ST.TERESA'S COLLEGE (AUTONOMOUS)

ERNAKULAM

(Affiliated to Mahatma Gandhi University, Kottayam)

CURRICULUM AND SYLLABI FOR

BACHELOR'S PROGRAMME IN ZOOLOGY

AND

SYLLABI FOR COMPLEMENTARY ZOOLOGY COURSES

(FOR BOTANY, HOME SCIENCE AND PSYCHOLOGY)

Under Choice Based Credit & Semester System

(2018 Admissions)

DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES IN ZOOLOGY

Sl. No.	Name of the member	Official Address	Designation
1.	**Dr. Reema Kuriakose**	**Associate Professor**, Department of Zoology, St. Teresa's College Ernakulam	**Chairperson**
2.	**Dr. Priyalakshmi G**	**Associate Professor,** Department of Zoology, Bharata Mata College, Thrikkakara.	**Subject Expert**
3.	**Dr. Mini. K.D**	**Assistant Professor,** Department of Zoology, Sree Sankara College, Kalady	**Subject Expert**
4.	**Dr. Swapna P Antony**	**Assistant Professor**, Dept. of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology Fine Arts Avenue, Kochi.-682016	**Subject Expert, Alumnus**
5.	**Dr. Meera Jan Abraham**	**Associate Professor,** Department of Zoology, St. Teresa's College Ernakulam	**Member**
6.	**Dr. Soja Louis**	**Assistant Professor**, Department of Zoology, St. Teresa's College Ernakulam	**Member**

PREFACE

As an autonomous college under Mahatma Gandhi University, St. Teresa's College has taken conscientious efforts to strengthen the curriculum by retaining all the fundamental stipulations of the University/ Higher Education Council, to ensure a well-balanced Curriculum. Within the constraints of a prescribed syllabus, we have resolved to take a collective effort to create an inspiring academic culture in the institution, essential for teachers and students to access deeper knowledge and participate in its expansion and transmission. It is also to re-articulate the almost lost or forgotten fact that production and transmission of Quality Knowledge, essential for the development of students in particular and society in general, are the primary functions of any Educational Institution.

The Syllabus restructuring of 2018 aims to provide the students many opportunities to engage with authentic, real world learning. This has been evident through the significant number of new Programmes introduced at the wake of autonomy in 2014 with their integral placement opportunities. Increasingly, however, opportunities for engagement in work-based learning that can be provided through the curriculum across a range of subject areas are creating new and exciting ways to support student learning.

I acknowledge the efforts taken by the teachers in developing Programme and Course outcomes that focus on cognitive and intellectual skills of the learners ,confidence to carry out independent and scholarly research in area of professional interest to them and to position themselves globally effective cross- cultural educators .

I congratulate the efforts taken by the Principal Dr. Sajimol Augustine M. and the team for restructuring the syllabi under the leadership of Smt. Shanty B.P in a meaningful manner. Transformation is what makes St. Teresa's distinctive. Transforming lives in order to make a real impact on the local and international stage through the creation, sharing and application of knowledge. We look forward to sharing with you the outcomes of our curriculum restructuring and these resources we hope will enable you to reflect on learning gain in our own institution.

Dr. Sr. Celine E
Director, St.Teresa's College (Autonomous)

FOREWORD

Autonomy in the field of higher education implies responsibility and accountability and this in turn leads to excellence in academics and pro active governance. St Teresa's College was given autonomous status in the year 2014 and we have made a concerted attempt to maintain a high level of quality in the standard of education that we impart.

Academic autonomy has granted us the freedom to fine tune the syllabus keeping in mind the changing needs of the new generation of students. Education in the current scenario throws up a multitude of challenges and the curricula and syllabi ought to reflect the paradigm shift that has occurred in the various disciplines. Structured feedback was taken from the Students, Alumni and the experts from the industry and the changes suggested by them were duly incorporated in the syllabi.

The Board of Studies constituted for each department meet regularly in the stipulated time frame and in depth discussions are conducted about the different dimensions of the curricula and syllabi.The IQAC team has felicitated the conduct of a number of workshops and conferences to equip the faculty with the necessary skill set to frame the syllabi, set question papers for internal tests that evaluate whether the learning outcomes enlisted in the syllabus have been achieved and to ensure the fair and transparent conduct of examinations.

The responsibility that autonomy has placed on us is indeed onerous but we have strived together to meet all the challenges that were placed in our way. We have worked towards moulding young women as responsible citizens who will carry forward the task of nation building in an exemplary manner. All effort has been made to nurture their academic ambitions as well as their skills in co curricular activities.

With sincere gratitude I acknowledge the instinct support and constant guidance extended by Rev. Sr. Dr. Vinitha, the Director of the College.

I specially thank the team headed by Smt. Shanty B. P. for updating the syllabi, the Heads of the Departments and all the faculty members for their diligence, commitment and exceptional contribution towards this endeavour.

Dr. Sajimol Augustine M.
Principal, St.Teresa's College (Autonomous)

ACKNOWLEDGEMENT

My sincere thanks and heartfelt gratitude to Dr. Mini. K.D , Assistant Professor, Department of Zoology, Sree Sankara College, Kalady, for her invaluable suggestions and timely help in framing the syllabus.

The Department is highly indebted to Dr. Priyalakshmi G, Associate Professor, Department of Zoology, Bharata Mata College, Thrikkakara, for her sincere effort to restructure various courses of the programme.

My immense thanks to Dr. Swapna P Antony, Assistant Professor, Dept. of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology for her cooperation.

The Department of Zoology, St. Teresa's college, gratefully acknowledges the role played by Dr. Jojy Alex, Associate Professor, Dept. of Chemistry, St. Thomas College, Pala, for his timely guidance in framing the syllabus.

I deeply appreciate the extreme sincerity and care with which all the members of Zoology Department, Dr. Meera Jan Abraham, Dr. Soja Louis, Dr. Helvin Vincent and Mrs. Jaya. S of St.Teresa's college who worked throughout in framing the syllabus. Special word of thanks to Mrs Jaya. S, without her diligence, sincerity and co-operation, the completion of syllabus may not have been possible.

The guidance of Dr. Usha Nair, Associate Professor and IQAC Co-ordinator, Department of Hindi and Smt. Shanty B.P., Assistant Professor, Department of Statistics, was of great help in framing the overall structure of the syllabus.

I would like to place on record my deep sense of gratitude to our Principal, Dr. Sajimol Augustine. M. and Dr. Sr. Vinitha. E. for their unstinted support during the various stages of syllabus revision.

Dr. Reema Kuriakose
Chairperson,
Board of Studies in Zoology,
St. Teresa's College (Autonomous)

CONTENTS

BACHELOR'S PROGRAMME IN ZOOLOGY
Under Choice Based Credit & Semester System
(2018 admissions onwards)

PREAMBLE

The curricula of an undergraduate programme should focus both basic and advanced concepts in Zoology. It should inspire the students in seeking higher studies in Zoology and to become an entrepreneur. It will also enable the students to get employed in the Biological Research Institutes, Industries, Educational Institutes and in the various departments of State and Central Govt. based on the subject Zoology.

The ongoing B.Sc. Zoology Programme was introduced by the Department of Zoology from the academic year 2015-2016. The new course that will be effective from the academic year 2018-2019 onwards have been drawn-up to accommodate the widening horizons of the discipline of Biological Sciences. We have followed the UGC guidelines in restructuring the syllabus and as per UGC norms, Human rightswere included along with Environmental biology paper and the use of animals is reduced for the practicals.

The major Change in the present syllabi is the Introduction of Occupational zoology Course and practicals of the same. Cell Biology course was combined with Genetics. Molecular Biology Paper was combined with Biotechnology and Bioinformatics which will provide an insight to the recent developments and techniques in various branches of Biology. The classical zoology also has been given due weightage in the present curriculum. Through project work done in the degree, students are introduced into the world of research.

GRADUATE ATTRIBUTES

- Identify and name the common animals.
- Emphasise the role of every living organism in the web of life.
- Explain the role and impact of different environmental conservation programmes
- Identify animals beneficial to humans and its rearing.
- Develop respect for nature.
- Explain various physiological changes in human beings.
- Analyze the impact of environment on Animals.
- Understand the basic concepts of genetics and various genetic abnormalities.
- Identify various potential risk factors to the health.
- Use tools of information technology for all activities related to zoology.
- An overview on Origin of life and Evolution of various organisms.
- Define processes that cause evolutionary change and explain how these processes can cause deviation from Hardy Weinberg equilibrium.
- Visualize the pattern of distribution of life on Earth.
- Knowledge on animal behavioural patterns and sociobiology of man.
- Explain the basis of Inheritance.
- Recognize the modes of interaction of genes.
- Interpret data from progeny and pedigree analysis.
- Describe the consequences of mutation and non disjunction of genes.
- Assimilate knowledge on the principles of genetic engineering and its applications.
- Knowledge on Human Rights.

AIMS AND OBJECTIVES OF THE PROGRAMME

The curriculum for Bachelor's programme in Zoology is framed in such a way that it bridges the gap between the Plus two and Post graduate programme in Zoology by providing a comprehensive and logical framework in different branches of basic Zoology. The curriculum caters to the all-round development of the student focusing on the intellectual, professional and personal development of the student.

By the end of the First year (**2nd Semester**)

1. Inculcate interest and love for nature with its myriad of living creatures.
2. Help to understand the unity of life with rich diversiy of organisms and their ecological and evolutionary significance.
3. Enable students to identify the local fauna by their common name and scientific name.
4. Familiarise students with the basic anatomy of invertebrates.
5. Encourage students to observe fauna in their natural habitat through field studies.
6. Acquire basic skills in the observation and study of nature.
7. Impart basic knowledge of various branches of zoology and general biology meant both for a graduate course and for higher studies.

By the end of the second year (**4th Semester**)

1. Understand the role of Chordates and other living organism in the web of life.
2. Impart awareness on the necessity to conserve of biosphere and instill in them the concept of sustainable development.
3. Acquire experimental skills and scientific investigation.
4. Encourage research aptitude through study of instruments and research oriented projects.
5. Acquire basic skills in the biological techniques, Biostatistics, Biophysics and Bioethics.

By the end of the third year (**6th Semester**)

1. Equip the students with basic knowledge of Environmental Biology, Human Rights, Cell Biology and genetics.
2. Acquire basic knowledge and skills in Occupational Zoology for self employment.
3. Improve the analytical skills of the student.

4. Develop teaching skills through conduct of seminars.
5. Provide computer literacy and knowledge in Bioinformatics.
6. Impart a wide knowledge on human physiology, nutrition and community health.
7. Develop research aptitude in applied branches like Endocrinology, Ethology, Microbiology, Immunology, Biochemistry and Biotechnology.
8. Impart awareness in Developmental Biology, Evolution & Zoogeography.

PROGRAMME DESIGN

The U.G. programme in Zoology must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based courses (e) Open courses and (f) Project work and Viva - voce. No course shall carry more than 4 credits. The student shall select any one open course in Semester V offered by any department other than their parent department including the physical education department, depending on the availability of infrastructure facilities, in the institution. The number of courses for the restructured programme should contain **12** compulsory core courses, **1** open course, **1** choice based course from the frontier area of the core courses, **6** core practicals, **1** project in the area of core, **8** complementary courses, **4** complementary practicals otherwise specified, from the relevant subjects for complementing the core of study. There should be **10** common courses, or otherwise specified, which includes the first and second language of study.

PROGRAMME STRUCTURE – B.Sc Zoology (Model I)

Sl.No.	Programme Duration	6 Semesters
1	Total Credits required for successful completion of the programme	**120**
2	Credits required from Common course I	**22**
3	Credits required from Common course II	**16**
4	Credits required from Core course, Choice based and Complementary courses including project	**79**
5	Credits required from Open course	**3**
6	Minimum attendance required	**75%**

Courses

The programme contains 43 courses in 6 semesters. The total credit of the programme is 120. The number of Courses for the programme should contain 12 compulsory core courses and 1 choice based course, from the frontier area of the core courses, 1 open course from other discipline and a project; 2 complementary courses each in the first four semesters from the relevant subjects for complementing the core of study. There should be 10 common courses which includes the first and second language of study.

Project

All students shall do a project related to the core course. The project can be done individually or as a group of maximum 3 students. However, the viva on this project will be conducted individually. The projects are to be identified during the 5th semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department by the end of 6th semester and are to be produced before the external examiners.

SCHEME OF COURSES

Courses	No. of courses
Common Courses	10
Core Courses (Theory)	12
Core Courses (Practicals)	6
Project	1
Choice based core	1
Complementary courses I & II (Theory)	8
Complementary courses I & II (Practicals)	4
Open Courses	1
Grand Total	**43**

COURSES WITH CREDITS

Courses	Credits
Core Courses Theory	34
Core Courses Practical	12
Open Course	3
Choice Based Core	3
Project/ Field Study / Viva	2
Total	**54**
Complementary Courses I - Theory	10
Complementary Courses I - Practical	4
Complementary Courses II - Theory	10
Complementary Courses II - Practical	4
Total	**28**
Common Courses	38
Total	**38**
Grand Total	**120**

COURSE CODE FORMAT

The programme is coded according to the following criteria.

1. The first letter plus last letter /another letter from the programme i.e., **ZY**
2. One digit to indicate the semester. i.e., **ZY1 (Zoology, 1st semester)**
3. One letter from the type of courses such as, **A** for common course, **B** for core course, **C** for Complementary course, **D** for Open course. i.e.., **ZY1B (Zoology, 1st semester Core course)**
4. Two digits to indicate the course number of that semester. i.e.., **ZY1B01 (Zoology, 1st semester, Core course, course number is 01)**
5. The letter **B** to indicate for Bachelors Programme.
6. **ZY1B01B** (Zoology, 1st semester, Core course, courses number 01,**B** for bachelors Programme)
7. **18 to indicate the year of syllabus implementation.**i.e., **ZY1B01B18**
8. The letter **P** denotes practical – it should come after the code letter for the course i.e., **BP** (core practical-e.g.ZY2BP01B18) **CP** (complementary practical-e.g.ZY2CP01B18)

ZOOLOGY CODES

Code

ZY Zoology

ZYB Zoology Core Course

ZY1B01B18, ZY2B02B18, ZY3B03B18, ZY4B04B18, ZY5B05B18, ZY5B06B18, ZY5B07B18, ZY5B08B18, ZY6B09B18, ZY6B10B18, ZY6B11B18, ZY6B12B18,

Zoology Core, Choice Based (ZY6B13aB18/ZY6B13bB18/ZY6B13cB18)

ZYBP Zoology Core Practical

(ZY2BP01B18/ZY4BP02B18/ZY6BP03B18/ZY6BP04B18/ZY6BP05B18/ ZY6BP06B18)

ZYD Zoology Open Course

ZY5D01aB18/ZY5D01bB18/ZY5D01cB18)

ZYC Zoology Complementary Zoology

(ZY1C01B18/ZY2C01B18/ZY3C01B18/ZY4C01B18)

ZYCP Zoology Complementary Zoology Practical 'Model I'

(ZY2CP01B18/ZY4CP01B18)

ZYBPR Zoology Project ZY6BPRB18.

SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS

B.SC. ZOOLOGY PROGRAMME: CORE COURSES

Name of Semester	Theory	Practical
First Semester	2	2
Second Semester	2	2
Third Semester	3	2
Fourth Semester	3	2
Fifth Semester	16	8
Field study & group activity	1	
Sixth Semester	16	8
Project work (in sixth sem), visit to research institute	1	
Total	44	24

DURATION OF THE PROGRAMME

The duration of UG programmes have 6 semesters. There shall be 2 semesters in an academic year. The odd semester commences in June and on completion, the even semester commences after a semester break. Students having a minimum of 75% average attendance for all the courses only, can register for the examination.

STRUCTURE OF THE PROGRAMME -BACHELOR'S PROGRAMME IN ZOOLOGY

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
I	Common Course I	**EN1A01B18**	**Fine-tune Your English**	5	4	20	80
		EN1A02B18	**Pearls from the Deep**	4	3	20	80
	Common Course II-	**FR1A01B18**	Second Language – 1 French **- French Language and communicative skills -I**	4	4	20	80
		MA1A01B18	Malayalam **- Kathasahithyam**				
		HN1A01B18	Hindi **- Kahaani Aur Upanyas**				
	Core Course I	**ZY1B01B18**	**General perspectives in Science & Protistan Diversity**	2	2	15	60
	Core Course Practical I	**ZY2BP01B18**	**Practical : General Perspectives in Science, Protistan Diversity & Animal Diversity – Non Chordata (**Practical exam in the II Semester)	2	-	-	-
	Complementary Course I	**CH1C01B18**	Chemistry 1 **Basic Theoretical and Analytical Chemistry**	2	2	15	60
		CH2CP01B18	Chem. Practicals: **Volumetric Analysis (**Practical exam in the II Semester)	2	-	-	-
	Complementary Course II	**BO1C01B18**	Botany 1 (Theory) **Cryptogams, Gymnosperms and Plant Pathology**	2	2	15	60
		BO2CP01B18	Botany Practicals **Cryptogams, Gymnosperms, Plant Pathology and Plant Physiology (**Practical exam in the II Semester)	2	-	-	-
			Total	**25**	**17**		

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
II	Common Course I	**EN2A03B18**	English 3 **Issues that Matter**	5	4	20	80
		EN2A04B18	English 4 **Savouring the Classics**	4	3	20	80
	Common Course II	**FR2A03B18-**	French - **French Language and communicative skills-II**	4	4	20	80
		MA2A03B18-	Malayalam - **Kavitha**				
		HN2A03B18	Hindi - **Kavita Vyakaran Aur Anuvad**				
	Core Course II	**ZY2B02B18**	**Animal Diversity- Non Chordata**	2	2	15	60
	Core Practical	**ZY2BP01B18**	**General Perspectives in Science, Protista Diversity& Animal Diversity – Non Chordata (**Combined Practical exam Semesters I & II in the II Semester)	2	2	10	40
	Complementary Course I	**CH2C01B18**	Chemistry 2 (Theory) **Basic organic chemistry**	2	2	15	60
		CH2CP01B18	Chemistry Practicals **Volumetric Analysis (**Combined Practical exam of Semesters I & II in the II Semester)	2	2	10	40
	Complementary Course II	**BO2C01B18**	Botany 2 (Theory) **Plant Physiology**	2	2	15	60
		BO2CP01B18	Botany Practicals **Cryptogams, Gymnosperms, Plant Pathology and Plant Physiology (Practical)** **(**Combined Practical exam of Semesters I & II in the II Semester)	2	2	10	40
			Total	**25**	**23**		

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
III	Common Course I	**EN3A05B18**	English 5 **Literature and/as Identity**	5	4	20	80
	Common Course II	**FR3A05B18**	Second Language-3 French- **- An Advanced course in French -I**	5	4	20	80
		MA3A05B18	Malayalam- **- Drisyakalasahithyam**				
		HN3A05B18	Hindi – **Naatak AurLambi Kavita**				
	Core Course III	**ZY3B03B18**	**Animal Diversity - Chordata**	3	3	15	60
	Core Course Practical	**ZY4BP02B18**	**Animal Diversity –Chordata, Research methodology, Biophysics & Biostatistics (**Practical exam in the IV Semester)	2	-	-	-
	Complementary Course I	**CH3C01B18**	Chemistry 3 **Inorganic and Organic Chemistry**	3	3	15	60
		CH4CP01B18	Chemistry Practicals **Organic Chemistry Practicals (**Practical exam in the IV Semester)	2	-	-	-
	Complementary Course II	**BO3C01B18**	Botany 3 **Angiosperm Taxonomy and Economic Botany**	3	3	15	60
		BO4CP01B18	Botany Practicals **Angiosperm Taxonomy, Economic botany, Anatomy and Applied Botany (**Practical exam in the IV Semester)	2	-	-	-
			Total	**25**	**17**		

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
1V	Common Course I	**EN4A06B18**	English – 6 **Illuminations**	5	4	20	80
	Common Course II	**FR4A06B18**	Second language 4 French **– An Advanced course in French –II**	5	4	20	80
		MA4A06B18	Malayalam – **Malayala Gadhyarachanakal**				
		HN4A06B18	Hindi – **Gadya Aur Ekanki**				
	Core Course 1V	**ZY4B04B18**	**Research methodology, Biophysics & Biostatistics**	3	3	15	60
	Core Practicals	**ZY4BP02B18**	**Animal Diversity –Chordata, Research methodology, Biophysics & Biostatistics (**Combined Practical exam of Semesters III IV in the IV Semester)	2	2	10	40
	Complementary Course I	**CH4C01B18**	Chemistry 4 **Advanced Bio-Organic Chemistry**	3	3	15	60
		CH4CP01B18	Chemistry Practicals **Organic Chemistry Practicals (**Combined Practical exam of Semesters III & IV in the IV Semester)	2	2	10	40
	Complementary Course II	**BO4C01B18**	Botany 4 **Anatomy and Applied Botany**	3	3	15	60
		BO4CP01B18	Botany Practicals **Angiosperm Taxonomy, Economic botany, Anatomy and Applied Botany (Practical)** **(**Combined Practical exam of Semesters III & IV in the IV Semester)	2	2	10	40
			Total	**25**	**23**		

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
V	Core Course	**ZY5B05B18**	Core Course 5 **Environmental Biology & Human rights**	3	3	15	60
		ZY5B06B18	Core Course 6 **Cell Biology & Genetics**	3	3	15	60
		ZY5B07B18	Core Course 7 **Evolution, Ethology & Zoogeography**	3	3	15	60
		ZY5B08B18	Core Course 8 **Human Physiology, Biochemistry & Endocrinology**	3	3	15	60
	Open Course	**Offered by other departments**	---	4	3	20	80
	Core Practical	**ZY6BP03B18**	Environmental Biology, Toxicology, Cell Biology & Genetics **(Practical exam and Credits in the VI Semester)**	4	-	-	-
		ZY6BP04B18	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology **(Practical exam and Credits in the VI Semester)**	4	-	-	-
		ZY6BP05B18	Developmental Biology, Microbiology & Immunology **(Practical exam in the VI Semester)**	-	-	-	-
		ZY6BP06B18	Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology **(Practical exam in the VI Semester)**	-	-	-	-
	Field study/ Project	**ZY6BPRB18**	Core Course Field Study, Study tour and Group activity (Credit 2 in 6th semester with investigatory project and visit to research institutes)	1	-	-	-
			Total	**25**	**15**		

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
VI	Core Course	**ZY6B09B18**	Core Course 9: **Developmental Biology**	3	3	15	60
		ZY6B10B18	Core Course 10: **Microbiology & Immunology**	3	3	15	60
		ZY6B11B18	Core Course 11: **Biotechnology, Bioinformatics and Molecular Biology**	3	3	15	60
		ZY6B12B18	Core Course 12: **Occupational Zoology (Apiculture, Vermiculture Sericulture & Aquaculture)**	3	3	15	60
		ZY6B13aB18 **ZY6B13bB18** **ZY6B13cB18**	Choice Based Core Course (Electives) **1 - Nutrition, Health & Life Style Management** 2 - Ecotourism & Sustainable Development 3 - Agricultural Pest Management	4	3	20	80
	Core Practical	**ZY6BP03B18**	Environmental Biology, Toxicology, Cell Biology & Genetics **(Practical exam in the VI Semester)**	-	2	10	40
		ZY6BP04B18	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology **(Practical exam in the VI Semester)**	-	2	10	40
		ZY6BP05B18	Developmental Biology, Microbiology & Immunology **(Practical exam in the VI Semester)**	4	2	10	40
		ZY6BP06B18	Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology **(Practical exam in the VI Semester)**	4	2	10	40
	Project	**ZY6BPRB18**	Project work & Field Visit/Study Tour, Visit to research institutes, Group activity	1	2	10	40
			Total	**25**	**25**		

RECORDS

1. General Perspectives in Science, Protistan Diversity& Animal Diversity – Non Chordata.
2. Animal Diversity –Chordata, Research Methodology, Biophysics & Biostatistics.
3. Environmental Biology, Toxicology, Cell Biology & Genetics
4. Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology
5. Developmental Biology, Microbiology & Immunology
6. Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology

Each record will be having external and internal evaluation. A total of 1 credit will be allotted for each record and respective practical.

