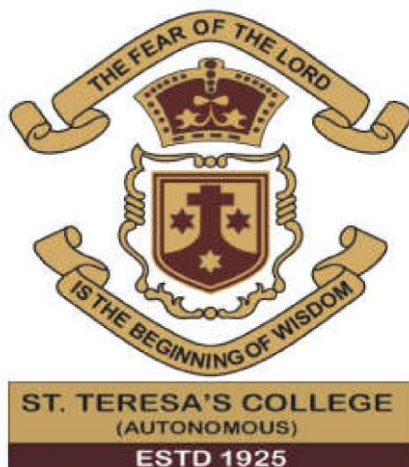


ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

Affiliated to Mahatma Gandhi University, Kottayam



CURRICULUM AND SYLLABI FOR PROGRAMME

B.Sc. ZOOLOGY

Programme Code: BZOO

and

COMPLEMENTARY COURSES

Under Choice Based Credit and Semester System

(2023 Admission Onwards)

ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES IN ZOOLOGY (2021-2024)

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9	Subject Expert - 1 Outside MG University	Dr. Vidia Panicker	Associate Professor	Department of Zoology, Sree Narayana College, Chempazhanthy, Thiruvananthapuram - 695587

10	Subject Expert - 2 Outside MG University	Dr. Jeeja Tharakan	Assistant Professor	Department of Zoology, St. Aloysius College, Elthuruth, Thrissur - 680611.
11	University Nominee	Dr. Mini. K.D	Assistant Professor	Department of Zoology, Sree Sankara College, Kalady - 683574
12	Representative from Industry/ Corporate Sector/ Allied field related to placement	Dr. Beena P. S.	Senior Scientist	OmicsGen Life Sciences Pvt Ltd, Veegaland Homes, K Chittilappilly Tower, 2nd Floor, Opp. NPOL Main Gate, NGO Quarters-Bharata Mata College Road, Thrikkakara P.O, Kakkanad, Kochi - 682021
13	Alumni Representative	Dr. K. Manjusha	Assistant Professor	Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Panangad, Ernakulam - 682506

PREFACE

The curriculum, which encompasses the totality of student experience, should ensure a collective and dedicated effort to birth an inspiring academic culture in a campus. It is this vision of quality knowledge, its production and transmission that has fueled the Teresian quest for essential and elemental student development. St. Teresa's College has taken meticulous care in the conception of the new well-balanced curriculum by retaining the fundamental prerequisites mentioned by the University/Higher Education Council. With the constraints of a prescribed syllabus in mind, we have created an academic sanctuary, where a deeper access to knowledge is achievable to students and teachers as well.

The Syllabus restructuring of 2023 instigates opportunities of real-world learning to equip a modern scholar with the practicality of experience. As an autonomous institution under Mahatma Gandhi University, St. Teresa's College offers a significant number of Programmes with definite placement windows to the learners. Student knowledge and training across a range of subject areas is efficiently enriched by engaging them in work-based learning, as provided by the revised and restructured curriculum.

The indefatigable effort taken by the teachers in developing Programmes and Course outcomes is commendable. The blossoming of the cognitive and intellectual skills of the scholars, the initiation of a research mentality, and pragmatic skill sets to venture out confidently into a professional space, are the core off-shoots that are anticipated. The curriculum should equip the students to be educators themselves, with a voice that echoes global effectiveness.

I congratulate the efforts taken by the Principal Prof. Alphonsa Vijaya Joseph and her team for restructuring the syllabus in keeping with the latest demands in academia. We trust that the syllabus will transform minds to embark upon higher academic summits and thereby mould learners who will make significant contributions to the world. We look forward to sharing the outcomes of our restructured curriculum and the positive changes that would reshape the academic lives of all our scholars.

Dr. Sr. Vinitha (Sr. Celine E)

Manager, St. Teresa's College (Autonomous)

FOREWORD

The most significant characteristic of an autonomous college is its commitment to curriculum renewal or revision. Academic autonomy has granted the college the freedom to fine tune the syllabus keeping in mind the changing needs of the new generation of students, the new educational scenario in the global context and incorporation of skill based curricula. Revision of the syllabus implies responsibility and accountability and this in turn leads to excellence in academics and proactive governance. 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.

