disease

Determining Caloric intake and expenditure

Obesity, causes and preventing measures – Role of Diet and Exercise, BMI

Core Readings

K Park, (2008) Park's Text Book of Preventive and Social Mediine 18th Edition. Banarasidass Bhenot Publication

Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book

Module V — Safety Education and Health Promotion Principles of Accident prevention, Hea — **5 hrs**

and Safety in daily life. Health and Safety at work. First aid and emergency ca

Common injuries and their management. Modern life style and hypokin diseases. Diabetese, Cardiovascular disorders - Prevention and Management.

Core Readings

Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Tay & Francis Publishers Ane Book

Module VI — Life Skills Education — **3 hrs**

Physical activity, emotional adjustment and well being,. Yoga, Meditation and Relaxation, Psychoneuroimmunology

Core Readings

Edlen Gordon Janes and Barttlet. Human Genatics a modern Synthesis. Published by Boston. P 39, 266-270

PART III COMMUNITY HEALTH AND SANITATION — **36 hrs**

Module VII — Public health and water quality. Prevention of Water borne diseases. Potabl — **12 hrs**

water quality monitoring and waste water management. Faecal bacteriae ar pathogenic microorganisms transmitted by water. Cholera and Typhoid. Determination of sanitary quality of drinking water, water purification techniques.

Vermi composting a method of solid waste management

Core Readings

r M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5t
edition. Tata McGraw Publishing Company Ltd.
Monica Cheesbrough, Laboratory Manual for Tropical Counties Vol.II LBS.

Module VIII Public Health and Food borne diseases and their prevention **12 hrs**

Food poisoning caused by toxins produced by microbes eg Staphylococcal fo
poisoning, Botulism, Salmonellosis
Food infection caused by growth of microorganisms in the human body a
the contaminated food has been eaten. Eg Food Infection hepatitis (hepatiti

Core Readings

r M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5t
edition. Tata McGraw Publishing Company Ltd.
:er S, Franis G And Abraham g. (2008) Microbiology &
Immunology. Zoological Society Study Material Series. Published by Zoologica
Society of Kerala.

Module IX Public health and diseases (a) Emerging pathogens and diseases – Swine flue **12 hrs**
(H1N1), bird flue (H5N1), SARS, Anthrax
Reemerging pathogens and diseases – TB, Chikungunya
. (b) Vector borne diseases (mosquito) and their control measures
(Chikungunya , Malaria, Filariasis and Dengu fever)
Mosquito eradication (c) Leptospirosis and preventive measures – Rodent
control measures (d) Cancer different types, causes of cancer, carcinogens,
diet & cancer (e) HIV, AIDS – causes & preventive measures

Core Readings

Zoological Society of Kerala Study Material Series 2002– Cell biology Genetic
& Biotechnology published by Zoological Society of Kerala.
K Park, (2008) Park's Text Book of Preventive and Social

Selected Further Readings

Fashey, Tomas D, Insel, Paul M and Roth Walt (2005) Fit and Well. New York; Mc Graw Hill Inc
Greenberg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health and Fitness , London Allyn and Bacon Inc.
Edlen Gordon Janes and Barttlet. Human Genatics a modern Synthesis. Published by Boston.
Monica Cheesbrough, Laboratory Manual for Tropical Counties Vol.II LBS.

Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi

Pelczar M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications)

Rai. B.C. Health Education and Hygiene. Published by Prakashan Kendra, Lucknow