Field Study/ (Study Tour)

Study tour/Field study, visit to research institute and various places of zoological importance.

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

GROUP ACTIVITY

Students are expected do one group activity in the fifth semester and submit the report in the sixth semester for external practical examination along with study tour report. A maximum of ten students can choose any one group activity like aquarium management, vermicomposting, bee keeping and conduct of zoological exhibitions, designing of posters of zoological importance, surveys related to disease outbreaks, community health programmes or any matter of zoological interest.

Consolidated Scheme for I to VI semesters Programme Structure

B.Sc. Zoology Programme (Model -1)

SCHEME OF CORE COURSES: DISTRIBUTION OF HOURS AND CREDIT

Name of semester	Course Code	Title of Course	Category	Inst Hrs/ week	Total Hrs/ Sem	Credit
		SEMESTER 1				
1	ZY1B01B18	General perspectives in Science & Protistan Diversity	Core	2	36	2
1	ZY2BP01B18	Practical: General Perspectives in Science, Protistan Diversity & Animal Diversity – Non Chordata	Core	2	36	-
		Total credits				**2**
		SEMESTER -2				
2	ZY2B02B18	Animal Diversity- Non Chordata	Core	2	36	2
2	ZY2BP01B18	Practical: General Perspectives in Science, Protistan Diversity & Animal Diversity – Non Chordata	Core	2	36	2
		Total credits				**4**
		SEMESTER -3				
3	ZY3B03B18	Animal Diversity - Chordata	Core	3	54	3
3	ZY4BP02B18	Practical: Animal Diversity – Chordata, Research methodology, Biophysics & Biostatistics	Core	2	36	-
		Total credits				**3**
		SEMESTER -4				
4	ZY4B04B18	Research methodology, Biophysics & Biostatistics	Core	3	54	3
4	ZY4BP02B18	Practical: Animal Diversity – Chordata, Research methodology, Biophysics & Biostatistics	Core	2	36	2
		Total credits				**5**
		SEMESTER -5				
5	ZY5B05B18	Environmental Biology & Human rights	Core	3	54	3
5	ZY5B06B18	Cell Biology & Genetics	Core	3	54	3
5	ZY5B07B18	Evolution, Ethology & Zoogeography	Core	3	54	3
	ZY5B08B18	Human Physiology, Biochemistry & Endocrinology	Core	3	54	3
5	Offered by other Departments	Open Course	Open course			3
5	ZY6BP03B18	Practical: Environmental Biology, Toxicology, Cell Biology & Genetics	Core	2	36	-

5	ZY6BP04B18	Practical: Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology	Core	2	36	-
5	ZY6BP05B18	Practical: Developmental Biology, Microbiology & Immunology	Core	2	36	-
5	ZY6BP06B18	Practical: Core Course Practical Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology	Core	2	36	-
		Total Credits				**15**
		SEMESTER -6				
6	ZY6B09B18	Developmental Biology	Core	3	54	3
	ZY6B10B18	Microbiology & Immunology	Core	3	54	3
6	ZY6B11B18	Biotechnology, Bioinformatics and Molecular Biology	Core	3	54	3
6	ZY6B12B18	Occupational Zoology (Apiculture, Vermiculture Sericulture & Aquaculture)	Core	3	54	3
	ZY6B13aB18	Nutrition, Health & Life Style Management	Core	4	72	3
6	ZY6BP03B18	Practical: Environmental Biology, Toxicology, Cell Biology & Genetics	Core	-	-	2
6	ZY6BP04B18	Practical: Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology	Core	-	-	2
6	ZY6BP05B18	Practical: Developmental Biology, Microbiology & Immunology	Core	4	36	2
6	ZY6BP06B18	Practical: Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology	Core	4	36	2
6	ZY6BPRB18	Project		1	18	2
		Total Credits				**25**

*** 2 Hours / week will be allotted for Practicals for each core course in all semesters. Choice based course does not have Practical hours. The Practical Examination will be conducted only in even semesters.**

*** One hour will be allotted for doing Project in 5th and 6th semester and Project evaluation will be done at the end of 6th semester.**

***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.**

SCHEME OF CHOICE BASED COURSES - DISTRIBUTION OF HOURS AND CREDIT

Sl. No.	Semester	**Course code**	**Course title**	Inst Hrs/ week	Total Hrs/ Sem	Credits
1	6	**ZY6B13aB18**	**Nutrition, Health & Life Style Management**	4	72	3
2	6	ZY6B13bB18	Ecotourism & Sustainable Development	4	72	3
3	6	ZY6B13cB18	Agricultural Pest Management	4	72	3
4	6	ZY6B13dB18	Vector & Vector borne diseases	4	72	3

SCHEME OF OPEN COURSES FOR OTHER STREAMS - Electives: DISTRIBUTION OF HOURS AND CREDIT					
Vth semester	(Zoology Department can offer any one of the 3 open courses)				
Name of semester	**Course Code**	**Name Of OpenCourse**	**Inst Hrs/ week**	**Total Hrs/ Sem**	**Credit**
5	**ZY5D01aB18**	**Human Genetics, Nutrition and Public Health**	4	72	3
5	ZY5D01bB18	Vocational Zoology (Apiculture, Vermiculture & Ornamental Fish Culture)	4	72	3
5	ZY5D01cB18	Man, Nature & Sustainable Development	4	72	3

SCHEME OF COMPLEMENTARY ZOOLOGY COURSES FOR B.Sc. BOTANY /HOME SCIENCE: DISTRIBUTION OF HOURS AND CREDIT

Name of semester	Course Code	Title of the Course	Inst Hrs/ week	Total Hrs/ Sem	Credit
Semester 1	ZY1C01B18	Non Chordate Diversity	2	36	2
	ZY2CP01B18	Non Chordate and Chordate Diversity (Practicals)	2	36	-
Semester 2	ZY2C01B18	Chordate Diversity	2	36	2
	ZY2CP01B18	Non Chordate and Chordate Diversity (Practicals)	2	36	2
Semester 3	ZY3C01B18	Physiology and Immunology	3	54	3
	ZY4CP01B18	Physiology, Immunologyand Applied Zoology (Practicals)	2	36	-
Semester 4	ZY4C01B18	Applied Zoology	3	54	3
	ZY4CP01B18	Physiology, Immunology and Applied Zoology (Practicals)	2	36	2

SCHEME OF COMPLEMENTARY ZOOLOGY COURSES FOR B.Sc. PSYCHOLOGY: DISTRIBUTION OF HOURS AND CREDIT

Name of semester	Course Code	Title of the Course	Inst Hrs/ week	Total Hrs/ Sem	Credit
Semester 1	ZY1C02B18	Body Systems and Behaviour	3	54	2
Semester 2	ZY2C02B18	Biological Basis of Behaviour II	3	54	2
Semester 3	ZY3C02B18	Neurophysiology of Behaviour	3	54	2
Semester 4	ZY4C02B18	Biophysiology of Behaviour	3	54	2

SCHEME OF EXAMINATIONS – CORE COURSE

a) SCHEME OF EXAMINATION - THEORY (CORE COURSE)

Theory Examinations will be conducted at the end of the respective semester in which the course is conducted. Duration - 3 Hrs

Sem	Course Code	Course Title	Course Category	Duration	Marks		Credits
				Hrs	Internal (I)	External (E)	
1	ZY1B01B18	General perspectives in Science & Protistan Diversity	Core Course 1	3	15	60	2
2	ZY2B02B18	Animal Diversity – Non Chordata	Core Course 2	3	15	60	2
3	ZY3B03B18	Animal Diversity-Chordata	Core Course3	3	15	60	3
4	ZY4B04B18	Research Methodology, Biophysics and Biostatistics	Core Course4	3	15	60	3
5	ZY5B05B18	Environmental Biology & Human rights	Core Course 5	3	15	60	3
5	ZY5B06B18	Cell Biology & Genetics	Core Course 6	3	15	60	3
5	ZY5B07B18	Evolution, Ethology & Zoogeography	Core Course 7	3	15	60	3
5	ZY5B08B18	Human Physiology, Biochemistry & Endocrinology	Core Course 8	3	15	60	3
6	ZY6B09B18	Developmental Biology	Core Course 9	3	15	60	3
6	ZY6B10B18	Microbiology and Immunology	Core Course 10	3	15	60	3
6	ZY6B11B18	Biotechnology, Bioinformatics & Molecular Biology	Core Course 11	3	15	60	3

6	ZY6B12B18	Occupational Zoology (Apiculture, Vermiculture Sericulture & Aquaculture)	Core Course 12	3	15	60	3
Zoology Open Cour se Sem 5 *(Select any1 from 3)*	**ZY5D01aB18**	**Human Genetics, Nutrition and Public Health**	Open course (for other streams)-1	3	20	80	3
	ZY5D01bB18	Vocational Zoology (Apiculture, Vermiculture & Ornamental Fish Culture)	Open course -2				
	ZY5D01cB18	Man, Nature & Sustainable Development	Open course -3				
Sem 6 *(Select any1 from the four)*	**ZY6B13aB18**	**Nutrition, Health & Life Style Management**	Choice Based Course-1	3	20	80	3
	ZY6B13bB18	Ecotourism & Sustainable Development	Choice Based Course-2				
	ZY6B13cB18	Vector & Vector borne diseases	Choice Based Course-3				
	ZY6B13dB18	Agricultural Pest Management	Choice Based Course-4				

b. SCHEME OF PRACTICAL EXAMINATIONS–CORE COURSE

Practical Examinations will be conducted at the end of even semester 2, 4 and 6.

Semester	Code	Practical No.	Course Title	Duration	Marks		Credits
				Hrs	Internal (I)	External (E)	
2	ZY2BP01B18	I	General Perspectives in Science, Protistan Diversity & Animal Diversity – Non Chordata	3 Hrs	10	40	2
4	ZY4BP02B18	II	Animal Diversity – Chordata, Research methodology, Biophysics& Biostatistics	3 Hrs	10	40	2
6	ZY6BP03B18	III	Environmental Biology, Toxicology, Cell Biology & Genetics	3 Hrs	10	40	2
6	ZY6BP04B18	IV	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry & Endocrinology	3 Hrs	10	40	2
6	ZY6BP05B18	V	Developmental Biology, Microbiology & Immunology	3 Hrs	10	40	2
6	ZY6BP06B18	VI	Biotechnology, Bioinformatics, Molecular Biology & Occupational Zoology	3 Hrs	10	40	2
6	ZY6BPRB18	Project	Project and Viva	-	20	80	2

c. Total Credits for Core Course

Theory	
Core + Choice Based Core (Elective)	37
Open course	3
Practical	12
Project	2
Total	**54**

a) SCHEME OF FIELD STUDY, RESEARCH INSTITUTE VISIT, GROUP ACTIVITY, PROJECT AND VIVA-CORE COURSE (Credit 2)

Marks: Maximum 100

	Internal Assessments (I)	External Assessments (E)
Project:- Log book showing the progress of project work duly signed by the supervising teacher & HOD	**20**	**Project report – 50 marks** Title- 2 Marks Abstract- 3 Marks Introduction & Review of literature- 10 Marks Methodology- 10 Marks Results- 10 Marks Discussion & Conclusion - 10 Marks Neat presentation and Novelty- 5 Marks **Presentation & Viva- 30Marks** (Student can present the project using OHP or LCD, in 7 Minutes) Viva Voce.
Total	**20**	**80**

SCHEME OF EXAMINATIONS - COMPLEMENTARY COURSE

a) SCHEME OF EXAMINATION - THEORY (COMPLEMENTARY COURSE FOR BOTANY AND HOMESCIENCE)

Theory Examinations will be conducted at the end of the respective semester in which the course is conducted. Duration - 3 Hrs

Sem	Course Code	Course Title	Course Category	Duration	Marks		Credits
				Hrs	Internal (I)	External (E)	
1	ZY1C01B18	Non Chordate Diversity	Complementary Course	3	15	60	2
2	ZY2C01B18	Chordate Diversity	Complementary Course	3	15	60	2
3	ZY3C01B18	Physiology and Immunology	Complementary Course	3	15	60	3
4	ZY4C01B18	Applied Zoology	Complementary Course	3	15	60	3

b) SCHEME OF PRACTICAL EXAMINATIONS – COMPLEMENTARY COURSE

Practical Examinations will be conducted at the end of even semester 2 and 4.

Semester	Code	Practical No.	Course Title	Duration	Marks		Credits
				Hrs	Internal (I)	External (E)	
2	ZY2CP01B18	I	Non Chordate and Chordate Diversity (Practicals)	3 Hrs	10	40	2
4	ZY4CP01B18	II	Physiology, Immunology and Applied Zoology (Practicals)	3 Hrs	10	40	2

c) SCHEME OF EXAMINATION - THEORY (COMPLEMENTARY COURSE FOR PSYCHOLOGY)

Sem	Course Code	Course Title	Course Category	Duration	Marks		Credits
				Hrs	Internal (I)	External (E)	
1	ZY1C02B18	Body Systems and Behavior	Complementary Course	3	20	80	2
2	ZY2C02B18	Biological Basis of Behaviour II	Complementary Course	3	20	80	2
3	ZY3C02B18	Neurophysiology Of Behavior	Complementary Course	3	20	80	3
4	ZY4C02B18	Biophysiology of Behaviour	Complementary Course	3	20	80	3

EXAMINATIONS

The external theory examination of all semesters shall be conducted by the College at the end of each semester. Internal evaluation is to be done by continuous assessment.
Examinations have two parts: Internal or In-Semester Assessment (ISA) &External or End–Semester Assessment (ESA). The ratio between ISA and ESA shall be 1:4. Both internal and external marks are to be rounded to the next integer.

MARKS DISTRIBUTION FOR END-SEMESTER ASSESSMENT (ESA) AND IN-SEMESTER ASSESSMENT (ISA)

Marks distribution for ESA and ISA and the components for internal evaluation with their marks are shown below:
Components of the internal evaluation and their marks are as below.

For all courses without practical
a) End–Semester Assessment (ESA): 80 marks
b) In-Semester Assessment (ISA): 20 marks

ISA - Theory	Marks
Attendance	5
Assignment/Seminar/Viva	5
Test papers (2 x 5)	10
Total	20

Attendance:

% of Attendance	Marks
>90%	5
Between 85 and 90	4
Between 80 and 85	3
Between 75 and 80	2
75 %	1
< 75	0

For all courses with practical

a) End–Semester Assessment (ESA): 60 marks

b) In-Semester Assessment (ISA): 15 marks

ISA - Theory	**Marks**
Attendance	**5**
Assignment/Seminar/Viva	**2**
Test papers (2 x 4)	**8**
Total	**15**

FOR ALL PRACTICAL PAPERS (conducted only at the end of even semesters):

(a) End–Semester Assessment (ESA): 40

(b) In-Semester Assessment (ISA): 10

ISA components	**Marks**
Attendance	**2**
Test paper (1 x 4)	**4**
Record*	**4**
Total	**10**

*Bonafide reports of the practical work conducted shall be submitted at the time of examination

FOR PROJECTS/ INDUSTRIAL VISIT/ FIELD STUDY AND VIVA-VOCE*:

(a) Marks of external Examination : 80

(b) Marks of internal evaluation : 20

Components of Project/ I.V. and Viva – Evaluation External	**Marks**
Project Report (External)	50
Presentation and Viva-voce (External)	30
Total	**80**

* Bonafide reports of the project work or Industrial Visit conducted shall be submitted at the time of examination.
* **All the four components of the internal assessment are mandatory.**

Components of Project - Internal Evaluation	**Marks**
Punctuality	5
Experimentation / Data Collection	5
Knowledge	5
Report	5
Total	**20**

ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all courses.

SEMINAR / VIVA

A student shall present a seminar in the 5th semester and appear for Viva- voce in the 6th semester for all courses.

IN SEMESTER ASSESSMENT- TEST PAPERS

Two internal test- papers are to be attended in each semester for each paper. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for twoyears and shall be made available for verification by the University. Theresponsibility of evaluating the internal assessment is vested on the teacher(s) who teach the paper.

END-SEMESTER ASSESSMENT:

The End-Semester examination of all courses shall be conducted by the College on the close of each semester. For reappearance/ improvement, students can appear along with the next batch.

Pattern of Question Paper:

A question paper shall be a judicious mix of short answer type, short essay type/ problem solving type and long essay type questions.

For each course the End-semester Assessment is of 3 hours duration. The question paper has 3 parts. Part A contains 12 objective type questions of which 10 are to be answered .Part B contains 9 short essay questions of which 6 are to be answered. Part C has 4 long essay questions of which 2 are to be answered.

Part	**No. Questions**	**No. of questions to be answered**	**Marks (for courses with practical)**	**Marks (for courses without practical)**
A (Short Answer type)	12	10	10 x 1 = 10	10 x 2 = 20
B (Short Essay)	9	6	6 x 5 = 30	6 x 5 = 30
C (Long Essay)	4	2	2 x 10 =20	2 x 15 = 30

CONDUCT OF PRACTICAL EXAMINATIONS
PRACTICAL EXAMINATION

Practical examinations will be conducted only at the end of even semesters for all programmes.

PATTERN OF QUESTION PAPERS

Pattern of questions for external examination of practical papers will be decided by the concerned Board of practical examination.

GRADES

A 7-point scale based on the total percentage of marks (ISA + ESA) for all courses (theory, practical, project)

% of marks	**Grade**	**Grade point**
>95	S - Outstanding	10
85 - 95	A^+ - Excellent	9
75 - 85	A - Very good	8
65 - 75	B^+ - Good	7
55 - 65	B - Above average	6
45 - 55	C - Satisfactory	5
35 - 45	D - Pass	4
<35	F - Failure	0
	Ab - Absent	0

PASS CRITERIA:

- A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% for a pass in a course.
- For a pass in a programme, a separate minimum of Grade D is required for all the individual courses.
- If a candidate secures F Grade for any one of the courses in a semester/programme, only F grade will be awarded for that semester/programme until he/she improves this to D Grade or above within the permitted period.
- Students who complete the programme with D grade will have one betterment chance within 12 months, immediately after the publication of the result of the whole programme.

CREDIT POINT AND CREDIT POINT AVERAGE

Credit Point (CP) of a course is calculated:

$$CP = C \times GP$$

C = Credit; GP = Grade point

Semester Grade Point Average (SGPA) of a semester:

$$SGPA = TCP/TC$$

TCP = Total Credit Point of that semester

TC = Total Credit of that semester

Cumulative Grade Point Average (CGPA) is calculated:

$$CGPA = TCP/TC$$

TCP = Total Credit Point of that programme

TC = Total Credit of that programme

GRADE POINT AVERAGE (GPA)

GPA of different category of courses viz. Common courses, Complementary courses, Core courses etc. are calculated:

$$GPA = TCP/TC$$

TCP = Total Credit Point of a category of course

TC = Total Credit of that category of course

Grades for the different courses, semesters and overall programme are given based on the corresponding GPA:

GPA	Grade
>9.5	**S - Outstanding**
8.5 – 9.5	**A^+ - Excellent**
7.5 – 8.5	**A - Very good**
6.5 – 7.5	**B^+ - Good**
5.5 – 6.5	**B - Above average**
4.5 – 5.5	**C - Satisfactory**
3.5 – 4.5	**D - Pass**
<3.5	**F - Failure**

- There shall be supplementary exams only for V sem
- Notionally registered candidates can also apply for the said supplementary examinations
- For reappearance/improvement for other semesters, appear along with the next batch
- A student who registers his name for the external exam for a sem will be eligible for promotion to the next semester
- A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester
- A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the University examination for the same semester, subsequently.
- There shall be no improvement for internal evaluation.

SYLLABUS FOR
BACHELOR'S PROGRAMME IN ZOOLOGY
(CORE)

SEMESTER I

CORE COURSE I
ZY1B01B18: GENERAL PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY

Credits – 2
Duration: One Semester
Total Lecture Hours: 36

Aim: To provide an overview of Protistan diversity and an insight into scientific studies and animal identification.

Course Overview and Context

The course provides an overall idea on the progress of Biology. It also creates an awareness on systematic identification of animals. The course seeks to famliarize the students about the protistan fauna living in and around us. It helps to instill in them a curiosity to study the anatomical and physiological peculiarities in some invertebrates through type study. It throws awareness on parasitic species which are the cause behind many diseases.

PART I PERSPECTIVES IN SCIENCE 8Hrs

Module I Introduction to Scientific Studies 4 Hrs

Types of knowledge: practical, theoretical, and scientific knowledge. What is science, Features of science, Deductive and inductive models, scientific temper, empiricism, vocabulary of science.