A revision of the syllabus is implemented by modifying the curriculum after review to evaluate the effectiveness of the curriculum after it has been implemented and to reflect on what students did and did not get out of it. In line with the new Educational policy, a big educational reform can be effected by restructuring of syllabi to maintain a high level of quality in the standard of education that we impart.

The three themes under Higher Education relevant to policy initiative for restructuring of the curriculum i.e., integrating skill development in higher education, linking higher education to society and integration of new knowledge are considered with utmost importance during revision of the syllabus.

Outcome-Based Education emphasizes that the learning process is innovative, interactive and effective, where the main goal is student achievement at the end of the learning period. St. Teresa's College in its pursuit of imparting quality education has adopted Outcome Based Education (OBE) system that involves restructuring of curriculum, academic processes, teaching methodologies, assessment and evaluation systems in education to reflect the achievement of high order learning. It is a student-centric instruction model that focuses on measuring student performance through outcomes that include knowledge, skills and attitudes.

The revised syllabus and curriculum is the result of the combined efforts of the members of the Board of studies, curriculum expert committee and the syllabus committee who worked as a team to revise the syllabus and curriculum in the stipulated period. Active consultations were held with various stakeholders to elicit multiple perspectives in higher education which were incorporated in the new curriculum.

With sincere gratitude I acknowledge the instinct support and constant guidance extended by Rev. Dr. Sr. Vinitha, Provincial Superior and Manager, Rev. Sr. Emeline, Director, Dr. Sajimol Augustine M., Senior Administrator, Smt. Betty Joseph, Vice-Principal and Dr. Beena Job, Dean of self-financed programmes. I specially thank the team headed by Dr. Betty Rani Isaac, the Heads of the Departments and all the faculty members for their diligence, commitment and exceptional contribution towards this endeavour.

Prof. Dr. Alphonsa Vijaya Joseph

Principal

ACKNOWLEDGEMENT

My sincere thanks and heartfelt gratitude to Dr. Vidia Panicker, Associate Professor, Department of Zoology, Sree Narayana College, Chempazhanthy, Thiruvananthapuram, for her invaluable suggestions and timely help in framing the syllabus.

The Department is highly indebted to Dr. Mini. K.D, Assistant Professor, Department of Zoology, Sree Sankara College, Kalady, for her sincere effort to restructure various courses of the programme.

My immense thanks to Dr. Jeeja Tharakan, Assistant Professor, Department of Zoology, St. Aloysius College, Elthuruth, Thrissur, for her cooperation.

The Department of Zoology, St. Teresa's college, gratefully acknowledges Dr. K. Manjusha, Assistant Professor, Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies, Panangad and Dr. Beena P. S., Senior Scientist, OmicsGen Life Sciences Pvt Ltd, Kakkanad the role played by 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, Reema Kuriakose, Dr. Meera Jan Abraham, Dr. Helvin Vincent and Ms. Parvathy K.R. of St. Teresa's College who worked throughout in framing the syllabus.

The guidance of Dr. Kala M.S., Professor and IQAC Co-ordinator, Department of Physics, Dr. Betty Rani Issac, Associate Professor, Department of Home Science and the members of Syllabus and curriculum committee 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 Rev. Dr. Sr. Vinitha, Provincial Superior and Manager, Prof. Dr. Alphonsa Vijaya Joesph, Principal, Rev. Sr. Emeline CSST, Director, Dr. Sajimol Augustine M., Senior Administrator and Smt. Betty Joseph, Vice-Principal for their unstinted support during the various stages of syllabus revision.

Dr. Soja Louis

Chairperson, Board of Studies in Zoology,

CONTENTS

Preamble	1
Programme Outcome	2
Programme Specific Outcome	3
Eligibility	3
Programme Design	3
Programme Structure	4
Courses	4
Scheme of Courses	5
Scheme of Distribution of Instructional hours for core courses	6
Course Code Format	6
Duration of Programme	7
Detailed Programme Structure	8
Scheme- Core Courses	15
Scheme- Open Courses	17
Scheme- Choice Based Core Courses	17
Examinations	23
Pass Criteria	27
Credit Point and Credit Point Average	28
Syllabi	29
Core Courses	29
Choice Based Core Courses	96
Open Courses	111
Complementary Courses (for Botany, Home Science)	125
Complementary Courses (for Psychology)	146

B.Sc. ZOOLOGY PROGRAMME

Under Choice Based Credit and Semester System (2023 admissions onwards)

PREAMBLE

The curricula of an undergraduate programme should focus on 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, and 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 2018-2019. The new course that will be effective from the academic year 2023- 2024 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 the use of animals is reduced for the practicals.