Module II What is Biology? 4 Hrs

Life and its manifestations, History of Biology: Biology in ancient times Landmarks in the progress of Biology. Branches of Zoology, Scope of Zoology

PART II SYSTEMATICS 10 Hrs

Module III Taxonomical Principles and tools

Systematic, Taxonomy, Phylogeny [Brief account], Approaches to taxonomy, Molecular taxonomy, Bar coding, Tree of Life, Zoological nomenclature, International Code of Zoological Nomenclature (ICZN), Law of Priority. Five Kingdom Classification; Linnaean classification, Basis for Animal kingdom classification [Levels of organization, Symmetry, Coelom], Identification tools:Taxonomic key. Types: Single access key- Dichotomous [linked and nested] and Polytomous key, Multi access key, Computer aided Interactive Key, Advantages and Disadvantages.

PART III PROTISTAN DIVERSITY 18 Hrs

Module IV Kingdom Protista

Type: Paramecium 5 Hrs

Salient features of Kingdom Protista **10 Hrs**

Classification of Protista up to phyla

1. Phylum Rhizopoda : Eg. Amoeba
2. Phylum Actinopoda : Eg. Actinophrys
3. Phylum Dinoflagellata : Eg. Noctiluca
4. Phylum Parabasalia : Eg. Trichonympha
5. Phylum Metamonada : Eg. Giardia
6. Phylum Kinetoplasta : Eg. Trypanosoma
7. Phylum Euglenophyta : Eg. Euglena
8. Phylum Cryptophyta : Eg. Cryptomonas
9. Phylum Opalinata : Eg. Opalina
10. Phylum Bacillariophyta : Eg. Diatoms
11. Phylum Chlorophyta : Eg. Volvox
12. Phylum Choanoflagellata : Eg. Proterospongia
13. Phylum Ciliophora : Eg. Balantidium coli
14. Phylum Sporozoa : Eg. Plasmodium
15. Phylum Microsporidia : Eg. Nosema
16. Phylum Rhodophyta : Eg. Red Alga

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

General Topics: 3 Hrs

1. Parasitic protists (diseases mode of transmission and prophylactic measures) - Entamoeba, Trypanosoma, Plasmodium (detailed account of life cycle), Leishmania.

References

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SEMESTER I

CORE COURSE I - PRACTICAL
ZY2BP01B18: GENERAL PERSPECTIVES IN SCIENCE, PROTISTAN DIVERSITY & ANIMAL DIVERSITY – NON CHORDATA

Credits -
No. of Hours: 36

GENERAL PERSPECTIVES IN SCIENCE AND PROTISTAN DIVERSITY

1. Taxa, identification techniques
   Bird body parts
   Butterfly/ dragonfly body parts
2. Identification using keys
   Insects (Any 3 specimens)
3. General identification - The students are expected to identify any 6 Protistans studied by their generic names and write the general characters of their Phylum.
4. Identification of any 4 economically important protists/parasitic protists (Slides/ figures may be used for identification)
5. Identification of two Protistans from pond water.

COMPETENCIES:

- Understand the scientific classification of Protistan diversity.
- Learn the physiological and anatomical peculiarities of phyla through type study.
- Study the evolutionary significance of various fauna.
- Stimulate the curiosity in living things around them.

BLUE PRINT
B.Sc. I Semester - Core Course
CODE: ZY1B01B18
COURSE TITLE: GENERAL PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY

Modules	**Hours** **36**	**PART A** **(short answer)** **1 marks** **10/12**	**PART B** **(short essay)** **5 marks** **6/9**	**PART C** **(essay/problem)** **10marks** **2/4**	**Total**
Module I	4	2	2	0	12
Module II	4	2	1	1	17
Module III	10	3	3	1	28
Module IV	18	5	3	2	40

SEMESTER II

CORE COURSE II
ZY2B02B18: ANIMAL DIVERSITY - NON CHORDATA

Credits – 2
Duration: One Semester
Total Lecture Hours: 36

Aim: To provide an overview of invertebrate faunal diversity.
To instill curiosity on the various invertebrates around us

Course Overview and Context

The course seeks to familiarize the students about the non chordate fauna living in and around us. It helps to instill in them a curiosity to study the anatomical and physiological peculiarities in some invertebrates through type study. It throws awareness on parasitic, helminthes and vector arthropods which are the cause behind many diseases. It also highlights the importance of conservation of coral reefs.

MODULE I: Kingdom Animalia **10 Hrs**

Outline classification of Kingdom Animalia
Three branches - Mesozoa, parazoa and Eumetazoa
Mesozoa: Phylum Orthonectida - Eg. Rhopalura (mention 5 salient features)
Parazoa:1.Phylum Placozoa – Eg. Trycoplax adherens
2. Phylum Porifera – Classification upto classes; Mention gemmules
Class I: Calcarea. Eg. Sycon
Class II: Hexactinellida Eg. Euplectella
Class III: Demospongia Eg. Cliona.
General Topics

- Canal system in sponges.

Phylum Coelenterata – Type: Obelia Classification upto classes
Class I: Hydrozoa Eg. Halistemma, Physalia. mention Metagenesis
Class II: Scyphozoa Eg. Rhizostoma.
Class III: Anthozoa Eg. Metridium.
General Topics:

- Coral and coral reefs with special reference to conservation of reef fauna.
- Polymorphism in Coelenterates

Phylum Ctenophora - Eg. Pleurobrachia.

MODULE II

Phylum Platyhelminthes Salient features; classification up to classes **3 Hrs**
Class I: Turbellaria. Eg. Planaria.
Class II: Trematoda Eg. Fasciola
Class III: Cestoda Eg. Taenia saginata.

General Topics:

- Life history of Fasciola hepatica.
- Platyhelminth parasites of Man and Dog (Schistosoma, Taenia solium, Echinococcus)

Phylum Nemathelminthes (Nematoda) **2 Hrs**
Salient features, classification up to classes
Class: Phasmidia Eg. Enterobius
Class: Aphasmidia Eg. Trichinella

General Topic

- Pathogenic nematodes in man. (Wuchereria bancrofti, Ascaris lubricoides, Ancylostoma duodenale, Trichinella).

Phylum Annelida **2 Hrs**
Salient features, Classification upto classes.
Class I: Archiannelida Eg. Polygordius
Class II: Polychaeta Eg. Chaetopterus
ClassIII: Oligochaeta Eg. Megascolex.
Class IV: Hirudinea Eg. Ozobranchus, Hirudinaria

MODULE III **11 Hrs**

Phylum Onychophora Eg. Peripatus (Mention its affinities)

Phylum Arthropoda
Salient features, Classification upto classes
Type: Prawn –Fenneropenaeus (Penaeus)
1. Sub Phylum - Trilobitomorpha
Class -Trilobita (mention the salient features) Eg.Triarthrus – A trilobite (extinct)
2. Subphylum –Chelicerata
Class 1 Merostomata (Xiphosura) Eg. Limulus
Class 2.Arachnida Eg. Palamnaeus- Scorpion
Class 3 Pycnogonida Eg. Pycnogonum – Sea spider
3. Subphylum- Crustacea
Class 1 Branchiopoda Eg. Daphnia
Class 2 Ostracoda Eg. Cypris -seed shrimp
Class 3 Copepoda Eg. Cyclops
Class 4 Remipedia Eg. Speleonectes (eyeless crustacean seen in caves)
Class 5.Branchiura Eg. Argulus (common fish louse)
Class 6 Cirripedia Eg. Sacculina (parasitic castrator of crabs)
Class 7 Malacostraca Eg. Squilla (spot tail mantis shrimp)
4. Subphylum- Uniramia
Class 1 Chilopoda Eg. Scolopendra – (Centipede)
Class 2 Symphyla Eg. Scutigerella – (garden centipedes or pseudocentipedes)
Class 3 Diplopoda Eg. Spirostreptus- (Millipede)
Class 4 Pauropoda Eg. Pauropus

Class 5 Hexapoda (Insecta)	Eg.Bombyx mori – (silk moth)

MODULE IV

Phylum Mollusca **3 Hrs**

Salient features, Classification upto classes

Class I- Aplacophora	Eg. Neomenia
Class II- Monoplacophora	Eg. Neopilina
Class III Amphineura	Eg. Chiton
Class IV Gastropoda	Eg. Aplysia
Class V Scaphopoda	Eg. Dentalium
Class VI Pelecypoda (Bivalvia)	Eg. Pinctada
Class VII Cephalopoda	Eg. Sepia

Phylum Echinodermata **3 Hrs**

Classification upto classes

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

General Topics

- Larval forms of Echinodermata.

Phylum Hemichordata: Eg. Balanoglossus **2 Hrs**

Minor Phyla

1. Chaetognatha	Eg. Sagitta
2.Sipunculida	Eg. Sipunculus

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SEMESTER II

CORE COURSE II–PRACTICAL 1
ZY2BP01B18: GENERAL PERSPECTIVES IN SCIENCE, PROTISTAN DIVERSITY & ANIMAL DIVERSITY – NON CHORDATA

Credits – 2
No. of Hours: 36

ANIMAL DIVERSITY – NON CHORDATA

Scientific Drawing:-
Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla.
Anatomy:-Study of sections (Any two)
1. Hydra
2. Ascaris (male and female)
3. Earthworm
4. Fasciola

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

Mounting:-
1. Prawn appendages.
2. Mouth parts - Cockroach/ Plant bug/ House fly / Mosquito. (Any Three)

Identification:-
General identification &classification - The students are expected to identify, classify and describe the following Phylum -wise number of animals by their common names, generic names and 30% of these by their scientific names. Porifera-1, Coelenterata-3, Platyhelminthes-2, Annelida-2, Arthropoda-5, Mollusca- 4, Echinodermata-3.
Identification of (a) Parasitic protist – any 2 (b) larval forms of Fasciola- any 2(c) Nematode parasites of man- any 3 (Slides/figures may be used for study)
Taxonomic identification with key:-
Identification of insects up to the level of Order (any Four).

COMPETENCIES:

- Understand the scientific classification of invertebrate fauna
- Learn the physiological and anatomical peculiarities of some invertebrate phyla through type study
- Study the evolutionary significance of various invertebrate fauna
- Stimulate the curiosity in living things around them

BLUE PRINT

B.Sc. II Semester - Core Course

CODE: ZY2B02B18

COURSE TITLE: ANIMAL DIVERSITY-NON CHORDATA

Modules	**Hours 36**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	10	3	2	1	23
Module II	7	3	2	1	23
Module III	11	3	3	1	28
Module IV	8	3	2	1	23

SEMESTER III

CORE COURSE III
ZY3B03B18: ANIMAL DIVERSITY –CHORDATA

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim:

- To acquire in depth knowledge on the diversity of chordates and their systematic position.
- To make them aware of the economic importance of some classes.
- To understand the evolutionary importance of selected chordate group

Course Overview and Context

The course gives an overall idea on classification of chordates and highlights the differences between different classes of chordates. It also throws light on the evolutionary significance of certain animals which form the connecting links between two groups. It also helps in the identification of poisonous and non poisonous snakes and migration in Birds and Fishes.

MODULE I

Introduction **1 Hr**
General Characters and outline classification of Chordata up to class,
Origin of Chordates – mention theories in brief
Protochordates
General characters and Classification **2 Hrs**

1. Sub phylum: Urochordata

Class I Larvacea Eg. Oikopleura
Class II Ascidiacea Eg: Ascidia (Mention RetrogressiveMetamorphosis)
Class III Thaliacea Eg: Doliolum

2. Sub phylum: Cephalochordata **2 Hrs**
Example - Amphioxus (Structure and affinities)

MODULE II

3. Sub phylum: Vertebrata General characters and Classification **2 Hrs**

4. Division 1– Agnatha

Class I Ostracodermi Eg: Cephalaspis
Class II Cyclostomata Eg: Petromyzon

Division 2 - Gnathostomata **10 Hrs**
Super class Pisces
General Characters and Classification
Class: Chondrichthyes - General Characters

Sub class - Elasmobranchi Eg: Narcine
Sub class - Holocephali Eg: Chimaera
Class: Osteichthyes - General Characters
Sub class - Choanichthyes
Order 1 Crossopterigii (Coelocanths) Eg: Latimeria (Evolutionary Significance)
Order 2 Dipnoi Eg: Lepidosiren - Distribution, affinities and systematic position of lung fishes.

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 fishes.
2. Parental care in fishes.
3.Scales in fishes.
4.Migration in fishes

MODULE III
Super class: Tetrapoda General characters, Classification up to Orders **11 Hrs**
Class Amphibia - Type Frog (Euphlyctis hexadactylus)
Order I : Anura Eg: Hyla
Order II :Urodela Eg: Amblystoma (mention axolotl larva and Paedomorphosis /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
Order III. Crocodilia Eg..Crocodylus
Sub class IV: Synapsida Eg: Cynognathus
General topic
Identification of poisonous and non-poisonous snakes
Poisonous and non-poisonous snakes

Class Aves **5 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

MODULE IV

Class Mammalia Type: Rabbit (*Oryctolagus cuniculus*) **17 Hrs**

Brief mention of general characters and classification up to order with example. (Mention any five salient features of each order, detailed accounts of examples are not necessary) Sub class I: Prototheria Eg: Echidna, Ornithorhychus

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 Pholidota Eg: Manis
Order 8 Proboscidea Eg: Elephas
Order 9 Hydracoidea Eg: Procavia
Order 10 Sirenia Eg: Dugong
Order 11 Perissodactyla Eg:Rhinoceros
Order 12 Artiodactyla Eg: Camelus-mention ruminant stomach
Order 13 Lagomorpha Eg: Oryctolagus
Order 14 Rodentia Eg: Hystrix (Porcupine)
Order 15 Tubulidentata Eg: Orycteropus
Order 16 Cetacea Eg: Delphinus

General topics

1. Dentition in Mammals
2. Aquatic Mammals and their adaptations.

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SEMESTER III

CORE COURSE III - PRACTICAL
ZY4BP02B18: ANIMAL DIVERSITY –CHORDATA, RESEARCH METHODOLOGY, BIOPHYSICS & BIOSTATISTICS

Credits –

No. of Hours: 36

ANIMAL DIVERSITY –CHORDATA

1. Scientific Drawing
   Make scientific drawing of 5 locally available vertebrate specimens belonging to different classes
2. Dissections
   Frog: Photographs/diagrams/one dissected & preserved specimen each/models may be used for study.
   a. Frog Viscera
   b. Frog Digestive System
   c. Frog Arterial System
   d. Frog 9^{th} & 1st Spinal nerve
   e. Frog Sciatic Plexus
   f. Frog Brain
3. Mounting of placoid scales; study of cycloid and ctenoid scales
4. Osteology
   Frog vertebrae - typical, atlas, 8^{th}, 9^{th} and Urostyle.
   Rabbit – Atlas, Axis and typical vertebra
   Pectoral and pelvic girdles of Frog and Rabbit/ Bird - Keel and Synsacrum
   Turtle/Tortoise - plastron and carapace
5. Study of sections.
   Amphioxus T. S. through pharynx/T.S. through intestine
6. Identification
   Identify, classify and describe the following animals by their generic names and 30 % of them by their scientific names.
   Protochordata-1, Pisces-5, Amphibia-5, Reptilia- 5, Aves-2, Mammalia-2.

Taxonomic identification with key:-

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

COMPETENCIES

- Learn the diversity in chordates and their systematic position.
- Understand the economic importance of some classes.

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B.Sc. III Semester – Core Course

CODE: -- ZY3B03B18

COURSE TITLE: ANIMAL DIVERSITY- CHORDATA

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C (essay/problem) 10 marks 2/4**	**Total**
Module I	5	1	1	0	6
Module II	12	1	1	1	16
Module III	20	5	3	2	40
Module IV	17	5	4	1	35

SEMESTER IV

CORE COURSE IV
ZY4B04B18: RESEARCH METHODOLOGY, BIOPHYSICSAND BIOSTATISTICS

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim: To equip the students for research and project work.

Course Overview and Context:
The course provides a basic concept of scientific method in research process.It also throws light on the principle and use of various instruments used in biological research. It also equips the students with the basic techniques of animal rearing, collection and preservation. It also helps the students to apply statistical methods in biological studies.

RESEARCH METHODOLOGY

Module I **13 Hrs**

Basic concepts of research: Meaning, Objectives, Approaches, Types of research.
Research Process: Scientific method in research (eight steps).
Importance of literature reviewing in defining a problem, Identifying gap areas from literature review.
Research Communication and scientific documentation: Project proposal writing,
Research report writing, (Structure of a scientific paper), Thesis, dissertation, research article.
Presentation techniques: Oral presentation, Assignment, Seminar, Debate, Workshop, Colloquium, Conference
Sources of Information: Primary and secondary sources. Library- Books, Journals, Periodicals, Reviews, Internet.
Search engines, Online libraries, e-Books, e-Encyclopedia, Institutional Websites. Plagiarism

Module II **12 Hrs**

Animal Collection – Tools & techniques
Sampling techniques
Quadrate Line transect
Measurements
Density Abundance Frequency
Biodiversity indices – concepts Simpson index
Collection methods, techniques and equipments
Plankton, Insects, Fish, Bird
Preservation techniques – Taxidermy Rearing techniques

Laboratory and field
Units of measurements- units, SI system, Equivalent weight, normality, molarity

BIOPHYSICS

Module III **14 Hrs**

Basic understanding on principle and uses of the following:
Microscopy
(a) Light microscopy, Parts of a microscope, Dry and Oil immersion objectives, 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

BIOETHICS

Module IV **5 Hrs**

Bioethics : Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act 1960, Biodiversity Act 2003.
Concept of 3 R – conservation (Refined- to minimize suffering, Reduced – to minimize animals, Replaced – modern tools and alternate means), Animal use in research and education.
Laboratory animal use, care and welfare, Animal protection initiatives- Animal Welfare Board of India, CPCSEA, ethical commitment. Working with human: Consent,harm, risk and benefits.

BIOSTATISTICS
Module V **10 Hrs**

Sample & Sampling techniques: Collection of data, classification of data, frequency distribution tables, graphical representation: - Bar diagrams, Histogram, Pie diagram and Frequency curves - Ogives.
Measures of Central Tendency: Mean, Median, Mode (Problem - Direct method only) Measures of dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Standard error. (Merits & demerits and problems on SD).
Correlation: Definition, Types of correlation.(mention in brief)
Test of Hypothesis and Test of Significance: Basic concept, Levels of significance, test of significance, Procedure for testing hypothesis, types of hypothesis- Null hypothesis and Alternate hypothesis.

References:

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SEMESTER IV

CORE COURSE IV– PRACTICAL 2
ZY4BP02B18: ANIMAL DIVERSITY – CHORDATA, RESEARCH METHODOLOGY, BIOPHYSICS & BIOSTATISTICS

Credits – 2
No. of Hours: 36

RESEARCH METHODOLOGY, BIOPHYSICS & BIOSTATISTICS

PART A - RESEARCH METHODOLOGY

Animal collection Tools, Techniques & Estimation

1. Quadrate study
2. Transect study
3. Sampling Methods
4. Species area curve
5. Simpson index

PART B - BIOPHYSICS

1. Study of simple and compound light microscopes
2. Micrometry –calibration and measurement of microscopic objects –low power
3. Camera Lucida (draw a few diagrams using Camera Lucida)
4. Paper chromatography (demonstration only)
5. Instrumentation – demonstration (write notes on principle, equipment and its use) pH Meter, Colorimeter/ Spectrophotometer, Centrifuge

PART C - BIOSTATISTICS

1. MS Excel: To create mean and median, Construction of bar diagram, Pie diagram and Line graphs.
2. MS Access: To create grade of students
3. Internet: Access a web page on any biological topic.
4. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
5. Range and standard deviation for a biological data
6. Correlation using any biological data.
7. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.

COMPETENCIES:

- Impart the basic philosophy of science, its history, concepts and scope.
- Develop scientific temper.
- Familiarize with the basic tools and techniques of scientific study with emphasis on biological sciences.
- Familiarize with field techniques including observation/collection and preservation the animal collection methods.
- Understand the laws and ethics related to animal welfare.
- Understand the standard units of measurements.

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B.Sc. IV Semester - Core Course

CODE: ZY4B04B18

COURSE TITLE: RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	13	3	2	1	23
Module II	12	3	2	1	23
Module III	14	2	2	1	22
Module IV	5	1	1	0	06
Module V	10	3	2	1	23

SEMESTER V

CORE COURSE V
ZY5B05B18: ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

Credits – 3
Duration: One Semester
Total LectureHours: 54

Aim: To create morally inspired young generationsas environmental education instills in them a love for nature.

Course Overview and Context:
The course provides a basic knowledge on Environmental Sciences, Ecosystem, their functioning, protection, conservation, the factors polluting them, their impacts and control measures. The course also discusses the management measures to reduce the impact of toxicants and creates awareness on disaster management and mitigation measures. The concepts and manifestations of Human rights are also included in the course.

MODULE 1: ECOSYSTEM 12 Hrs

Basic concepts of ecosystem
Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic components (Producers, consumers, decomposers).
Ecological pyramid- number, biomass, energy.
Functions of ecosystem: Productivity - Food chain - Food web - Energy flow - Laws of Thermodynamics.
Types of Ecosystem: Terrestrial - Forest – Grassland - Desert, Aquatic – Marine - Fresh water, Wetland and Biome
Concept of limiting factors: Liebig's and Shelford's laws of limiting factors.
Biogeochemical cycles: Concept, gaseous and sedimentary cycles, Carbon cycle, Nitrogen cycle.
Renewable resources (solar, wind, hydroelectric, biomass and geothermal) and Non renewable resources (mineral and metal ore, fossil fuels).

MODULE 2: CONCEPTS OF POPULATION AND COMMUNITY 8 Hrs

Concept of population: Population attributes - Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves.
Animal interactions: Positive – Commensalism – Mutualism - Protocooperation, Negative – Predation – Parasitism – Competition – Antibiosis.
Characteristics of a community: Species diversity- richness, evenness, stratification, dominance, ecological indicators, Ecotone and Edge effect, Keystone species, Concepts of Ecological Niche

and Guild, Ecological succession, community evolution- climax.

MODULE 3: BIODIVERSITY AND ENVIRONMENTAL ISSUES 16 Hrs

Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity.
Concept and importance of Biodiversity: Levels of Biodiversity-Species diversity, Genetic diversity, Microbial, Ecosystem diversity, India as a mega-diversity nation, Biodiversity hotspots.
Global Environmental Issues: Ozone depletion, Greenhouse effect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear accidents, IPCC/UNFCCC.
National Environmental issues: Deforestation, forest fire, pollution (air, water, soil, noise, thermal, nuclear - brief account only) solid waste management, sewage, drinking water crisis and water logging.
Toxic products and disaster: Types of toxic substances – degradable, non degradable, Impact on human – case studies: Endosulphan tragedy, Bhopal disaster.
Flood, drought, cyclone, earthquake and landslide (Management and mitigation)
Local Environmental issues: Landscape alteration, sand mining, quarrying, changing crop pattern, conversion of paddy lands.
Threats to water resources of Kerala: Degrading Mangrove and wetland ecosystems of Kerala, Ramsar sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment.

MODULE 4: CONSERVATION OF BIODIVERSITY 12 Hrs

Protected area concept – Sanctuary, National Park, Biosphere reserve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves
Concept of threatened fauna – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data Books.
Man–animal conflict (Tiger, Elephant, Dog, Monkey) – causes and concern
Water conservation- rainwater harvesting, watershed management.
Environment education
Environmental laws (Brief account only): The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Indian Forests Act (Revised) 1982. The Environment (Protection) Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989, The Forest (Conservation) Act, 1980, The Wildlife Protection Act, 1972, Biodiversity Act, 2002.

MODULE 5: HUMAN RIGHTS **6 Hrs**

Introduction, main concepts associated with Human Rights, Different types of human rights, Manifestations & phenomena, Role of agencies in promoting human rights, Mechanisms for checking violations of human rights, National human right commission, Constitutional provisions related to Human rights.

References:

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SEMESTER V

CORE COURSE V - PRACTICAL
ZY6BP03B18: ENVIRONMENTAL BIOLOGY, TOXICOLOGY, CELL BIOLOGY & GENETICS

Credits –
No. of Hours: 36

ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

1. Estimation of dissolved oxygen.
2. Estimation of carbon dioxide.
3. Estimation of soil organic carbon (Demonstration only).
4. Identification of marine/ fresh water planktons.
5. Counting of plankton using plankton counting chamber
6. Study of equipments - Secchi disc, Plankton net.
7. Study of sandy shore fauna and rocky shore fauna.
8. Study of animal associations.
9. Visit to any two important areas of bio diversity: 1. Forest, 2. Sea shore, 3. Mangrove,
4. Wet lands, 5. Bird sanctuary, 6. Wild life sanctuary, 7. Sacred groves

Field study (compulsory)

COMPETENCIES:

- Impart basic knowledge on ecosystems and their functioning.
- Learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures.
- Study toxicants, their impacts on human health and environment and remedial measures.
- Create awareness about disasters, prevention and mitigation measures.
- To develop the basic concepts and various agencies promoting human rights.

BLUE PRINT

B.Sc. V Semester - Core Course

CODE: ZY5B05B18

COURSE TITLE: ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	12	3	3	1	28
Module II	08	2	1	0	07
Module III	16	4	2	2	34
Module IV	12	2	2	1	22
Module V	06	1	1	0	06

SEMESTER V

CORE COURSE VI
ZY5B06B18: CELL BIOLOGY AND GENETICS

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim:
To understand the structure and function of the cell.
To make aware of the structure and role of different cell organelles.
To emphasize the central role of genes and their inheritance.

Course overview and context
This course provides indepth knowledge on the structure and function of cell organelles, cell division and cell communication. It creates an understanding of the basis of inheritance and different modes of gene interactions. The interpretation of data from progeny and pedigree analysis is explained. The consequence of mutation and non disjunction in humans has been highlighted.

CELL BIOLOGY **22 HRS**

Module I **6 Hrs**

Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Mycoplasmas, Virus, Virions and Viroids, Prions.
Cell membrane & Permeability: Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model). Cell properties - permeability, Transport (Diffusion, Osmosis, Passive transport, Active transport, bulk transport), Cell coat and Cell recognition.

Module II **10 Hrs**

Cell Organelles: Structure and functions of following cell organelles: 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. Nucleus: Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus.

Chromosomes – Structure & organization, Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.

Module III **6Hrs**

Cell Communication: Basic principles of cell communications, Cell signaling(in brief), Types of signaling, Mention signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives), Role of cyclic AMP

Cell Division: Cell cycle - G1, S, G2 and M phases, Mitosis and Meiosis.The difference between Mitosis and Meiosis.

GENETICS **32 Hrs**

Module IV **10 Hrs**

Mendelian Genetics: History and Scope of genetics. Mendel's experiments- Monohybrid Cross, Dihybrid Cross, Mendel's Laws, Test Cross, Back Cross and Reciprocal Cross. Chromosome Theory of Inheritance

Interaction of genes: Allelic: Incomplete Dominance (Four O Clock Plant).Co- Dominance (Skin colour in Cattle) Lethal Alleles: Dominant lethal gene(Creeper chicken) and recessive lethal gene (cystic fibrosis).

Non Allelic: Complementary (Flower colour in Sweet Pea), Supplementary (Coat colour in mice), Epistasis - dominant (Plumage in poultry) and recessive (Coat colour in mice). Polygenes (Skin colour inheritance in man), Pleiotropism (Vestigial wing gene in Drosophila).

Multiple alleles – ABO Blood group system, Rh group and its inheritance. Erythroblastosisfoetalis.

Module V **12 Hrs**

Sex determination: Chromosome theory of sex determination (Autosome and Sex chromosomes), male heterogamy and female heterogamy, (XX-XY, XX-XO, ZZ-ZW, ZZ-ZO), Sex determination in man- role of Y chromosome. Genic Balance theory of Bridges. Barr bodies, Lyon's hypothesis, Gynandromorphism, sexmosaics, intersex (Drosophila), Hormonal (free martin in calf) and Environmental (Bonelia) influence on Sex determination

Recombination and Linkage: Linkage and recombination of genes based on Morgan'swork in Drosophila, Linked genes, Linkage groups, Chromosome theory of Linkage, Types of linkage-complete and incomplete. Recombination, cross over value, chromosome mapping. (Definition)

Sex Linked inheritance: Characteristics of Sex Linked inheritance, X Linked inheritance of man (Hemophilia), Y linked inheritance [Holandric genes], Incompletely Sex Linked genes or pseudoautosomal genes (Bobbed bristles in Drosophila), Sex limited genes (Beard in man) and Sex influenced genes (inheritance of baldness in man).

Module VI **10 Hrs**

Mutation: Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal, chromosomal mutations, structural and numerical changes. Gene mutations. (Addition, Deletion and substitution).

HumanGenetics: Karyotyping, Normal Human chromosome Complement, Pedigree analysis, Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Edward's syndrome,Cri-du-chat syndrome) Sex chromosomal abnormalities (Klinefelter's syndrome, Turner's syndrome) Single gene disorder (Brief mention) Autosomal single gene disorder (Dominant – Brachydactyly, polydactyly, Recessive - sickle cell anaemia), Sex linked inheritance (Haemophilia and colour blindness),criss-cross inheritance. Inborn errors of metabolism such as phenylketonuria, alkaptonuria, Albinism. Multifactorial traits – polygenic disorder- cleft lip and cleftpalate.Genetic Counseling, Eugenics and Euthenics -Brief account only

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CELL BIOLOGY

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SEMESTER V

CORE COURSE VI– PRACTICAL 3
ZY6BP03B18: ENVIRONMENTAL BIOLOGY, TOXICOLOGY, CELL BIOLOGY & GENETICS

Credits – 2
No. of Hours: 36

CELL BIOLOGY & GENETICS

PART A: CELL BIOLOGY

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 cell organelles
5. Preparation of temporary whole mount.
6. Preparation of permanent whole mount (demonstration)
7. Preparation of human blood smear and identification of Leucocytes

PART B: GENETICS

1. Genetic problems on Monohybrid, Dihybrid Crosses and Blood groupinheritance
2. Study of normal male and female human karyotype (use photographs orXerox copies)
3. Abnormal human karyotypes - Down, Edwards, Klinefelter and Turner syndromes (use photographs or Xerox copies)
4. Sexing of Drosophila.
5. Study of Barr body in human buccal epithelium

COMPETENCIES:

- Learn the structure and functions of various cell organelles
- Learn Cell Communication
- Emphasize the central role that genetics plays in the life of all organisms.
- Understand the pattern of inheritance of Characters.
- Distinguish between heritable and non heritable disorders
- Develop critical thinking, skill and research aptitudes in Cell Biology and Genetics

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B.Sc. V Semester - Core Course

CODE: ZY5B06B18

COURSE TITLE: CELL BIOLOGY AND GENETICS

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	6	1	2	0	11
Module II	10	3	1	1	18
Module III	6	1	0	1	11
Module IV	10	2	2	1	22
Module V	12	3	3	0	18
Module VI	10	2	1	1	17

SEMESTER V

CORE COURSE - VII
ZY5B07B18: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim

- To acquire knowledge about the evolutionary history of earth - living and nonliving.
- To acquire basic understanding about evolutionary concepts and theories and to critically analyse them.
- To understand the distribution of animals on earth, its pattern, evolution and causative factors.
- To impart basic knowledge on animal behavioural patterns and sociobiology of man.

Course Overview and Context

This course helps the student gain an understanding on the origin of life and evolution of various organisms. The course also critically analyses the various theories of organic evolution. It also visualises the patterns of distribution of life on earth. It defines the processes that cause evolutionary changes and explains how it can cause deviation from Hardy Weinberg Equilibrium. A basic knowledge on animal behaviour pattern and sociobiology of man has also been highlighted.

PART I - EVOLUTION **30 Hrs**

Module I - Originof life **8 Hrs**

Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation (Abiogenesis or Autogenesis), Special creation, Biogenesis, Endosymbiosis.
Chemical evolution - Haldane and Oparin theory, Miller-Urey experiment.
Direct evidences of evolution – Recapitulation Theory of Haeckel, Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous organs.

Module II - Theories of organic evolution **9 Hrs**

Lamarckism and its Criticism, Weismann's Germplasm theory, Darwinism and its Criticism, Neo-Darwinism, Theory of DeVries.

Population genetics and evolution: Hardy-Weinberg Equilibrium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on population: Bottleneck effect and founder effect.

Module III – Nature of evolution **13 Hrs**

Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transformations), True speciation, Instantaneous and gradual speciation, allopatric and sympatric speciation

Isolation: Types of isolating mechanisms - Geographic isolation (mention examples) and Reproductive isolation. Role of isolating mechanisms in evolution

Microevolution, Macroevolution (Adaptive radiation -Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass extinction (brief account only). Evolution of Horse.

PART II - ETHOLOGY **14 Hrs**

Module IV – Introduction, Learning, imprinting and behaviour **10 Hrs**

Definition, History and scope of ethology

Types of learning with examples; patterns of behaviors – types of rhythms, navigation, homing instinct, hibernation, aestivation; pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and parental behavior).

Module V – Social organization **4 Hrs**

Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies.

PART III - ZOOGEOGRAPHY **10 Hrs**

Module VI – General Topics **4 Hrs**

Continental drift theory, Types and means of animal distribution, Factors affecting animal distribution; insular fauna – oceanic islands and continental islands.

Module VII – Zoogeographical realms **6 Hrs**

Palaearctic region, Nearctic region, Neotropical region, Ethiopian region, Oriental region, Australian region (brief account with physical features and fauna, Wallace's line, Weber's line, Biogeography of India with special reference to Western Ghats.

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EVOLUTION

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SEMESTER V

CORE COURSE VII - PRACTICAL
ZY6BP04B18: EVOLUTION, ETHOLOGY, ZOOGEOGRAPHY, HUMAN PHYSIOLOGY, BIOCHEMISTRY & ENDOCRINOLOGY

Credits –
No. of Hours: 36

EVOLUTION, ETHOLOGY AND ZOOGEOGRAPHY

1. Identification of Zoogeographical realms usingmap.
2. Study on endemic species of eachrealm.
3. Show the discontinuous distribution of lung fishes, camel, elephant.
4. Providing a map trace the route of HMS Beagle.
5. Providing a map mark any two continental/oceanic islands:

Greenland, Madagascar, New Zealand, New Guinea, Maldives, Iceland, Hawaii – Any two.

6. Contributions of scientists (showing photos) – Any four.
7. Identification of different stages of horse evolution.
8. Study on Homology and Analogy
9. Study on connecting links (Peripatus, Archaeopteryx, Protopterus, Echidna)
10. Pheromone traps, Skinner box & T-maze
11. Experiment to demonstrate phototaxis and chemotaxis using Drosophila/ Housefly
12. Identification of behaviour (Grooming/ courtship dance of flamingos/ stickle backfish/ Tail wagging dance/ Aggressive behaviour/ Auto/ Allo grooming, Flehmen response) showing pictures (Any five)

COMPETENCIES:

- Acquire knowledge about the evolutionary history of earth (living and non living).
- Critically analyse theories of Organic Evolution.
- Study various tools and techniques for evolutionary studies.
- Understand the distribution of animals on earth, its pattern, evolution and causative factors.
- Impart basic knowledge on animal behavioural patterns and sociobiology of man.

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B.Sc.V Semester - Core Course

CODE: ZY5B07B18

COURSE TITLE: EVOLUTION, ETHOLOGY & ZOOGEOGRAPHY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	8	2	0	1	12
Module II	9	2	3	0	17
Module III	13	3	2	1	23
Module IV	10	2	1	1	17
Module V	4	1	1	0	6
Module VI	4	0	0	1	10
Module VII	6	2	2	0	12

SEMESTER V

CORE COURSE VIII
ZY5B08B18: HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

Credits – 3
Duration: One Semester
Total LectureHours: 54

Aim: To create an awareness between the structure and functions of various systems in the human body.

Course Overview and Context
The course provides an in depth knowledge on various organ systems, their functioning and related disorders. Students will acquire a broad understanding on the principles of Biochemistry illustrating the different types of food, their structure, function and metabolism. It also throws light on the hormonal regulation of various systems of the body and the role played by various hormones in regulating the homeostasis is elaborated.

HUMAN PHYSIOLOGY **31 Hrs**

Module I **8 Hrs**

Nutrition
Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sources and deficiency disorders). Importance of dietary fibre and antioxidants. Balanced diet, Recommended Dietary Allowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition (PEM).

Digestion: Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestion and absorption of carbohydrates, proteins and fats.Nervous and hormonal control of digestion.

Module II **8 Hrs**

Respiration: Phases of respiration (external respiration, gas transport and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, Bohr Effect, transport of carbon dioxide, (chloride shift). Control of respiration. Respiratory disturbances (Hypoxia, Hypercapnia, Hypocapnia Asphyxia). Dysbarism, Oxygen toxicity, Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration.

Circulation: Composition of Blood, (Brief account, self study) Haemopoiesis. Haemostasis (blood coagulation) – clotting factors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action. Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke). ESR, blood pressure, ECG, Angiogram and Angioplasty.

Module III **5 Hrs**

Excretion: Histology of Bowman's capsule and tubular part. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion. Urine concentration – counter current mechanism. Role of Kidney in Acid – base balance, hormonal regulation of kidney function. Renal disorders (kidney stone, acute and chronic renal failure, Nephritis, Nephrotic syndrome and dialysis). Homeostasis: Definition, Concept and importance in biological system. Thermal regulation and physiological adaptations to heat and cold in homeotherms.

Module IV **10 Hrs**

Nerve physiology: Ultra structure of neuron. Nerve impulse production (resting membrane potential, action potential), transmission of impulse along the nerve fiber, interneuron (synaptic) transmission, neuromuscular junction and transmission of impulses.Neurotransmitters (acetyl choline, adrenalin, dopamine). EEG. Memory, Neural disorders (brief account on Dyslexia, Parkinson's disease, Alzheimer's disease, Epilepsy).

Muscle physiology: Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament Theory, cross bridge cycle, biochemical changes and ATP production in muscle, Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.

BIOCHEMISTRY **15 Hrs**

Module V **5 Hrs**

Carbohydrates: Basic structure, biological importance and classification of monosaccharides, oligosaccharides and polysaccharides with examples.

Proteins: Basic structure and classification of amino acids; structure, biological importance and classification of proteins with examples.

Lipids: Structure of fatty acid, saturated and unsaturated fatty acid, biological importance and classification of lipids with examples.

Vitamins and minerals: Major fat soluble and water soluble vitamins. Important minerals and trace elements required for living organisms. Biological importance of vitamins and minerals.

Enzymes: Chemical nature of enzymes, mechanism of enzyme action, Factors influencing enzyme action (self study) enzyme activation, enzyme inhibition, allosteric enzymes, isoenzymes, co-enzymes. Michaelis–Menten enzyme kinetics.

Module VI **10 Hrs**

Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis, Hexose monophosphate Shunt, Glycolysis, Citric Acid Cycle, Electron Transport Chain and ATP synthesis. Ethanol metabolism.

Protein metabolism: Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.

Lipid metabolism: Biosynthesis of fatty acids, Beta oxidation, physiologically important compounds synthesized from cholesterol.

ENDOCRINOLOGY

Endocrinology and reproduction **8 Hrs**

Module VII **8 Hrs**

Endocrine physiology: Hormones – classification and mechanism of hormone action. Major endocrine glands (Histology is not included) their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland, gonads, Placenta), Homeostasis and feedback mechanism.

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SEMESTER V

CORE COURSE VIII–PRACTICAL 4
ZY6BP04B18: EVOLUTION, ETHOLOGY, ZOOGEOGRAPHY, HUMAN PHYSIOLOGY, BIOCHEMISTRY & ENDOCRINOLOGY

Credits – 2
No. of Hours: 36

HUMAN PHYSIOLOGY, BIOCHEMISTRY & ENDOCRINOLOGY

A. HUMAN PHYSIOLOGY

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

B. BIOCHEMISTRY

1. Qualitative analysis of protein, glucose, starch and lipids.
2. Chromatography – Determination of Rf value of amino acids and identification of amino acids (Identify the Amino Acids using different solvent front and solute front – Demonstration)

C. ENDOCRINOLOGY

1. Cockroach – Corpora cardiaca &Corpora allata (Demonstration)
2. Effect of adrenalin on heart beat of Cockroach (Demonstration)

COMPETENCIES:

- Understand the basic concepts in physiology, biochemistry, and endocrinology
- Analyse the different kinds of food, their structure, function and metabolism.
- Create an awareness regarding the various physiological activities of animals with special reference to humans.
- Understand the hormonal regulation of physiological processes in invertebrates and vertebrates
- Familiarize with hormonal regulation of physiological systems in invertebrate and vertebrate systems
- Understand the various experimental methods and designs that can be used for further study and research.

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B.Sc.V Semester - Core Course

CODE: ZY5B08B18

COURSE TITLE: HUMAN PHYSIOLOGY, BIOCHEMISTRY & ENDOCRINOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	8	2	1	0	7
Module II	8	2	1	1	17
Module III	5	1	0	1	11
Module IV	10	2	2	1	22
Module V	5	1	1	0	6
Module VI	10	2	2	1	22
Module VII	8	2	2	0	12

SEMESTER VI

CORE COURSE IX

ZY6B09B18: DEVELOPMENTALBIOLOGY

Credits – 3

Duration: One Semester

Total Lecture Hours: 54

Aim:

Acquaint students with basic concepts in reproduction and Developmental Biology

Course Overview and Context

The course provides an idea on the historical developments in the field of Embryology, basic concepts in the classification of Eggs, sexual cycle, and Fertilization. It also throws light on the various steps involved in the development of an organism from Frog to Man. It will provide an insight in Teratology, Experimental embryology and Regeneration.

Module I **10 Hrs**

Introduction: Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman).

Reproductive Physiology: Gonads- anatomy of testis and ovary, spermatogenesis, oogenesis, gonadal hormones and their functions. Hormonal control of human reproduction - Female reproductive cycles (Estrous cycle, Menstrual cycle). Structure of mammalian sperm and egg,.Reproductive health and importance of sex education.

Egg types: Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs. Polarity and symmetry of egg.

Fertilization: Mechanism of fertilization-(Encounter of spermatozoa and Ova, Approach of the Spermatozoon to the Egg, Acrosome Reaction and Contact of Sperm and Ovum, Activation of Ovum, Migration of Pronuclei and Amphimixis,), Significance of fertilization, Polyspermy,

Parthenogenesis- Different types and significance.(natural and artificial. Arrhenotoky, Thelytoky, Obligatory and Facultative)

Module II **14 Hrs**

Cleavage: Types (Holoblastic (equal, unequal) and Meroblastic cleavage (discoidal and superficial), planes Meridional, Vertical, Equatorial, Latitudinal and patterns (Radial and Spiral, bilateral & rotational with examples) Determinate, Indeterminate cleavage, Cell lineage of Planocera. Influence of yolk on cleavage.

Blastulation: Morula, blastula formation, types of blastula (coeloblastula, stereoblastula, Discoblastula, Blastocyst) with examples.

Fate maps: Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.

Gastrulation: Definition Major events in gastrulation. Morphogenetic cell movements. (Epiboly, Emboly -invagination, involution, delamination, convergence, divergence infiltration) Influence of yolk on gastrulation. Exogastrulation. Concept of germ layers and derivatives (Brief account).

Cell differentiation and gene action: Potency of embryonic cells (Totipotency, Pleuripotency, Unipotency of embryonic cells). Determination and differentiation in embryonic development, Gene action during development with reference to Drosophila (Maternal effect genes, Zygotic genes).

Module III **20Hrs**

Embryology of Frog: Gametes, fertilization, cleavage, blastulation, fatemap, gastrulation, neurulation, notogenesis. Differentaition of Mesoderm and Endoderm, Development of Eye and Brain. Metamorphosis of frog, Hormonal and environmental conrol.

Embryology of chick: Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.

Human development: Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation.Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilisation (test tube baby)

Module IV **5Hrs**

Experimental embryology: Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.

Teratology / Dysmorphology, Developmental defects: Teratogenesis, important teratogenic agents.(Radiations, chemicals and drugs, infectious diseases) genetic teratogenesis in human beings,

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

Module V **5 Hrs**

General topics: Classification and functions of placenta in mammals. Prenatal diagnosis (Amniocentesis, Chorionic villi sampling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).Regeneration in animals.