Outcome based education involves assessment and evaluation practices in education, reflecting the attainment of expected learning and mastery in the programme. It is a systematic way to determine if a programme has achieved its goal. This approach of learning makes the student an active learner, the teacher a good facilitator and together they lay the foundation for life-long learning. The process includes framing of specific course outcomes at various appropriate levels of taxonomy, mapping the course outcomes of each course with the Programme Specific Outcomes and finally calculating the course attainment based on the marks scored by the student in both the Internal and External assessments.

PROGRAMME OUTCOMES (PO)

On completion of an undergraduate Programme from St. Teresa's College (Autonomous), Ernakulam, students should be able to demonstrate the programme outcomes listed below:

PO 1. *Disciplinary knowledge*

- Demonstrate a mastery of the fundamental knowledge and skills required in the discipline to function effectively as an entry-level professional in the field.

PO 2. *Scientific Temper*

- Experiment with new approaches, challenge existing knowledge boundaries and take informed action to solve problems related to society.
- Identify, define, and deal with problems through logical, analytical and critical thinking acquired from different domains of knowledge

PO 3. *Research and Digital Competence*

- Develop a research culture for lifelong learning and demonstrate competency in creating new knowledge.
- Analyze and choose from available data and information sources to communicate, collaborate and network through a range of digital media.

PO 4. *Communication Skills*

- Develop language proficiency through interactions embedded in meaningful contexts.
- Demonstrate communicative competence particularly using technology in social and global environments.

PO 5. *Leadership, Teamwork and Interpersonal Skills*

- Function effectively both as leader and/or member of a team.
- Collaborate and interact effectively with others.

PO 6. *Moral and Ethical Awareness and Social Responsibility*

- Demonstrate social and national responsibility.
- Engage in activities that contribute to the betterment of society, with a preferential option for the economically challenged and the marginalized.

BZOO - B.Sc. ZOOLOGY

PROGRAM SPECIFIC OUTCOMES (PSO)

On completion of B.Sc Zoology Programme students should be able to demonstrate the

Programme specific outcomes listed below:

- PSO1:** Explain the major concepts and theoretical principles in the undergraduate programme in Zoology. (Understand)
- PSO2:** Apply different domains of knowledge to deal with problems in Zoology (Apply)
- PSO3:** Integrate critical thinking and scientific knowledge to design, perform, record and analyse experiments. (Create)
- PSO4:** Develop communication skills to decipher and transmit the basic concepts and emerging trends in Zoology. (Apply)
- PSO5:** Apply the theoretical knowledge and skills in biology and Chemistry and environmental consciousness to identify, investigate and formulate new ideas and concepts. (Apply)

ELIGIBILITY

The eligibility for B.Sc. Zoology Programme is Pass in +2 Examination with Biology as an optional subject.

PROGRAMME DESIGN

The B.Sc. Zoology programme must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based core 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

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 course	1
Complementary courses I and II (Theory)	8
Complementary courses I and 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 Course	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

**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 and group activity	1	
Sixth Semester	16	8
Project work (in sixth sem), visit to research institute	1	
Total	44	24

COURSE CODE FORMAT

The programme is coded according to the following criteria.