References:

- Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper,Stephen L. Hauser, Dan L. Longo,Larry Jameson and Joseph Loscalzo; 2008; Harrisons Principles of InternalMedicine; Chruch Livingston 17th Ed.
- Balnisky B.I.; 1981 An Introduction to Embryology, W.B. Saunders and Co. Berril, N..J.; and Kars, G.; 1986. Developmental biology, Mc Graw Hills Dutta 2007 Obstrestics , Church Livingston 17 Ed
- Majumdar N. N -1985 Vetebrate embryology; Tata McGraw-Hill, New Delhi
- Melissa A & Gibbs, 2006; A practical Guide to Developmental Biology, Oxford university press (Int. student edition)
- Scott F. Gilbert; 2003; Developmental biology; Sinauer Associates Inc.,U.S.; 7th Revised edition.
- Vijayakumarn Nair, K. & George, P. V. 2002. A manual of developmental biology, Continental publications , Trivandrum
- Taylor D J, Green NPO & G W Stout. (2008) Biological Science third edition. Cambridgeuniversity press. Ref pp 748 biology 755.

SEMESTER VI

CORE COURSE IX - PRACTICAL

ZY6BP05B18: DEVELOPMENTAL BIOLOGY, MICROBIOLOGY &IMMUNOLOGY

Credits –

No. of Hours: 36

DEVELOPMENTAL BIOLOGY

Model/Chart/ Slide may be used

1. Embryological studies- Blastula (frog,chick)
2. Embryo transfer, cloning, gastrula (frog, chick)
3. Amniocentesis
4. Embryotransfer technology,cloning
5. Study of placenta- pig andman
6. 18 hour, 24 hour, 33 hour and 48 hour chickembryo.
7. Candling method.
8. Vital staining-demonstration.
9. Male and female reproductive organs inFish/ Cockroach.
10. Calculate the fecundity of fish.
11. Calculate the gonado-somatic index of given fish.

COMPETENCIES:

- Basic understanding of the embryology of Frog, Chick and man.
- Helps to identify congenital defects and the underlying causes.
- Awareness in Teratology, Experimental Embryology and Regeneration.
- Knowledge in human reproductive biology.

BLUE PRINT

B.Sc. VI Semester – Core Course

CODE: ZY6B09B18

COURSE TITLE: DEVELOPMENTALBIOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	10	2	2	1	22
Module II	14	4	2	1	24
Module III	20	4	4	1	34
Module IV	5	1	1	0	6
Module V	5	1	0	1	11

SEMESTER VI

CORE COURSE X
ZY6B10B18: MICROBIOLOGY AND IMMUNOLOGY

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim: Recognise the importance of microbes in the web of life

Course Overview and Context

The course highlights the techniques of Sterilization, media preparation and culture methods. Classification and fine structure of bacteria and virus are well described. Awareness on modes of infection and epidemiology and pathogenicity, diagnosis and treatment of various diseases has been generated. Clinical applications of Antigen – antibody reactions are well discussed. Different types of hypersensitivity and immune response has been elaborated**.**

MICROBIOLOGY

Module I **10 Hrs**

Introduction: History and scope of microbiology. Outline classification of Microbes. (Bacteria, Fungus & Virus)

Methods in Microbiology: Sterilization and disinfection - physical and chemical methods.

Culture media – selective media, enrichment media, differential media.Plating techniques and isolation of pure colony. Culture preservation techniques: Refrigeration, Deep freezing, Freezing under liquid nitrogen, lyophilization.

Module II **15 Hrs**

Morphology and fine structure of bacteria: Size, shape, cilia, pili, flagella, capsule, cell wall and its composition. Cytoplasmic membrane, protoplast, spheroplast, intracellular membrane systems, cytoplasm, vacuoles, genetic material, cell inclusions, bacterial spores.

Bacterial growth Curve, Staining techniques – gram staining.

Bacterial Reproduction: Sexual – (conjugation, transduction) and Asexual (Fission, budding, fragmentation).

Virology: Structure of virus; Human, animal, and bacterial virus. Viral replication, cultivation of animal viruses.

Module III **8 Hrs**

Infections & Diseases: Types of infections – primary, secondary and nosocomial infections. (Brief Account only)Contagious diseases – epidemic, endemic and pandemic, mode of Transmission – food, water, air, vectors and different types of carriers.

Diseases: Epidemiology, symptomology, diagnosis and treatment. Bacterial - Clostridium tetani (tetanus), Viral – HIV virus (AIDS), fungal –Candida albicans (candidiasis).

IMMUNOLOGY

Module IV **9Hrs**

Introduction to Immunology: Innate and acquired immunity, passive (natural and artificial) and active immunity (Natural and Artificial).Mechanisms of innate immunity - barriers, inflammation, phagocytosis.

Lymphoid organs: Primary (Thymus, Bone marrow) and secondary lymphoid organs (lymph nodes, spleen).

Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.

Module V **9 Hrs**

Antigens, Types of antigens, haptens, adjuvants, immunoglobulin structure, classes and functions of immunoglobulins.

Types of Immunity- , humoral & cell mediated immunity Monoclonal & polyclonal antibodies

Antigen – antibody reactions, Precipitation test, Agglutination test, VDRL WIDAL, ELISA.

Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency - AIDS. Hypersensitivity- Type I, (E.g. Anaphylaxis) II (Transfusion reaction),III (Arthus reaction) and IV (Mantaux Test) (in brief).

Vaccines **3 Hrs**

Introduction. Types of vaccines, Current Vaccines, Recent trends in vaccine preparation

References:

- Ananthanarayan R & Jayaram Paniker C K. (2009) Text Book of Microbiology Orient Longman Private Ltd.
- Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.
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- Susan Panicker & George Abraham (Editors) (2008), Micro Biology and Immunology, Zoological Society of Kerala, Kottayam.
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- 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 and R.A.Killungten (2007): Introductory Microbiology Cambridge University Press 6. Ivan Roitt I (2002) Essentials of Immunology ELBS.

SEMESTER VI

CORE COURSE X–PRACTICAL 5
ZY6BP05B18: DEVELOPMENTAL BIOLOGY, MICROBIOLOGY & IMMUNOLOGY

Credits – 2
No. of Hours: 36

MICROBIOLOGY & IMMUNOLOGY

1. Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow
2. 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.

3. Culture methods (Demonstration)

(a) Streak plate technique and isolation of pure colonies.

(b) Lawn culture

(c) Pour plate culture

(d) Liquid culture

4. Examination of microbes in living condition: Hanging drop method for demonstrating motility of bacteria.
5. Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.
6. Antibiotic sensitivity test (demonstration only)
7. Streak plating (individual performance)
8. Preparation of a fungal smear – Lactophenol cotton blue staining and mounting
9. Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)
10. Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man

COMPETENCIES:

- Create awareness of the pathogens, health related problems, their origin and treatment.
- Equip the students with the knowledge of modern developments and recent trends in microbial sciences.
- Conscientise students on controlling the morbidity and mortality rates due to diseases.

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B.Sc.VI Semester - Core Course

CODE: ZY6B10B18

COURSE TITLE: MICROBIOLOGY AND IMMUNOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	10	3	2	1	23
Module II	15	3	2	1	23
Module III	8	2	2	0	12
Module IV	9	2	1	1	17
Module V	12	2	2	1	22

SEMESTER VI

CORE COURSE XI
ZY6B11B18: BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim:
To create an awareness on the basic techniques and applications of biotechnology.
To understand the basic bioinformatics and its applications relevant to the emerging diseases of society and its modern methods of treatment.

Course Overview and Context
The principles of genetic engineering and its numerous applications and hazards have been well discussed in Biotechnology. Bioinformatics gives a baseline idea on the integrated applications of biology and computers. It also discusses the wide possibilities of molecular biology and gives an understanding at the genetic level.

BIOTECHNOLOGY **20 Hrs**

Module I **11 Hrs**

Introduction: Scope, Brief History

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers & adapters), Vectors (Plasmids, Phage vectors, Cosmids, Artificial Chromosomes) Host cells. Basic steps & techniques in rDNA technology

Gene Libraries, Construction of genomic library and cDNA Library. PCR technique and DNA amplification, Brief description of screening methods – Probes, Nucleic Acid hydridization, In situ Hybridization, Fluorescence in situ Hybridization (FISH), Colony hybridization. Methods of transfer of desired gene into target cell. Blotting Techniques- Southern, Northern, Western blotting. DNA Finger printing (DNA Profiling) and its application. Molecular markers –RFLP.

Module II **9 Hrs**

Animal Cell Culture: Brief account on methods, substrates, media and procedure of animal cell culture, Stem Cells, types and potential use, Organismal Cloning- reproductive & therapeutic- brief account only.

Applications of Biotechnology: Applications in Medicine (insulin, growth hormone, gene therapy), Agriculture (GM plants and biopesticides), Environment (bioremediation), Industry (Single Cell Protein) and applications of Fermentation Technology- lactic acid, vitamins, food and beverages.

Potential Hazards of Biotechnological Inventions: Risks related to genetically modified organisms (GMO) and biologically active products, Biological warfare & Biopiracy. Protection of biotechnological inventions. Intellectual Property Rights, Patenting and patent protection.

BIOINFORMATICS **14 Hrs**

Module III **8 Hrs**

Definition, Nature & Scope of Bioinformatics - Contrast between Bioinformatics and Computational Biology, Biological databases: Nucleotide sequence databases (NCBI-GENBANK, DDBJ and EMBL). Protein databases - structure and sequence databases (PDB, SWISSPROT and UNIPROT). Introduction to Sequence alignments: Local alignment and Global alignment, Pair wise alignment (BLAST and FASTA) and multiple sequence alignment. Basic ideas of Protein Structure prediction- Concept of Homology Modeling- Idea of Molecular Phylogenetics - Phylogenetic Tree construction and Analysis - advantages and computational procedure (Brief description of Phylip).

Module IV **6 Hrs**

Bioinformatics tools: (i) Molecular Visualization Software – Rasmol (Basic features only) – (ii) ORF finding (iii) Gene finding (iv) Hydrophobicity Prediction (v) Single Nucleotide Polymorphism (SNP) prediction using GENSNIP. Basic concepts of Drug discovery pipe line, computer aided drug discovery and its applications. Human Genome Project and Human Brain Project (Brief account).

MOLECULAR BIOLOGY **20 Hrs**

Module V **8 Hrs**

Nature of Genetic Material: Discovery of DNA as genetic material – Griffith's transformation experiment. Avery MacCarty and Macleod, Hershey Chase Experiment of Bacteriophage infection, Prokaryotic genome; Eukaryotic genome.Structure and.types of DNA & RNA. DNA replication. Modern concept of gene (Cistron, muton, recon, viral genes).

Brief account of the following - Split genes (introns and exons), Junk genes, Pseudogenes, Overlapping genes, Transposons.

Module VI **12 Hrs**

Gene Expression: Central Dogma of molecular biology and central dogma reverse, one gene-one enzyme hypothesis, One gene - one polypeptide hypothesis Characteristics of genetic code, Contributions of Hargobind Khorana.

Protein synthesis (prokaryotic): Transcription of mRNA, Reverse transcription, post transcriptional modifications, Translation, Post translational modifications.

Gene regulation: Prokaryotic (inducible & repressible systems) Operon concept - Lac operon and Tryptophan operon, Brief account of Eukaryotic gene regulation.

References:

BIOTECHNOLOGY

- Singh B.D Biotechnology 2002. Kalyan Publishers New Delhi.
- Brown C.H., Campbell I & Priest F, G. 1987. Introduction of Biotechnology (Blackwell scientific publishers Oxford).
- Colin Ratledge Bijorn Kristiansesn, 2008. Basic Biotechnology 3 rd ed. Cambridge University.
- Janarathanan S & Vincent S. 2007. Practical Biotechnology, Method of Protocols. UniversityPress.
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- Martinko and Parker 2002, Biology of Microorganisms, Brock Eighth Ed. PrenticeHall.
- Singh B.D. Biotechnolgy 2002, Kalyan Publishers NewDelhi.
- Sudha Gangal 2007. Biotechnology Principles and & practice of Animal Tissue culture, Universities Press.

BIOINFORMATICS

- Arthur M. Lesk. Introduction to Bioinformatics, OXFORD publishers.
- D. Mount, Bioinformatics: sequence & Genome Analysis, Cold spring Harbor press, USA.
- Dan E. Krane and Michael L. Raymer, Fundamental Concepts of Bio-informatics, Pearson Education.
- Chavali. L.N. 2009 Bioinformatics & Bioprogramming in Cambridge University press
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- Jin Xiang 2008 Essential Bioinformatics 1st Ed. Cambridge University Press.
- 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.

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MOLECULAR BIOLOGY

- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James. (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
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- Gupta, P. K (2002) Cell and Molecular Biology, (2ed), Rastogi Publications., Meerut.
- James Darnell. (1998) Molecular Biology. Scientific American Books Inc.
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SEMESTER VI

CORE COURSE XI - PRACTICAL
ZY6BP06B18: BIOTECHNOLOGY, BIOINFORMATICS, MOLECULAR BIOLOGY& OCCUPATIONAL ZOOLOGY

Credits -
No. of Hours: 36

BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

BIOTECHNOLOGY

1. Identify and comment on the item provided: (Western blotting / Southern blotting / Northern blotting /PCR).
2. Write down the procedure involved in DNA isolation.

BIOINFORMATICS

1. Download/ use print out/ pictures of genome sequences of any 2 organisms.Identify and mention the characteristic features ofboth.
2. Download/ use print out/ pictures of a protein sequence, identify it & comment on its amino acid composition
3. Download / use print out/ pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.

MOLECULAR BIOLOGY

1. Identify and comment on the molecular composition / structural orientation / functional significance (Any tissue / Cell organelles/ DNA, DNA replication, RNA different types) using models or diagrams.

COMPETENCIES:

- Introduce the student to some of the present and future applications of bio-sciences
- Understand the nature of genetic materials at molecular level, their expression and regulation.
- Inspire the students in learning the frontier areas of biological sciences
- Equip the students with the knowledge of modern developments and recent trends in biological sciences.
- Develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

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B.Sc.VI Semester - Core Course

CODE: ZY6B11B18

COURSE TITLE: BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	11	2	2	1	22
Module II	9	2	2	1	22
Module III	8	2	1	1	17
Module IV	6	1	1	0	6
Module V	8	2	2	0	12
Module VI	12	3	1	1	18

SEMESTER VI

CORE COURSE XII
ZY6B12B18: OCCUPATIONAL ZOOLOGY
(APICULTURE, VERMICULTURE, SERICULTURE& AQUACULTURE)

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim: To impart in students the basic skills of rearing various animals in their household.

Course Overview and Context
This course equips students with self employment capabilities and acquaints them with various rearing techniques in Apiculture, Vermiculture, Sericulture and Aquaculture. It provides them with the scientific knowledge of profitable farming of Bees, Silkworms and Fishes.

Module 1: APICULTURE **18 Hrs**

Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees. Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and dearth period. Division of the colony, uniting two colonies, replacing old queen with new queen, swarming management, monsoon management. Enemies of bees. Diseases of bees, Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey. Extraction of wax,. Uses of honey and wax. Royal jelly, Propolis, Apitherapy. Agencies supporting apiculture.

Activity: Visit to an apiculture unit.

Field visit and report submission - 10 Hrs

Field visit and report submission on any two items are taken for internal evaluation.

MODULE 2: VERMICULTURE **8 Hrs**

Introduction, Ecological classification of earth worms. Species of earth worms used for vermiculture, Reproduction & life cycle, Role of earth worm in solid waste management, in

agriculture, in medicine etc. Preparation of vermibed, Maintenance & monitoring, Preparation of vermicompost, Preparation of vermiwash.

Activity: Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit

MODULE 3: SERICULTURE 4 Hrs

Four species of silkworms, Life history of silkworms, Silkworm Rearing Techniques. Mounting of worms. Harvesting and stiffling of cocoons.

MODULE 4: AQUACULTURE 24 Hrs

Advantages and salient features of aquaculture, Types of Aquaculture, Biotic and abiotic features of water, Importance of algae in aquaculture, Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture Mussel culture Pearl culture. Processing & Preservation.

Aquarium management - Setting up of an aquarium, Biological filter & Aeration, Breeding of gold fish, gourami (Osphronemus), fighter and Guppy (live bearer). Nutrition and types of feed for aquarium fishes, Establishment of commercial ornamental fish culture unit. Fish Transportation - Live fish packing and transport Common diseases of aquarium fishes and their management. Aquaponics (a brief introduction only).

Activity – Setting up of an Aquarium Field visit – Visiting an Aquaculture farm.

References:

- NPCS Board, The complete book on Bee keeping and honey processing, NIIR Project consultancy services, 106E, Kamala nagar, Delhi- 110007.
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SEMESTER VI

CORE COURSE XII–PRACTICAL 6
ZY6BP06B18: BIOTECHNOLOGY, BIOINFORMATICS, MOLECULAR BIOLOGY & OCCUPATIONAL ZOOLOGY

Credits – 2
No. of Hours: 36

OCCUPATIONAL ZOOLOGY

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

a) Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, Etroplus suratensis, Oreochromis /Tilapia, Mugil cephalus and Anabas testudineus)

b) Identification and morphology of ornamental fishes (gold fish, fighter, Gourami, Angel fish, Guppy

c) Two species of earthworms used in Vermiculture

d) Four species of honey bees

e) Economic importance and morphology of shell fishes (Any three species of prawn, two marine mussels, two oysters: one rock oyster - Crassostrea and pearl oyster - Pinctada fucata and freshwater mussel - Lamellidens marginalis).

2. Castes of bees.
3. Principle& uses of - Aquarium filters, Aquarium aerator, Aquarium plants, Oven, Pelletiser, Screw Press, die plate.
4. Identification and study of fish parasites and diseases (five numbers each) using slides/ pictures.
5. Bee keeping equipments, Beehive, Smoker, honey extractor, Queen Cage.
6. Bees wax, Honey, Vermicompost (Identification-Uses)
7. Formulation of artificial feed for aquarium fishes – demonstration
8. Tests for determining the adulteration in honey.
9. Mounting of pollen basket
10. Mounting of mouth parts of honey bee
11. Separation of cocoon from worm castings.
12. Silkworm. Cocoon/Adult
13. Chandrika /Natrika used in sericulture.

COMPETENCIES:

• Skill development in applied branches of Zoology.

• Understand the various methods in animal breeding and rearing techniques.

• Self employment opportunities.

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B.Sc. VI Semester - Core Course

CODE: ZY6B12B18

COURSE TITLE: OCCUPATIONAL ZOOLOGY

(APICULTURE, VERMICULTURE, SERICULTURE & AQUACULTURE)

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	18	4	4	1	34
Module II	08	2	1	1	17
Module III	04	2	1	0	07
Module IV	24	4	3	2	39

CHOICE BASED COURSES
FOR
ZOOLOGY CORE

SEMESTER VI

CHOICE BASED COURSE

ELECTIVE I

ZY6B13aB18: NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

Credits – 4
Duration: One Semester
Total Lecture Hours: 72

Aim: Promote health and wellbeing of the society as a whole.

Course Overview and Context

The course deals with Importance of health for individual and society at large. It emphasises the need for exercise and its effect on all body systems. It also provides an insight into health at the community level and on managing public health and water quality for an overall benefit. The common diseases breakouts that are associated with community are also dealt in the paper.

Module I NUTRITION 15 Hrs

Nutrition and health: Nutritional requirements of man, classification of major nutrients including protein, vitamins and minerals, water, role of fibre, biological value of food components, food groups and sources, balanced diet, RDA, BMI, BMR, Calorie intake and expenditure, Healthy eating pyramid, Nutrition in infancy, preschool, school, adolescent, pregnancy, lactation and old age. Nutrition in diseases and special conditions. Food safety: Nutrition education, food sanitation and hygiene, food adulteration and consumer protection.

Module II HEALTH 18 Hrs

Understanding of health: Definition, Dimensions, and Determinants of Health, basic parameters of health care. (Health Parameters: Individual normal standards) & Devices.1. Blood pressure, 2. Brain activities and sleep, 3.Focus or attention, 4.Pulse, 5. Body temperature, 6. Daily physical

activities, 7. Electrocardiogram (ECG), 8. Cardiac fitness 9. Stress, 10. Haematological parameters.

Module III LIFESTYLE DISEASES 15 Hrs

a) Neural diseases: Depression, stroke and other neural disorders (brief account)

b)Cardio vascular diseases - including hypertension, Atherosclerosis and stroke, chronic obstructive pulmonary disease, asthma, Diabetes Mellitus or Type 2 Diabetes, C) kidney disorders and chronic renal failure, D) Intestinal diseases- constipation, gastro-intestinal disturbances including diarrhoea and peptic ulcer, E) Liver diseases- liver cirrhosis, F) Modern lifestyle disorders: sleeping habits-apnoea, junk food, poor eating habits, anxiety, food poisoning, cancer,obesity, osteoporosis, PCOD G) Occupational lifestyle diseases.

Module IV CAUSES OF LIFESTYLE DISEASES 10 Hrs

Defects of modern food habits and unbalanced diet options, food adulteration, environmental pollution, poor life style choices, drug abuse, alcohol and drug consumption, lack of adequate exercise, wrong body posture, disturbed biological clock, stressful environmental conditions.

Module V PREVENTION AND CONTROL OF LIFE STYLE DISEASES 14 Hrs

Healthy life style habits and practices, healthy eating habits, exercise and fitness, good sleep patterns, a strict no to alcohol, drugs, and other illegal drugs. Uncontrollable factors like age, gender, heredity and race.

Healthy diet: disease prevention through appropriate diet and nutrition, avoiding foods that are high in fats, salt and refined products. Avoid junk food and replace by natural food/ organic food.

Physical exercise: Moderate exercise for fitness of body, walking, stretching, right postures of sitting & standing, relaxation and cutting down of stress, sports, aerobic exercise and yoga.

Physical Activity and Health benefits, Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skeletal and Muscular

Health literacy as a public health goal: Awareness programs in schools, colleges and through mass media.

References:

- AAPHERD (1980). Health Related Physical Fitness Test Manual. Published by Association drive Reston Virginia.
- ACSM (2005). Health Related Physical Fitness Assessment Manual Lippincott Williams and Wilkins USA, 3. Begum, M.R. (2006).A Text Book of Foods, Nutrition and Dietetics. 2nd Edn. Sterling Low Price Edition.Sterling Publishers Private Ltd., New Delhi
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- Greenberg, and Dintiman B 1997.Wellness Creating a life of Health and Fitness, London Allyn and Bacon Inc.
- Kumar, M and Kumar R. 2003 Guide to Healthy Living: Role of food and exercise. Deep and Deep Publications.
- Kumar, M. and Kumar R. 2004. Guide to Prevention of Lifestyle Diseases. Deep and Deep Publications.Curriculum for B.Sc. Zoology Programme.108
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- Ralph, S., Barger P., Jr. and Leolson E. (1999) Life Fit, 1999 Human Kinetics USA
- Schlenker, E. and J.A.Gilbert. (2014) Essentials of Nutrition and Diet Therapy, Edt. RD Williams. 11e Paperback – Import, 4 Nov 2014
- Sing.MD. (2008). Textbook of Nutritional Health and First Ed: 2008 Academic excellence.

COMPETENCIES:

- To provide students with a general concept of health and the parameters that define health and wellness.
- To understand principles of nutrition and its role in health.
- To familiarize the students regarding food safety, food laws & regulations.
- To provide knowledge and understanding regarding life style diseases.
- To promote an understanding of the value of good life style practices, physical fitness and healthy food habits for life style disease management.

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B.Sc. VI Semester - Choice Based Course

CODE: ZY6B13aB18

COURSE TITLE: NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

Modules	**Hours 72**	**PART A (short answer) 2 marks 10/12**	**PART B (short essay) 5 marks 6/9**	**PART C (essay/problem) 15 marks 2/4**	**Total**
Module I	15	4	2	1	33
Module II	18	3	2	1	31
Module III	15	2	2	1	29
Module IV	10	1	2	0	12
Module V	14	2	1	1	24

SEMESTER VI

ZOOLOGY CORE CHOICE BASED COURSE

ELECTIVE II

ZY6B13bB18: ECOTOURISM & SUSTAINABLE DEVELOPMENT

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim: Introduce the concepts, principles and applications of tourism and its sustainability

Course Overview and context
Critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends. Develop an appreciation among students with respect to tourism development from the sustainability perspective. Equip the students with basic knowledge for the emerging ecotourism industry

Module I. Fundamentals of Tourism **12 Hrs**

Introduction- Tourism, concepts and definitions History, types, Characteristics

The facilitating sectors Attractions Geography, heritage Wildlife, nature Quality Control

Module II. Major areas of eco-tourism **10 Hrs**

Concepts, practices and case studies for each: Marine tourism

Wildlife tourism Adventure tourism

Module III. Emerging trends in eco-tourism **10Hrs**

Cultural tourism Pilgrimage tourism Farm tourism Backwater tourism Health tourism

Module IV. Problems and prospects of eco-tourism **10 Hrs**

Economics and benefits of ecotourism

Cultural issues and negative aspects of ecotourism Environmental Impacts of Tourism

Module V. Sustainable tourism **12 Hrs**

Quality, Standards

Systems of sustainable tourism: environmental, sociocultural, Economical Environment and conservation: basic principles

Current practices of eco-conservation in tourism industry Sustainable tourism and society

Community based ecotourism

Eco-development committee (EDC) of Periyar Tiger Rerserve People initiatives.

Module VI. Eco-tourism guides **8 Hrs**

Ecotourism guiding and case studies

Activity

Field visit to Ecologically relevant places & Report writing **10 Hrs**

References:

- Bruner, E.M. 2005. Culture on tour: ethnographies of travel. The University of Chicago Press.
- Ghimire, K.B. and M. Pimbert. 1997. Social change and conservation: environmental politics and impacts of national parks and protected areas. London: Earthscan Publications.
- Karan Singh. 1980. Indian Tourism: Aspects of great adventure. Department of tourism. New Delhi.
- Ratandeep Sing. 2003. National Ecotourism and Wildlife tourism: Policies and guidelines.
- Kanishka Publishers, New Delhi
- Whelan, T. 1991. Nature tourism: managing for the environment. Washington, D.C.: Island Press.
- Brian Garrod and Julie C. Wilson. 2002. Marine Ecosystem. Channel View Publications.

- Ghimire, K.B. and M. Pimbert. 1997. Social change and conservation: environmental politics and impacts of national parks and protected areas. London: Earthscan Publications.
- Ratandeep Sing. 2003. National Ecotourism and Wildlife tourism: Policies and guidelines.
- Kanishka Publishers, New Delhi

COMPETENCIES:

- To introduce the concepts, principles and applications of tourism and its sustainability.
- To critically analyse the cost and benefits of ecotourism, including related laws and policies, community involvement and future trends.
- To develop an appreciation among students with respect to tourism development from the sustainability perspective.
- To equip the students with basic knowledge for the emerging ecotourism industry.

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B.Sc. VI Semester - Choice Based Course

CODE: ZY6B13bB18

COURSE TITLE: ECOTOURISM & SUSTAINABLE DEVELOPMENT

Modules	Hours 72	PART A (short answer) 2 marks 10/12	PART B (short essay) 5 marks 6/9	PART C (essay/problem) 15 marks 2/4	Total
Module I	12	2	2	1	29
Module II	10	2	1	1	24
Module III	10	2	2	0	14
Module IV	10	2	1	1	24
Module V	12	2	2	1	29
Module VI	8	2	1	0	9

SEMESTER VI

ZOOLOGY CORE CHOICE BASED COURSE

ELECTIVE III

ZY6B13cB18: AGRICULTURAL PEST MANAGEMENT

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim: Understand the various pests and the diseases they spread on crops.

Course Overview and Context

The course deals with the various crop pests that can cause diseases in agriculture. It emphasizes the basic knowledge on the various insect and non insect pests and the chances of crop loss. It provides an insight into the prevention and possible management measures. It helps to learn the different control measures practiced today and give awareness on pest managementand promote organic foodfarming for a sustainable environment and healthy society.

Module I **5 Hrs**

Pest and crop loss: Introduction, historical perspective-origin of pest, Evolution of pest. Causes of pest outbreak- biotic, abiotic and genetic factors. Modern agricultural practices and pest problem - high yielding varieties, monoculture, fertilizers, pesticides, irrigation, and cultural practices.

Module II **15 Hrs**

Pest categories: Types of pests- insect pest and non-insect pest.

Insect pest: insect structure and function-external features (body parts), mouth parts of phytophagous insects, internal anatomy, growth, development, reproduction, life cycle and metamorphosis (one example each from ametabolous, hemimetabolous and holometabolous insect), diapause. types of insect pests-key pests, occasional pests, potential pests.

Non insect pests: General features, different types – Rodents (mention the nature of crop loss by them) Mites-Main types of mites; plant injury caused by mite, millipedes and centipedes, slugs and snails (mention the damage of invasive Giant African Snail).

Activity: Identify a minimum of 5 invasive species (plant / animal) in your locality and make a report on their ecological impact.

Module III **7 Hrs**

Pest and plants: Plant feeding insects-plant host range, types of injury, relationship of pest injury and yield.

Host plant resistance: Characterization of resistance, mechanism of resistance (antixenosis, antibiosis, tolerance), biophysical, biochemical and genetic bases of resistance.

Module IV **20 Hrs**

Pest control-principles and practices: Types of control-cultural control, biological control, chemical control, integrated pest management, miscellaneous control.

Cultural control: Water management, tillage, sanitation, plant diversity, crop rotation, planting time, harvesting practices etc

Biological control: Parasitoids and predators, control by insect pathogens. Techniques in biological control-conservation, introduction and augmentation. Biopesticides

Chemical control: Origin of chemical control, chemistry, mode of action and nomenclature (organochlorines, organophosphates, carbamates, synthetic pyrethroids, miscellaneous group) of pesticides, pesticide formulations and pesticide appliances (sprayers and dusters). Brief mention of attractants, repellents, chemosterilants and pheromones

Activity 1: Conduct a workshop on preparation of biopesticides of various types suitable for kitchen garden and agricultural fields.

Integrated Pest Management (IPM)

Miscellaneous control: Mechanical (hand picking, exclusion by screens and barriers, trapping, clipping, pruning etc), physical (hot and cold treatment, moisture, light traps etc), sterility principle.

Module V **25 Hrs**

Bionomics and control of major pests of crops and stored grains: Biology, life cycle and nature of damage by different pests of following crops and their control

Pests of paddy: Leptocorisa acuta, Scirpophaga incertulas, Spodoptera mauritia, Orseolia oryzae, Nilaparvata lugens

Pests of coconut: Oryctes rhinoceros, Rhyncophorus ferrugineus, Opisina arenosella, Aceria guerreronis

Pests of Banana: Cosmopolites sordidus, Pentalonianigronervosa

Pests of vegetables - Brinjal: Leucinodesorbonalis, Euzopheraperticella, Henosepilachnavigintioctopunctata, Urentiushystricellus

Gourds -Bactoceracucurbitae, Anadevidiapeponis, Epilachna spp. Raphidopalpafoveicollis, Baristrichosanthis

Pest of stored grains: Sitophilusoryzae, Corcyra cephalonica Triboliumcastraneum, Trogodermagranarium, Callasobruchuschinensis

Activity 2: Conduct a poster exhibition on various types of pests of paddy, coconut, banana and vegetable varieties of Kerala.

Activity 3: Collect different types of pest of stored grains from the local provision shops or houses and make a taxonomic study and prepare a powerpoint presentation on them.

Activity 4: Visit a minimum of 5 kitchen gardens in the neighborhood and enlist the common traditional pest control measures used in them.

Activity 5: Organise awareness classes on the ill effects of chemical pesticides and manure on human health with the support of local examples.

References:

- Ananthakrishnan, T.N. (1992) Dimensions of Insect – Plant Interactions. Oxford and IBH Publishing Co.Ltd. New Delhi.
- Atwal, A.S. (1986). Agricultural Pests of India and South East Asia. Kalyani Publications New Delhi.
- Awasthi, V.B. (2002). Introduction to General and Applied Entomology (2nd edn).Scientific Publishers (India), Jodhpur.
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- Fenemore, P.G and Prakash Alka. (2009) Applied Entomology. New Age International Publishers, New Delhi.
- Fenemore, P.G. and Prakash A. (1992). Applied Entomology.Wiley Eastern Ltd. New Delhi.
- Hill, D.S. (1983). Agricultural Insect Pests of Tropics and Their Control.Cambridge University Press Cambridge.
- John P.C., (Editor) (1998), Applied Zology, Zoological Society of Kerala, Kottayam
- Larry P. Pedigo, (2002) Entomology and Pest management, 4th Edition, Prentice Hall - India, Delhi
- Nair, M.R.G.K. (1978). A Monograph of Crop Pests of Kerala and Their Control.Kerala Agricultural University.
- Nair, M.R.G.K. (1986). Insects and Mites of Crops in India.ICAR New Delhi.

- Nayar, K.K., Ananthakrishnan, T.N. and. David, B.V. (1976). General and Applied Entomology. Tata McGraw Hill Publ. Co. Ltd New Delhi
- Pedigo, L.P. (1996). Entomology and Pest Management Practice. Hall India, Pvt. Ltd. New Delhi
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- Rao, V.P. Ghani, M.A., Sankaran T and Mathur, K.C. (1971). A Review of Biological Control of Insects and Other Pest in South East Asia and Pacific region. CAB, England.
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- Vasantharaj David. (2002). Elements of economic Entomology. Popular Book House, Chennai.
- Yazdani, S.S. and Agarwal, M. L.(1997). Elements of Insect Ecology. Narosa Publishing House, New Delhi

COMPETENCIES:

- To acquire basic skills in the observation and study and control of pests innature.
- To impart basic awareness regarding pest problem and crop loss due to theirdominance.
- To inculcate interest in adopting biological control strategies for pestcontrol.
- To understand various pests affecting our local crops and select the best method fortheir control.

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B.Sc. VI Semester - Choice Based Course
CODE: ZY6B13cB18

COURSE TITLE: AGRICULTURAL PEST MANAGEMENT

Modules	Hours 72	PART A (short answer) 2 marks 10/12	PART B (short essay) 5 marks 6/9	PART C (essay/problem) 15 marks 2/4	Total
Module I	5	1	1	0	7
Module II	15	2	2	1	29
Module III	7	1	2	1	27
Module IV	20	4	2	1	33
Module V	25	4	2	1	33

SEMESTER VI

CHOICE BASED COURSE

ELECTIVE IV

ZY6B13dB18: VECTOR AND VECTOR BORNE DISEASES

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim: Spread awareness on the vectors and the diseases they spread.

Course Overview and Context

The course deals with the animals (vectors) that can cause diseases and the type of disease each of them can cause. It emphasizes the basic knowledge on the various insect vectors and the mechanism of disease epidemiology. It provides an insight into the prevention and possible management measures. It imparts awareness of the conservation of thebiosphere.

Module I **10 Hrs**

Introduction: Vector: mechanical and biological vector, Reservoirs, Host-vector relationship, Vectorial capacity, Host Specificity.

Insect vectors: Mosquitoes, flies, fleas, lice, ticks and bugs- General account of ecology morphology and mouth parts.

Module II **6 Hrs**

Salient features and distribution of mosquito species: Anopheles, Aedes, Culex, and Mansonia.

Module III **25 Hrs**

Study of Vector Borne disease [Life cycle and pathology]: Mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis. Sand fly-borne diseases – Leishmaniasis, Phlebotomus fever. Tse- tse fly – sleeping sickness. House fly borne diseases: typhoid fever, cholera, dysentery, anthrax, Myiasis, Flea-borne diseases – Plague, Typhus fever. Louse- borne diseases –Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis.

Module IV **13 Hrs**

Introduction to Vector control: Aims, objectives and advantages.History and background, recent trends, alternatives to the use of insecticides (chemical & microbial), types of vector control - selective, integrated and comprehensive vector control.

Control measures of mosquitoes, sand fly, tsetse fly and domestic flies

Module V **8 Hrs**

Introduction to epidemiology: History, Definition, scope and uses of epidemiology. Epidemiology and public health. Achievements in epidemiology: Smallpox Methyl mercury poisoning. Rheumatic fever and rheumatic heart disease Iodine deficiency diseases Tobacco use, asbestos and lung cancer, Hip fractures. HIV/AIDS, SARS.

Field report on two case studies of epidemiology in India. **10 Hrs**

References:

- Bates M (1949) Natural History of mosquitoes The Macmillan Co.
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK.
- De Barjac. 1990. Bacterial control of mosquitoes & black flies: biochemistry, genetics & applications of Bacillus thuringiensisisraelensis & Bacillus sphaericus.
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- Potts, W.H. Glossinidae (tsetse flies). 1973. In: Smith, K.G.V. (ed.): Insects and other Arthropods of Medical Importance. British Museum (Natural History), London.
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- Rao, T. R. 1984. The Anophelines of India. Malaria Research Centre, ICMR, New Delhi.
- Service M. W. 1996. Medical Entomology for students. Chapman & Hall, London
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- Wall, R., Shearer, D. 2001.Veterinary ectoparasites: biology, pathology and control. Blackwell Science.
- Wall, R., Shearer, D. 1997. Adult flies (Diptera). In: Wall, R., Shearer, D. (eds.): Veterinary Entomology.Chapman & Hall, London.
- Ward, J.V. 1992. Aquatic Insect Ecology. John Wiley & Sons, Inc., USA.
- Williams, D.D. &Feltmate, B.W. 1992. Aquatic Insects. C.A.B. International, UK.
- R Bonita R Beaglehole T Kjellström Basic epidemiology 2nd edition WHO Library Cataloguing-in-Publication Data Bonita ISBN 92 4 154707 3 (NLM classification: WA 105) ISBN 978 92 4 154707 9 © World Health Organization 2006.

COMPETENCIES:

- To inculcate a general awareness among the students regarding the threats due to insect vectors.
- To understand the health hazards due to vector borne diseases.
- Develop anattitude towards sustainability.
- To motivate them to practice a disease preventive approach in day-to-day life.

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B.Sc. VI Semester - Choice Based Course
CODE: ZY6B13dB18
COURSE TITLE: VECTOR AND VECTOR BORNE DISEASES

Modules	**Hours 72**	**PART A (short answer) 2 marks 10/12**	**PART B (short essay) 5 marks 6/9**	**PART C (essay/problem) 15 marks 2/4**	**Total 80**
Module I	10	2	2	1	29
Module II	6	2	1	1	24
Module III	25	4	2	1	33
Module IV	13	2	2	1	29
Module V	8	2	2	0	14

OPEN COURSES FOR OTHER STREAMS

SEMESTER V

OPEN COURSES FOR OTHER STREAMS

ELECTIVE I

ZY5D01aB18: HUMAN GENETICS, NUTRITION AND PUBLIC HEALTH

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim: Promote health and wellbeing of the society as a whole.

Course Overview and Context

The course deals with Importance of health for individual and society at large. It emphasises the need for exercise and its effect on all body systems. It also provides an insight into health at the community level and on managing public health and water quality for an overall benefit. The genetic disorders and common diseases breakouts that are associated with community also dealt in the paper.

PART I: HEALTH, EXERCISE & NUTRITION

Module 1 Definition and Meaning of Health 10 Hrs

Definition, Dimensions and Determination of Health. Physical Activity and Health benefits
Effect of exercise on body systems – Circulatory, Respiratory, Endocrine, Skeletal and Muscular
Programmes on Community health promotion (Individual, Family and Society) Dangers of alcoholic and drug abuse, medico-legal implications

Module 2 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, BMR

Module 3 Safety Education in Health promotion 8 Hrs

Principles of Accident prevention Health and Safety in daily life, Health and Safety at work. First aid and emergency care.Common injuries and their management. Modern life style and hypo-kinetic diseases.Diabetes, Cardiovascular disorders-Prevention and Management.

Module 4 Life Skill Education 8 Hrs

Life skills, emotional adjustment and well being. Yoga, Meditation and Relaxation, Psychoneuroimmunology

PART II: PUBLIC HEALTH AND SANITATION

Module 5 Public health and water quality. 11 Hrs

Potable water, Health and Water quality, Faecal bacteriae and pathogenic microorganisms transmitted by water. Determination of sanitary quality of drinking water, water purification techniques

Module 6 Public health and diseases 10 Hrs

Water borne diseases-Cholera and Typhoid.Prevention of Water borne diseases.

Food borne diseases and Prevention -Botulinum, Salmenellosis, Hepatitis A

Vector borne diseases & Control measures - Chikungunya, Filariasis and Dengu fever

Zoonotic disease-Leptospirosis & its control

Emerging diseases - Swine flu (H1N1), bird flu (H5N1), SARS, Anthrax

Re-emerging diseases –TB, Malaria

PART III: HUMAN GENETICS

Module 7 Human Genetics 10 Hrs

Human normal chromosome complement. Genetic disorders in man. Chromosomal anomalies. Eg. Down Syndrome and Cridu chat syndrome. Sex chromosomal anomalies – Syndromes-Klinefelters Syndrome and Turners Syndrome. Single gene mutation disorders- Eg. Sickle Cell anaemia. Polygenic – Cleft lip and palate. Sex linked inheritance – Haemophilia and Colour

blindness. Pre – natal Diagnosis (Amniocentesis, and Chorionic Villus Sampling) Ultra sound scanning and Fetoscopy Genetic Counselling. Eugenics and Euthenics.

Health Centre visit & Report Presentation **5 Hrs**

References:

- Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.
- Greenberg, Jerol S and Dintiman George B (1997) Wellness Creating a life of Health and Fitness , London Allyn and Bacon Inc.
- K Park, (2008) Park's Text Book of Preventive and Social Mediine 18th Edition. Banarasidass Bhenot Publication
- Norman Bezzaant HELP First Aid for everyday emergencies. Jaico Publishing House, Bombay, Delhi
- Tom Sanders and Peter Emery. (2004) Molecular basis of human nutrition: Taylor & Francis Publishers Ane Book
- Pelczar M.J. Jr. E.C.S. Chane & N.R. Krieg, Microbiology (Concept & Applications). 5th edition. Tata McGraw Publishing Company Ltd.

COMPETENCIES:

- To inculcate a general awareness among the students regarding the real sense of health.
- To understand the role of balanced diet in maintaining health.
- To motivate them to practice yoga and meditation in day-to-day life.

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B.Sc. V Semester - Open Course

CODE: ZY5D01aB18

COURSE TITLE: HUMAN GENETICS, NUTRITION AND PUBLIC HEALTH

Modules	**Hours 72**	**PART A (short answer) 2 marks 10/12**	**PART B (short essay) 5 marks 6/9**	**PART C (essay/problem) 15 marks 2/4**	**Total**
Module I	10	2	1	1	24
Module II	10	2	2	0	14
Module III	8	1	1	0	7
Module IV	8	1	1	0	7
Module V	11	2	2	1	29
Module VI	10	2	1	1	24
Module VII	10	2	1	1	24
Health Centre visit & Report Presentation	5				

SEMESTER V

OPEN COURSES FOR OTHER STREAMS

ELECTIVE II

ZY5D01bB18: VOCATIONAL ZOOLOGY

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim:

- To appreciate the diversity of life on earth and instill an interest to conserve the rich faunal biodiversity leading to sustainable development.
- Equip the students interested in the applied branches of zoology with skills and knowledge which can lead to self employment opportunities

Course Overview and Context

Equip students with various rearing techniques in Aquaculture, Sericulture, Vermiculture and Apiculture. Knowledge of diseases frequenting the Bees, Silk worm and Fishes are elaborated. Knowledge on rearing of Bees, Silk worm and Fishes can lead to self employment opportunities.

Module 1: Aquarium management **12 Hrs**

General introduction to Aquarium, Aims and types of aquarium (material, size and shape), Requirements of an aquarium - filtration of waste, physical, chemical and biological; Setting an aquarium (self-sustainable with biological filters), Major indigenous aquarium fishes of Kerala.
Activity: Setting up of a freshwater aquariumand rearing of aquarium fishes.

Module 2: Ornamental Fish Culture **20 Hrs**

Introduction to ornamental fishes: Present status of ornamental fish culture in India with special reference to Kerala, Breeding of Gold fish, Fighter, Gourami (Osphroneus), and Guppy (live bearer). Nutrition and types feed for aquarium fishes,Use of live fish feedorganisms in Ornamental fish culture. Methods and techniques involved in the formulation of fish feed. Fish Transportation: Live fish packing and transport, Common diseases of aquarium fishes and their management. Establishment of commercial ornamental fish culture unit.

Activity: field visit to an ornamental fish breeding Centre to understand breeding practices of various aquarium fishes.

Module 3: Quail farming (Coturnix coturnix) **10 Hrs**

Introduction, care of quail chicks, care of adult quails, care of breeding quails ,ration for quail, care of hatching eggs, health care, use of quail egg and meat, Sources of quality chicks. Activity: Visit to a quail farm or viewing a quail documentary to familiarize the quail farming practices

Module 4: Vermiculture and composting **12 Hrs**

Introduction, ecological classification of earth worms, Life history, Species of earth worms used for vermicultre, Preparation of vermibed; Preparation of vermicompost, Preparation of vermiwash, Maintenance and management of vermicomposting unit, Role of vermiculture in solid waste management.

Activity: - Preparation of a vermiculture unit or visit to a vermicomposting unit.

Module 5: Apiculture **18 Hrs**

Definition, Uses of bees, species of bees cultured, organization of honey bee colony, bee keeping methods (modern method only) and equipments, management and maintenance of an apiary-growth period, dividing the colony, uniting two colonies, replacing old queen with new queen, honey flow period, Bee pasturage, Death period, Enemies of bees, Bee diseases, uses of honey and wax, Apitherapy, Propolis, Royal jelly, Agencies supporting apiculture.

Activity: Identify different types of honey bees and rearing equipments

Field visit and report Submission

Field visit and report writing on any two items are taken for internal evaluation, instead of assignment and seminar. Conduct a workshop on various cultural practices and the preparation of byproducts.

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COMPETENCIES:

- Develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.
- Emphasize the central role that biological sciences plays in the life of all organisms.
- Introduce the student to some of the present and future applications of bio-sciences.

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B.Sc. V Semester - Open Course

CODE: ZY5D01bB18

COURSE TITLE: VOCATIONAL ZOOLOGY

Modules	**Hours 72**	**PART A (short answer) 2 marks 10/12**	**PART B (short essay) 5 marks 6/9**	**PART C (essay/problem) 15 marks 2/4**	**Total**
Module I	12	2	2	1	29
Module II	20	3	2	1	31
Module III	10	2	1	0	9
Module IV	12	2	2	1	29
Module V	18	3	2	1	31

SEMESTER V

OPEN COURSES FOR OTHER STREAMS

ELECTIVE III

ZY5D01cB18: MAN, NATURE AND SUSTAINABLE DEVELOPMENT

Credits – 3
Duration: One Semester
Total Lecture Hours: 72

Aim: Dismantle compartmentalization of knowledge, reveals links between different disciplines and promotes solutions which reconcile interests of nature and human beings. Such a holistic approach is necessary for sustainable development.

Course overview and context
Learn the different resources available on earth. Study global environmental problems and its impact on human well being. Appreciate the perspectives of Man on nature and learn the strategies for conservation

Module I: Man in Nature **10 Hrs**
Introduction. Evolution of Man
Out of Africa and Candelabra Model
The Fossils and the Molecular Evidences Hunter-Gatherer and the Agriculturist Speech and Languages. Cultural Evolution Altruism and Morality

Module II: The Biosphere **10 Hrs**
Earth-Continents and Continental drift
Freshwater
Concept of Landscapes and Habitats Lithosphere- Forest (Tropical and Temperate) Grasslands, Deserts and Montane
The Biomes of the World Hydrosphere- Oceans, Estuaries
Water the Elixir of Life
Atmosphere- Structure and stratification

Module III: Dominance of Man on Earth **7 Hrs**
Industrial Revolution
Human Population Growth Resource Utilization
Environmental Consequences Modern Agriculture and Green Revolution
Environmental Impacts Imperialism and its Ecological Root

Module IV: Natural Resources **7 Hrs**

Renewable and Non- renewable Biodiversity
Importance of Biodiversity -the Six E S
Hotspots of Biodiversity
Biotic Richness of India
Monoculture and loss of Genetic Diversity Extinction Crisis, IUCN and Red Data Book

Module V: Global Environmental Issues Threatening NaturalResources and Human Life **10 Hrs**

Deforestation, Landscape alterations, Soil erosion, Flood and Drought, Desertification, Overexploitation, Pollution (Air, Water and Soil- Pollutants and Consequences only), Acid rain, Ozone depletion, Greenhouse effect and Global Warming (use case studies to illustrate the points) Waste disposal (Biodegradable and Non-degradable eg. Plastic and E- waste), Oil spill Energy - Production, Consumption and its Impact on Environment Quality of the Environment and Human Health

Module VI: Man's Perspective on Nature **10 Hrs**

Eco Spirituality, Eco-theology and Eco-feminism Community initiatives
Indigenous People's Perspective (tribal and traditional communities)
Native American, Amazonian, Australian Aborigines, Bishnoi Contributions of -John Muir, Aldo Leopold, Thoreau, Rachel Carson Edward Abbey, Arne Ness, Carolyn Merchant,Vandana Shiva

Module VII: Global Strategies for Conservation **8 Hrs**

UN conference on Man and Environment-1972 UNEP and its Contributions
The World Conservation Strategy-1980
World Commission on Environment and Development The Earth Summit -1992
The UNFCC and IPCC
Conservation Strategies in India-MoEF
Legal System- Mention Major Conservation Acts People's Participation in Conservation:
Chipko Movement and Narmada Bachao Andolan, Silent Valley

Module VIII: Sustainable Development **10 Hrs**

Definition and Concept Principles and Goals
Environment versus Development Debate Johannesburg Conference -2002 Strategies for Sustainable development
Sustainable Development in the era of Globalization Gandhian Environmentalism
Education for Sustainable Development (UNESCO-ESD) Building a Sustainable society
Sustainable life styles

References:

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COMPETENCIES:

- Understand how Man originated and attained present status.
- Learn the basic concepts of Ecosystems and its functioning.
- Study the use and abuse of nature by Man.
- Familiarize with sustainable development and develop an attitude for sustainability.

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B.Sc. V Semester - Open Course

CODE: ZY5D01cB18

COURSE TITLE: MAN, NATURE AND SUSTAINABLE DEVELOPMENT

Modules	**Hours 72**	**PART A (short answer) 2 marks 10/12**	**PART B (short essay) 5 marks 6/9**	**PART C (essay/problem) 15 marks 2/4**	**Total**
Module I	10	1	1	0	7
Module II	10	2	2	1	29
Module III	7	1	1	0	7
Module IV	7	1	1	0	7
Module V	10	2	1	1	24
Module VI	10	2	1	1	24
Module VII	8	1	1	0	7
Module VIII	10	2	1	1	24

ZOOLOGY COMPLEMENTARY COURSE FOR BOTANY & HOME SCIENCE

SEMESTER I

COMPLEMENTARY COURSE 1
ZY1C01B18: NON CHORDATE DIVERSITY

Credits – 2
Duration: One Semester
Total Lecture Hours: 36

Aim: To study the scientific classification of invertebrate fauna.

Course Overview and Context

The course seeks to famliarize the students about the non chordate fauna living in and around us. It helps to instill in them a curiosity to study the anatomical and physiological peculiarities in some invertebrates through type study. It throws awareness on parasitic protozoans, helminthes and vector arthropods which are the cause behind many diseases. It also high lights the importance of conservation of coral reefs.

Module I **10 Hrs**

Introduction: Five kingdom classification

Kingdom Protista: Salient features (any five important salient features) of each phylum with one example each (detailed account of example is not necessary).

Phylum Rhizopoda	(eg: Amoeba)
Phylum Actinopoda	(eg: Actinophrys)
Phylum Dinoflagellata	(eg: Noctiluca)
Phylum Parabasalia	(eg: Trichonympha)
Phylum Metamonda	(eg: Giardia)
Phylum Kinetoplasta	(eg: Trypanosoma)
Phylum Euglenophyta	(eg: Euglena)
Phylum Cryptophyta	(eg: Cryptomonas)
Phylum Opalinata	(eg: Opalina)
Phylum Bacillariophyta	(eg: Diatoms)
Phylum Chlorophyta	(eg: Volvox)
Phylum Choanoflagellata	(eg: Proterospongia)
Phylum Ciliophora	(eg: Paramecium)
Phylum Sporozoa	(eg: Plasmodium)
Phylum Microsporidia	(eg: Nosema)
Phylum Rhodophyta	(eg: Red algae)

General Topic: Pathogenic Protists – Plasmodium, Entamoeba

Module II **3 Hrs**

Phylum Porifera: Salient features (eg: Leucosolenia)
Phylum Coelenterata: Salient features and classification upto class.
Class 1: Hydrozoa (eg: Physalia)
Class 2: Schyphozoa (eg: Aurelia)
Class 3: Anthozoa (eg: Adamsia)
General Topic: Corals and Coral reefs.

Module III **6 Hrs**

Phylum Platyhelminthes: Salient features and classification up to class.
Class 1: Turbelleria (eg: Planaria)
Class 2: Trematoda (eg: Fasciola)
Class 3: Cestoda (eg: Taenia solium)
Phylum Nematoda: Salient features and classification up to class.
Class 1: Phasmida (eg: Wuchereria)
Class 2: Aphasmida (eg: Trichinella)
Phylum Annelida: Salient features and classification up to class.
Class 1: Archiannelida (eg: Polygordius)
Class 2: Polychaeta (eg: Nereis)
Class 3: Oligochaeta (eg: Pheretima)
Class 4: Hirudinomorpha (eg: Hirudinaria)

Module IV **11 Hrs**

Phylum Arthropoda: Salient features. Type study – Fenneropenaeus (Penaeus) - habitat, morphology, appendages, sexual dimorphism, digestive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system and larval stages.
Classification up to class with one example each
Subphylum Trilobitomorpha
Class 1: Trilobita (Extinct) (eg: Dalmanites)
Subphylum: Chelicerata
Class 1: Merostoma (eg: Limulus)
Class 2: Arachnida (eg: Spider)
Class 3: Pycnogonida (eg: Nymphon)
Subphylum Mandibulata
Class 1: Crustacea (eg: Daphnia)
Class 2: Chilopoda (eg: Centipede)
Class 3: Symphyla (eg: Scutigerella)
Class 4: Diplopoda (eg: Millipede)
Class 5: Pauropoda (eg: Pauropus)

Class 6: Insecta (eg: Butterfly)

Module V **6 Hrs**

Phylum Mollusca: Salient features and classification up to class
Class 1: Aplacophora (eg: Neomenia)
Class 2: Monoplacophora (eg: Neopilina)
Class 3: Polyplacophora (eg: Chiton)
Class 4: Bivalvia (eg: Perna)
Class 5: Gastropoda (eg: Xancus)
Class 6: Cephalopoda (eg: Sepia)
Class 7: Scaphopoda (eg: Dentalium)
Phylum Echinodermata: Salient features and classification up to class.
Class 1: Asteroidea (eg: Astropecten)
Class 2: Ophiuroidea (eg: Ophiothrix)
Class 3: Echinoidea (eg: Echinus)
Class 4: Holothuroidea (eg: Holothuria)
Class 5: Crinoidea (eg: Antedon)
Phylum Hemichordata: Salient features (eg: Balanoglossus.)

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SEMESTER I

COMPLEMENTARY COURSE 1 - PRACTICAL
ZY2CP01B18: NON CHORDATE AND CHORDATE DIVERSITY

Credits –
No. of Hours: 36

NON CHORDATE DIVERSITY

1. Scientific drawing - 5 specimens
2. Simple identification - 10 invertebrates, out of which 5 by their scientific names
3. T.S - Earthworm, T.S Fasciola
4. Dissection - Nervous system of Prawn
5. Dissection - Nervous system of Cockroach
6. Mounting - Prawn Appendages

COMPETENCIES:

- Understand the taxonomic status of various Invertebrate animals and animal groups
- Familiarize the students with the diverse group of organisms around us.
- Develop an aptitude for understanding nature and its rich bio-diversity.

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B.Sc. I Semester - Complementary Course
CODE: ZY1C01B18
COURSE TITLE: NON CHORDATE DIVERSITY

Modules	Hours 36	PART A- (short answer) 1 mark 10/12	PART B- (short essay) 5 marks 6/9	PART C- (essay/problem) 10 marks 2/4	Total
Module I	10	3	2	1	23
Module II	3	2	1	0	7
Module III	6	2	2	1	22
Module IV	11	3	2	1	23
Module V	6	2	2	1	22

SEMESTER II

COMPLEMENTARY COURSE 2
ZY2C01B18: CHORDATE DIVERSITY

Credits – 2
Duration: One Semester
Total Lecture Hours: 36

Aim: To familiarize students with Chordate diversity.

Course Overview and Context

The course gives an overall idea on classification of chordates and highlights the differences between non-chordates and chordates. It also throws light on the evolutionary significance of certain animals which form the connecting links between two groups. It also helps in the identification of poisonous and non poisonous snakes and migration in Birds and Fishes.

Module I **4 Hrs**

Phylum Chordata: Fundamental characters and outline classification upto class.
Sub phylum Urochordata:
General characters, Classification:
Class 1: Larvacea (eg: Oikopleura)
Class 2: Ascidiacea (eg: Ascidia), Retrogressive metamorphosis.
Class 3: Thaliacea (eg: Salpa)
Sub phylum Cephalochordata: Salient features (eg: Branchiostoma)

Module II **6 Hrs**

Sub phylum Vertebrata: Salient features
Division Agnatha: salient features and classification
Class 1: Cyclostoma (eg: Petromyzon)
Class 2: Class Ostracodermi (eg: Cephalapsis)
Division Gnathostomata: Salient features Super class Pisces
Super class Tetrapoda.
Super class Pisces: Salient features and classification
Class 1: Chondrichthyes (eg: Narcine)
Class 2: Osteichthyes (eg: Latimeria)
General Topic: Accessory respiratory organs in fishes.

Module III **14 Hrs**

Super class Tetrapoda: Salient features
Class 1: Amphibia: Salient features. Type study: Euphlyctis hexadactyla - Habitat, morphology, sexual dimorphism, coelom and viscera, skeletal system, digestive system, respiratory system,

circulatory system, excretory system, nervous system, sense organs, reproductive system, development.

Classification up to order:

Order 1: Urodela (eg: Amblystoma)
Order 2: Anura (eg: Bufo)
Order 3: Apoda (eg: Icthyophis)

Module IV **6 Hrs**

Class Reptilia: Salient features and classification up to subclass
Sub class 1: Anapsida (eg: Chelone)
Sub class 2: Diapsida (eg: Chamaeleon)
Sub class 3: Parapsida (eg: Icthyosaurus)
Sub class 4: Synapsida (eg: Cynognathus)
General Topics: Poisonous and non poisonous snakes of Kerala.
Class Aves: Salient features and classification up to subclass
Sub class Archeornithes (eg: Archaeopteryx)
Sub class Neornithes (eg: Struthio)
General Topics: Flight adaptation of birds

Module V **6 Hrs**

Class Mammalia: Salient features and classification up to subclass
Sub class 1: Protheria (eg: Echidna)
Sub class 2: Metatheria (eg: Macropus)
Sub class 3: Eutheria (eg: Elephas)
General Topic: General adaptation of aquatic mammals with example.

References:

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SEMESTER II

COMPLEMENTARY COURSE 2 - PRACTICAL
ZY2CP01B18: NON CHORDATE AND CHORDATE DIVERSITY

Credits – 2
No.of Hours: 36

CHORDATE DIVERSITY

1. Simple identification of 10 chordates, out of which 5 by their scientific names
2. Osteology - Vertebrae and girdles of Frog
3. Snake identification - 3 poisonous and 3 non poisonous snakes with key
4. Mounting of placoid scales of shark
5. Dissections: Frog: Photographs/Diagrams/ models may be used for the study.

1. Frog - Viscera
2. Frog - Digestive System
3. Frog - Arterial System
4. Frog – Brain

COMPETENCIES:

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

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B.Sc. II Semester - Complementary Course

CODE: ZY2C01B18

COURSE TITLE: CHORDATE DIVERSITY

Modules	**Hours** **36**	**PART A** **(short answer)** **1 marks** **10/12**	**PART B** **(short essay)** **5 marks** **6/9**	**PART C** **(essay/problem)** **10 marks** **2/4**	**Total**
Module I	4	2	1	0	7
Module II	6	2	2	1	22
Module III	14	3	3	1	28
Module IV	6	3	2	1	23
Module V	6	2	1	1	17

SEMESTER III

COMPLEMENTARY COURSE -3
ZY3C01B18: PHYSIOLOGY AND IMMUNOLOGY

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim: To create awareness between the structure and functions of various systems in the human body

Course Overview and Context

The course provides an indepth knowledge in Nutrition, Circulation, Excretion and disorders affecting these organs. Neurophysiology, Muscle physiology, the functioning of various endocrine organs and disorders due to the deficiency of different hormones is also elaborated. Immunology deals with various types of immunity, vaccines, antigens, antibodies, and antigen-antibody reactions.It also throws light on different Immune response system and immune disorders.

Module I **14 Hrs**

Nutrition: Types of nutrition – autotrophy, heterotrophy. Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, Fe, I), vitamins (sources and deficiency disorders), nutritional disorders Respiration: Transport of respiratory gases in blood - transport of oxygen, transport of carbon dioxide, chloride shift. Respiratory disturbances – Hypoxia, Hypercapnia, Asphyxia, physiological effect of smoking, carbon monoxide poisoning.

Circulation: Composition and functions of blood. Plasma and formed elements - WBC, RBC and platelets, Mechanism of blood coagulation – clotting factors, intrinsic and extrinsic pathways, anticoagulants. ECG, Blood pressure, Arteriosclerosis, Heamophilia, cerebral and pulmonary thrombosis.

Module II **14 hrs**

Excretion: Structure of a nephron. Urine formation – glomerular filteration, tubular reabsorption, tubular secretion. Urine concentration – counter current mechanism. Composition of urine – normal and abnormal constituents. Hormonal regulation of kidney function. Kidney stone, dialysis.

Neuro physiology: Structure of a neuron. Myelinated and non myelinated nerve fibre, nerve impulse production (resting membrane potential, action potential), Impulse propagation, All or none law, saltatory conduction, synaptic transmission. Neurotransmitters (acetyl choline, adrenalin, dopamine), brain waves, EEG. Neural disorders - Parkinson's disease, Alzheimer's disease.

Muscle physiology: Types of muscles: striated, non striated and cardiac. Ultra structure of striated muscle, Mechanism of muscle contraction, Cori cycle and muscle relaxation. Muscle fatigue, oxygen debt, Rigor mortis.

Module III **8 hrs**

Endocrinology: Introduction to Endocrine system. Mechanism of hormone action, Endocrine glands - hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, endocrine pancreas, adrenal gland, thymus gland, testis and ovary. Physiological role of hormones, Hormonal disorders.

Module IV **12 Hrs**

Immunology: Introduction to immunology, types of immunity – innate, acquired, passive, active, mechanism of innate immunity (barriers, inflammation, phagocytosis). Types of antigens. Basic structure of immunoglobulins, Classes of immunoglobulins and functions. Antigen antibody reactions, Precipitation test, agglutination test, WIDAL, VDRL, HIV test (ELISA)

Module V **6 Hrs**

Immune response system: (Brief accounts of the followings)

Primary and secondary lymphoid organs, Cells of Immune system - T&B lymphocytes, natural killer cells, macrophages, plasma cells , memory cells, Monoclonal antibodies, Hybridoma technology.

Immune disorders: Hypersensitivity, Auto immunity (rheumatoid arthritis) & Immunodeficiency (AIDS), Vaccines - BCG, DPT, Polio vaccine.

References:

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- Singh H D, Madhavankutty K, Sarada Subrahmanyam 2014: Textbook of Human Physiology, 5th edn.S. Chand & Co Ltd, New Delhi.
- Zoological Society of Kerala, Study material 2002. Biochemistry, Physiology and Developmental Biology Published by Zoological Society of Kerala

SEMESTER III

COMPLEMENTARY COURSE 3 - PRACTICAL
ZY4CP01B18: PHYSIOLOGY, IMMUNOLOGYAND APPLIED ZOOLOGY

Credits –
No. of Hours: 36

PHYSIOLOGY AND IMMUNOLOGY

1. Preparation of Human Blood smear & Identification of leucocytes.
2. Qualitative analysis of Reducing Sugar, Protein and Lipid.
3. Action 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 & uses) -Sphygmomanometer, Stethoscope.

COMPETENCIES:

- Inspire the students to learn different systems.
- Appreciate the correlation between structure and function of organs.
- Understand the causes and prevention of hormonal abnormalities.
- Learn Mechanisms of immunity

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B.Sc. III Semester - Complementary Course

CODE: ZY3C01B18

COURSE TITLE: PHYSIOLOGY AND IMMUNOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	14	3	3	1	28
Module II	14	4	3	1	29
Module III	8	1	1	1	16
Module IV	12	1	1	1	16
Module V	6	3	1	0	8

SEMESTER IV

COMPLEMENTARY COURSE - 4
ZY4C01B18: APPLIED ZOOLOGY

Credits – 3
Duration: One Semester
Total Lecture Hours: 54

Aim: To impart in students the basic skills of rearing various animals in their household.

Course Overview and Context
This course equips students with self employment capabilities and acquaints them with various rearing techniques in Apiculture, Vermiculture, Sericulture and Aquaculture. It provides them with the scientific knowledge of profitable farming of Bees, Silkworms and Fishes.

Module I: Aquaculture 24 Hrs

Advantages of aquaculture, Traditional methods of aquaculture, Biotic and abiotic factors in water, Pond culture – construction and maintenance. Types of aquaculture, composite fish culture, integrated fish culture, induced breeding of carp & prawn, Importance of algae in aquaculture. Aquarium management - Setting up of an aquarium, biological filter and aeration. Common cultivable fishes of Kerala. Fish diseases, Prawn culture, mussel culture, pearl culture, Fish processing and preservation.

Module II: Sericulture 12 Hrs

Four species of silkworms, life history of silkworm, silk worm rearing techniques, Mounting of silkworm - Chandrika, defective cocoons, harvesting and stifling of coccons. Silkworm diseases and pest, preventive and control measures.

Module III: Vermiculture 6 Hrs

Species of earthworms, ecological classification of earthworms, life cycle and reproduction of earthworm. Physical & chemical effects of earthworms on soil, Vermicomposting – site selection, preparation of pit, maintenance, monitoring and harvesting of vermicompost.

Module IV: Apiculture **12 Hrs**

Species of honey bees, organization of honey bee colony. Bee keeping methods and equipments. Apiary management and maintenance. Bee pasturage, byproducts of honey bees and their uses. Diseases, pests of honey bees and control measures.

References:

- Alikunhi, K.. H, Fish Culture in India (ICAR, New Delhi)Andhra Pradesh Agricultural University, Hyderabad)
- Applied Zoology; (2002) Published by Zoological Society Of Kerala
- Bhosh, C.C., 1949, Silk Production and Weaving in India (CSIR), New Delhi) Director. Zoological Survey of India, 1994, earthworms Resources and Vermiculture
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- Singh, S., 1962 Bee keeping in India (ICAR, New Delhi.
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SEMESTER IV

COMPLEMENTARY COURSE 4 - PRACTICAL
ZY4CP01B18: PHYSIOLOGY, IMMUNOLOGYAND APPLIED ZOOLOGY

Credits – 2
No. of Hours: 36

APPLIED ZOOLOGY

General identification, economic importance, morphology, scientific names and common names of the following

1. Economic importance and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, Etroplus, Tilapia)
2. Two species of earthworms used in Vermiculture
3. Two species of honey bees
4. Silkworm. Cocoon/Adult
5. Castes of honey bees
6. Bee keeping equipments - Bee hive, Smoker, honey extractor
7. Identification and uses - Bee wax, Honey, Silk, Vermicompost
8. Chandrika / Natrika used in sericulture

COMPETENCIES:

- Skill development in applied branches of Zoology.
- Understand the various methods in animal breeding and rearing techniques.
- Self employment opportunities

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B.Sc. IV Semester - Complementary Course

CODE: ZY4C01B18

COURSE TITLE: APPLIED ZOOLOGY

Modules	**Hours 54**	**PART A- (short answer) 1 mark 10/12**	**PART B- (short essay) 5 marks 6/9**	**PART C- (essay/problem) 10 marks 2/4**	**Total**
Module I	24	4	5	1	39
Module II	12	3	2	1	23
Module III	06	2	0	1	12
Module IV	12	3	2	1	23

SEMESTER: I

COMPLEMENTARY COURSE

ZY1C02B18: BODY SYSTEMS AND BEHAVIOUR

Credits: 2

Duration: One Semester

Total Lecture Hours: 54

Aims and Objective:

To understand the biological foundations of behavior.

Course overview:

This course focuses on the physiology behind different systems of the body and physiology behind sleep and emotionality.

Module 1: Introduction (10hrs)

Physiological psychology and neuroscience. Digestive and respiratory system-**in brief functional relevance only.**

Module 2: Sensory Systems (20hrs)

Visual System- Anatomy of the eye, Nervous connections of the eye- optic nerve, lateral geniculate nucleus, Superior colliculus, Visual cortex.

Auditory system- Anatomy of the Auditory system, Nervous connections of the ear, pathway- Organ of Corti, Ventral cochlear nucleus, inferior colliculus, medial geniculate body, auditory cortex.

Module 3: Cardiovascular System (10hrs)

Structure of the human heart and its working (mention also the SA node, AV node & Purkinje System); Structure of arteries, veins, and capillaries, pulmonary and systemic circulation.Blood, a fluid connective tissue; components (Plasma, RBC, WBC and platelets).

Module 4: Emotionality (14hrs)

Physiological basis for emotionality .Hypothalamus and limbic system in emotionality.

Note – Activity based assignments and seminars

Assignments and seminars only on related topics so as to enable students to apply principles and theories studied to analyze phenomena relating to day to day functioning of human body.

References:

- Ahluwalia, K. B. (1994) Genetics. 4th Print,Wiley Eastern Ltd.
- Gardner; Eldon J. S, Michael J.S., & Peter; Principles of Genetics (4th ed. Wiley Eastern Ltd. Guyton, A. Medical Physiology (8th ed.), W. B. Saunders' Co.

- Leukal, F. (1985).An Introduction to Physiological Psychology. (1sted.). New Delhi: CBS Publishers and Distributors.
- Levinthal, C.F. (1996). Introduction to Physiological Psychology (3rd ed.) Prentice-Hall of India Pvt. Ltd.
- Pinel,J.P. (2007). Biopsychology.India: Dorling Kindersley Pvt. Ltd.
- Rosensweig, M.R., Breedlove, S. M., & Watson, N. V. (2004).Biological Psychology, (4thed.). USA: Sinauer Associates, lnc.
- Schneider, A.M. &Tarshis, B. (1986).An Introduction to Physiological Psychology.(3rd ed.).

COMPETENCIES

- Explain physiological psychology.
- Differentiate physiological psychology and neuroscience.
- Discuss digestive system.
- Classify different systems of the body.
- Explain visual pathway.
- Discuss auditory pathway.
- List out the components of blood.
- Explain structure of heart and its functioning.
- State physiological basis of emotionality.
- Explain the role of hypothalamus and limbic system in emotionality.

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B.Sc. I Semester - Complementary Course
CODE: ZY1C02B18
COURSE TITLE: BODY SYSTEMS AND BEHAVIOUR

Modules	Hours	PART A (10/12) 2 marks	PART B (6/9) 5 marks	PART C (2/4) 15marks	Total
Module I	10	3	3	0	21
Module II	20	3	1	2	41
Module III	10	3	3	1	26
Module IV	14	3	2	1	31

SEMESTER: II

COMPLEMENTARY COURSE
ZY2C02B18: BIOLOGICAL BASIS OF BEHAVIOUR II

Credits: 2
Duration: One Semester
Total Lecture Hours: 54

Aims and Objective:

To enable students to understand the influence of physiological system in human behaviour

Course Overview and Context:

Course focus on genetics and its disorders, physiological basis behind different motives, physiology behind sleep and arousal and stress.

Module 1: Genetics, Mutations and Genetic disorders (15hrs)

Mendel's Principles, modern concept of gene and gene action, sex - linked, sex – limited, sex-influenced characters. Gene mutation-Kinds of mutation, classification (Somatic, gametic, point, spontaneous, induced, dominant, recessive and silent mutations). Gene mutation disorders - albinism, phenylketonuria, alkaptonuria, galactosemia, brachydactyli. Autosomal anomalies - Down's syndrome, Edward's syndrome, Cri du chat syndrome. Sex chromosomal anomalies - Klinefelter's syndrome and Turner's syndrome.

Module 2: Physiological basis of sexual behavior, **hunger and thirst (11hrs)**

Defining sexual behavior, Dynamics, hormones and its impact, external cues, the brain and sexual behavior. Role of Hypothalamus and amygdala (Physiological motives and emotion- fear and anger)

Model 3: **Physiology of Stress (12hrs)**

Stress response, indicators of stress (hormonal, anatomical, and physiological), stress and disease. Stress, emotionality and endorphins.

Model 4: Physiology of sleep and arousal (16hrs)

Arousal, Sleep and Circadian Rhythms- Physiological measures of alertness and arousal-EEG. Physiological conceptions of wakefulness and sleep. Conceptions of sleep. Circadian rhythms and biological clock.

Note – Activity based assignments and seminars

Assignments and seminars only on related topics so as to enable students to apply principles and theories studied to discuss various problems and issues that may be developed in the immune system, endocrine system, neuron or cardiovascular systems

COMPETENCIES

- State Mendel's laws of inheritance
- Classify gene mutations.
- Define gene.
- Define sexual behavior.
- Explain sexual response cycle
- Discuss the role of brain in sexuality.
- Classify the indicators of stress.
- Explain the role of endorphin in emotionality.
- Define circadian rthythm.
- Explain the conceptions of sleep.
- Explain biological clock
- Classify the physiological measures of alertness and arousal.

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B.Sc. II Semester - Complementary Course

CODE: ZY2C02B18

COURSE TITLE: BIOLOGICAL BASIS OF BEHAVIOR

Modules	HOURS	PART A (10/12) 2 marks	PART B (6/9) 5 marks	PART C (2/4) 15 marks	Total
Module I	15	3	3	1	36
Module II	11	3	1	1	26
Module III	12	3	3	1	36
Module IV	16	3	2	1	31

SEMESTER: III

COMPLEMENTARY COURSE
ZY3C02B18: NEUROPHYSIOLOGY OF BEHAVIOUR

Credits: 2
Duration: One Semester
Total Lecture Hours: 54

Aims and Objective

To help students understand brain behavior relationship

Course overview and context

This course focuses on the relationship between brain and behavior and neurons and behavior.

Module 1: Nervous system & **Communication within a neuron and neurotransmitter**: (10hrs)

Brain- Behaviour relations, Cells of the Nervous system-Neurons, Structure of neuron, External, internal and supporting structures, types of neurons.

Membrane potential, resting potential, depolarization, hyper polarization, sodium-potassium pump, action potential.Neurotransmitters- Role of neurotransmitters in transmission of impulses.Excitatory and inhibitory post synaptic potentials.

Module 2: The Anatomy of the Central Nervous system (7hrs)

Central Nervous system, Forebrain, Midbrain and Hindbrain, Hypothalamus, Cortex, Spinal cord.

Module 3: The Anatomy of the Peripheral Nervous system (10hrs)

Autonomic Nervous system, Sympathetic and Parasympathetic Nervous system

Module 4: The Hemispheres of the Neocortex (9hrs)

Structure, functional asymmetry (surgical studies, clinical studies, behavioural studies), capabilities of the right and left hemispheres, language, handedness, cortex and learning.

Note – Activity based assignments and seminars

Assignments and seminars only on related topics so as to enable students to apply principles and theories studied to analyze phenomena relating to day to day functioning of human body. Discuss various problems and issues that may be developed in neurotransmitters, psychoneuroimmunology.

COMPETENCIES

- Explain the structure of nervous system.
- List out the cells in the nervous system.
- Classify the types of neurons.
- Define membrane potential.
- Differentiate membrane potential and resting potential.
- Discuss the anatomy of the central nervous system.
- Explain the structure of brain.
- Differentiate sympathetic and parasympathetic nervous system.
- Explain autonomic nervous system.
- Explain the structure of neocortex.
- Define handedness.
- Mention the hemispheres of brain and its functions.

BLUE PRINT

B.Sc. III Semester - Complementary Course

CODE: ZY3C02B18

COURSE TITLE: NEUROPHYSIOLOGY OF BEHAVIOR

Modules	HOURS	PART A (10/12) 2 marks	PART B (6/9) 5 marks	PART C (2/4) 15 marks	Total
Module I	10	3	2	1	31
Module II	7	4	2	1	33
Module III	10	3	2	1	31
Module IV	9	2	3	1	34

SEMESTER: IV

COMPLEMENTARY COURSE
ZY4C02B18: BIOPHYSIOLOGY OF BEHAVIOUR

Credits: 2
Duration: One Semester
Total Lecture Hours: 54

Aims and Objectives

To help students to understand the branch of psycho-neuroimmunology and to understand the physiological basis of basic processes

Course overview and context

Course focuses on the new branches like psychoneuro- immunology and psychoneuro-endocrinology and biological and physiological mechanism behind learning and memory.

Module 1: The immune system and Psychoneuro-immunology (10hrs)

Humoural immunity, cell mediated immunity, non-specific defenses; anatomy of an immune response; memory boosters; immunosuppression; Hypersensitivity reactions, autoimmunity.

Psychoneuroimmunology-Connections between emotions, nervous system and immune functions, Placebo effect, Immune deficiency, Effect of meditation and biofeedback.

Module 2: The Endocrine system and Psychoneuro-endocrinology (8hrs)

The endocrine glands and hormones, Hypothalamus- Autonomic nervous system, Hypothalamohypophysial endocrine system (HPT axis, HPA axis). Hormonal influence on learning and memory and behavior, Behaviour (emotion) and the limbic system.

Module 3: Mechanisms of Learning and Memory (9hrs)

Physiological changes during learning, Anatomical requirements for Learning, Physiological mechanisms for memory in the brain, triggers for memory retrieval. Amnesia, Dementia and Alzheimer's disease.

Module 4: Brain Chemistry, Drugs and Mental illness (9hrs)

Brain metabolism. Barrier to the brain.Major neurotransmitters in the brain.Opioid peptides and receptors in the brain.Brain chemistry and the use of psychiatric drugs.

Note – Activity based assignments and seminars

Assignments and seminars only on related topics so as to enable students to apply principles and theories studied to analyze phenomena relating to physiological basis of psychological processes and sensory processing.

COMPETENCIES

- Define humoural immunity.
- Discuss the anatomy of immune response.
- Define psychoneuroimmunology.
- Explain the role of nervous system in immune functioning.
- Define placebo effect.
- Classify endocrine glands and hormones.
- Differentiate HPA axis and HPT axis.
- Explain the hormonal influence on learning and behavior.
- List out the physiological changes during learning.
- Mention the triggers of memory retrieval.
- Differentiate dementia, Alzheimer's disease and amnesia.
- Explain the major neurotransmitters in the brain.

BLUE PRINT

B.Sc. IV Semester - Complementary Course

CODE: ZY4C02B18

COURSE TITLE: BIOPHYSIOLOGY OF BEHAVIOR

Modules	HOURS	PART A (10/12) 2 marks	PART B (6/9) 5 marks	PART C (2/4) 15marks	Total
Module I	10	4	2	1	33
Module II	8	2	2	1	29
Module III	9	4	3	1	38
Module IV	9	1	2	1	27

MODEL QUESTION PAPERS

B. Sc. ZOOLOGY - CORE COURSE
ZY1B01B18 - GENERAL PERSPECTIVES IN SCIENCE & PROTISTAN DIVERSITY
MODEL QUESTION PAPER
FIRST SEMESTER C.B.C.S.S EXAMINATION

Time: 3 Hours **Total Marks: 60 Marks**

PART A
(Answer any 10 questions. Each question carries 1 mark)

1. Define Law of priority.
2. What is Systematics?
3. Name any 2 organisms exhibiting radial symmetry
4. Define Pseudoceolom. Give an example.
5. What is a nested key?
6. Give the generic name of a) Sun animalcule b) Slipper animal cule
7. Name 2 pathogenic protists.
8. What are volutin granules? Give an example.
9. Define empiricism.
10. What is Cryobiology?
11. What does these vocabulary in science mean? a) Eury b) aer
12. Who proposed the theory of mutation and in which year?

(10 x 1=10 marks)

PART B
(Answer any 6 questions. Each question carries 5 marks)

13. Explain the life cycle of Entameoba.
14. Explain various types of Symmetry.
15. Discuss different types of Taxonomic Keys
16. Write Briefly on A) Noctiluca B) Trichonympha
17. List the general Characters of Protista
18. Write a note on the levels of Biological organisation.
19. What is Science? Explain its features
20. Write a note on the 5 characteristics that living things exhibit.
21. Write briefly on different types of coelom.

(6x 5 = 30 marks)

PART C
(Answer any 2 questions. Each question carries 10 marks)

22. With the help of a labelled diagram explain the life cycle of Plasmodium in Man.
23. Define conjugation. Discuss the process of Conjugation in Paramecium. Mention its Significance
24. Discuss in detail the requisites and rules of Zoological Nomenclature. Add a note on molecular Taxonomy.
25. Write an essay on the history of biology stating its landmarks in ancient, middle age and modern era.

(2 x 10 = 20 marks)

B. Sc. ZOOLOGY - CHOICE BASED CORE COURSE (ELECTIVE I)
ZY6B13aB18 - NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT
MODEL QUESTION PAPER
SIXTH SEMESTER C.B.C.S.S EXAMINATION

Time: 3 Hours **Total Marks: 80 Marks**

PART A

(Answer any 10 questions. Each question carries 2 marks)

1. What is balanced diet?
2. Define health.
3. What is BMR?
4. What are hypokinetic diseases?
5. Distinguish between Malnutrition and starvation.
6. Explain ECG and its uses?
7. What is sleep apnoea and its symptoms?
8. Define occupational diseases. Give 2 egs.
9. List any 4 health problems associated with wrong body posture.
10. Differentiate between exercise and physical activity.
11. What are the various possible health literacy programs for the public?
12. Enumerate any 4 ill-effects of tobacco smoking.

(10 x 2=20 marks)

PART B

(Answer any 6 questions. Each question carries 5 marks)

13. Explain theories of Ageing.
14. What biochemical changes can you observe in a cancer cell?
15. What are the different types of diabetes? How are they different?
16. Explain the dangers of alcoholic and drug abuse. Add a note on medico-legal implications.
17. Discuss the basic parameters of health care and the devices used for it.
18. Write briefly on the Nutrition required from infancy to old age in humans.
19. Discuss on the neuro degenerative diseases.
20. Explain the various kidney disorders.
21. Write an account on food adulteration and its impact on health.

(6x 5 = 30 marks)

PART C

(Answer any 2 questions. Each question carries 15 marks)

22. Discuss any 5 life style diseases, its causes and prevention.
23. Define health, its Dimensions, and Determinants.
24. Explain the effect of exercise on any 3 body systems.
25. Write an essay on the role of Vitamins in Human Health

(2 x 15 = 30 marks)

B. Sc. ZOOLOGY – OPEN COURSE FOR OTHER STREAMS (ELECTIVE I)
ZY5D01aB18 - HUMAN GENETICS, NUTRITION AND PUBLIC HEALTH
MODEL QUESTION PAPER
FIFTH SEMESTER C.B.C.S.S EXAMINATION

Time: 3 Hours **Total Marks: 80 Marks**

PART A
(Answer any 10 questions. Each question carries 2 marks)

1. What is balanced diet?
2. Define health and list its dimensions
3. What is botulism?
4. What is sickle cell anaemia?
5. Define vector borne diseases?
6. What is BMI? How is it calculated?
7. What is Amniocentesis? Briefly explain.
8. Describe the scientific parameters used to determine water quality?
9. What is Genetic counselling?
10. Explain the role of yoga and meditation in the well being of human beings.
11. Discuss the various Rodent control measures.
12. What are the different steps in primary treatment of water?

(10 x 2=20 marks)

PART B
(Answer any 6 questions. Each question carries 5 marks)

13. Write notes on Down syndrome.
14. Write notes on symptomalogy and treatment of Typhoid.
15. What is psychoneuro immunology? Explain its development in Modern Science?
16. Discuss the causes of infertility in Man?
17. Comment on different types of cancers? Add a note on carcinogens?
18. List a few vector borne diseases spread through Mosquitoes. Give the preventive measures?
19. Explain the mode of inheritance of Haemophilia in Man.
20. Write a note on DNA fingerprinting and its applications.
21. Explain about various water purification techniques. **(6x 5 = 30 marks)**

PART C
(Answer any 2 questions. Each question carries 15 marks)

22. Explain the method of waste water treatment and disposal.
23. Briefly explain Any 6 genetic disorders in man.
24. Explain the dangers of alcoholic and drug abuse. Add a note on medico-legal implications.
25. Explain the effect of exercise on any 3 body systems.

(2 x 15 = 30 marks)

B. Sc. ZOOLOGY - COMPLEMENTARY COURSE
(For Botany & Home Science as core)
ZY1C01B18 - NON CHORDATE DIVERSITY
MODEL QUESTION PAPER
FIRST SEMESTER C.B.C.S.S EXAMINATION

Time: 3 Hours **Total Marks: 60 Marks**

Part A

Answer any 10 questions. (Each question carries 1 mark)

1. Give the generic name of a) sun animalcule b) venus flower basket.
2. Write any 2 methods of sepia to escape from predators.
3. Give one example for digenetic parasite.
4. What are forcipules? In Which organism it is found?
5. Name the first larvae of Penaeus?
6. Name an organism which can digest Cellulose.
7. Differentiate between polyp and medusa
8. Give the common name for a) Physalia b) Adamsia
9. What is measly pork?
10. Define clitellum.
11. Define petasma.
12. What is Aristotles lantern? **(10× 1= 10 marks)**

PART B

(Answer any 6 questions. Each question carries 5 marks)

13. Briefly describe the life cycle of Plasmodium in mosquito
14. Explain polymorphism with the help of an example.
15. Write a detailed account on Peripatus.
16. What is dendrobranchia and branchial formula?
17. Discuss the lifecycle *Wuchereria.*
18. Give an account on the classification of Echinodermata.
19. Mention the salient features of platyhelminthes.
20. Write short essay on the affinities of *Balanoglossus.*
21. Write briefly on A) Noctiluca B) Trypanosoma. **(6 × 5= 30 marks)**

Part C

(Answer any 2 questions. Each question carries 10 marks)

22. With the help of a labelled diagram explain the life history of Entameoba.
23. Explain the general characters of the phylum Mollusca and classify the phylum upto classes citing an example from each.
24. Discuss the life cycle of Fasciola. Add a note on its Economic Importance.
25. With suitable figures give an account on the Cephalic appendages of *Penaeus.*

(10 × 2= 20 marks)

B. Sc. ZOOLOGY - COMPLEMENTARY COURSE
(For Psychology as core)
ZY1C02B18 - BODY SYSTEMS AND BEHAVIOUR
MODEL QUESTION PAPER
FIRST SEMESTER C.B.C.S.S EXAMINATION

Time: 3 hours **Total marks: 80**

Part A

Answer any 10 questions. (Each question carries 2 marks)

1. What are the branches of neuroscience?
2. Define Capillary bed.
3. Define emotion
4. What is limbic system?
5. Differentiate Sympathetic and parasympathetic nervous system
6. Neurophysins.
7. Functions of pancreas.
8. What are the components of cardiovascular system?
9. Discuss James – Lange theory of emotion.
10. Platelets
11. Define cognitive neuroscience.
12. Lobes of brain. **(10 x 2 = 20 marks)**

PART B

(Answer any 6 questions. Each question carries 5 marks)

13. Write a note on systemic and pulmonary circulation
14. What are the components of blood? Explain.
15. Discuss the physiological methods.
16. Explain the nervous connections of the eye.
17. Discuss in brief the working respiratory system
18. Explain the structure of arteries.
19. What are the functions of hypothalamus?
20. Discuss the role of limbic system in emotionality.
21. Discuss visual cortex **(6 x 5 = 30 marks)**

Part C

(Answer any 2 questions. Each question carries 15 marks)

22. Discuss the structure of human heart and its working.
23. Explain the physiological basis of emotionality.
24. Briefly explain the anatomy of eye.
25. Discuss neuroscience. **(2 x 15 = 30 marks)**