- A. The first letter plus second letter/any letter from the programme ie., **ZY**
- B. One digit to indicate the semester. i.e., **ZY1 (Zoology, 1st semester)**
- C. One letter from the type of courses such as, **A** for common course, **B** for Complementary course, **C** for Core course, **D** for Open course, ie., **ZY1C (Zoology, 1st semester Core course) PR** for project and **I** for Internship.
- D. Two digits to indicate the course number. ie., **ZY1C01(Zoology, 1st semester, Core course, course number is 01)**
- E. The letter **B** to indicate Bachelors Programme.
- F. **ZY1C01B** (Zoology, 1st semester, Core course, courses number 01, and **B** for bachelors Programme)
- G. **23 to indicate the year of syllabus implementation.** ie., **ZY1C01B23**
- H. The letter **P** denotes practical – it should come after the code letter for the course ie...,**CP** (core practical- eg.ZY2CP01B23)/**BP** (complementary practical-eg. ZY2BP01B23).
- I. The letter **PR** denotes project ie...Zoology Core Project ZY6PRB23.

ZOOLOGY CODES

Code

ZY Zoology

ZYB Zoology Core Course Theory **ZY1C01B23, ZY2C02B23, ZY3C03B23, ZY4C04B23, ZY5C05B23, ZY5C06B23, ZY5C07B23, ZY5C08B23, ZY6C09B23, ZY6C10B23, ZY6C11B23, ZY6C12B23.**

Zoology Core, Choice Based Theory (ZY6C13AB23/ZY6C13BB23/ZY6C13CB23)

ZYCP Zoology Core Practical

(ZY2CP01B23/ZY4CP02B23/ ZY6CP03B23/ZY6CP04B23/ ZY6CP05B23/ZY6CP06B23)

ZYD Zoology Open Course Theory (ZY5D01AB23/ZY5D01BB23/ZY5D01CB23)

ZYB Zoology Complementary Theory(ZY1B01B23/ZY2B01B23/ZY3B01B23/ZY4B01B23)

Please note: Since the department offers two different complementary courses, coding is as follows;

First course - (ZY1B01B23/ZY2B01B23/ZY3B01B23/ZY4B01B23)

Second course - (ZY1B02B23/ZY2B02B23/ZY3B02B23/ZY4B02B23)

Two digits to indicate the complementary course number. ie.,

ZY1B01 (Zoology, 1st semester, Complementary course, course number is 01)

ZYBP Zoology Complementary Zoology Practical 'Model I' (ZY2BP01B23/ZY4BP01B23)

ZYPR Zoology Project ZY6PRB23.

DURATION OF THE PROGRAMME

The duration of programmes is 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.

DETAILED STRUCTURE OF THE PROGRAMME -B. Sc. PROGRAMME IN ZOOLOGY

Sem	Course Type	Course Code	Course Title	Hrs/ Week	No. Of Credits	Marks	
						ISA	ESA
I	Common Course I	EN1A01B23	Fine-tune Your English	5	4	20	80
		EN1A02B23	Pearls from the Deep	4	3	20	80
	Common Course II	FR1A01B23	Second Language – I French - French Language and communicative skills -I	4	4	20	80
		MA1A01B23	Malayalam - Kathasahithyam				
		HN1A01B23	Hindi - Kahaani Aur Upanyas				
	Core Course I	ZY1C01B23	General perspectives in Science and Protistan Diversity	2	2	15	60
	Core Course Practical I	ZY2CP01B2 3	Practical : General Perspectives in Science, Protistan Diversity and Animal Diversity – Non Chordata (Practical exam in the II Semester)	2	-	-	-
	Complementary Course I	CH1B01B23	Chemistry 1 Basic Theoretical and Analytical Chemistry	2	2	15	60
		CH2BP01B2 3	Chemistry Practicals: Volumetric Analysis (Practical exam in the II Semester)	2	-	-	-
	Complementary Course II	BO1B01B23	Botany 1 (Theory) Anatomy and Applied Botany	2	2	15	60
		BO2BP01B2 3	Botany Practicals Anatomy, Applied Botany, Cryptogams, and Gymnosperms (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	EN2A03B23	English 3 Issues that Matter	5	4	20	80
		EN2A04B23	English 4 Savouring the Classics	4	3	20	80
	Common Course II	FR2A03B23	French - French Language and communicative skills-II	4	4	20	80
		MA2A03B23	Malayalam - Kavitha				
		HN2A03B23	Hindi - Kavita Vyakaran Aur Anuvad				
	Core Course II	ZY2C02B23	Animal Diversity- Non Chordata	2	2	15	60
	Core Practical	ZY2CP01B23	General Perspectives in Science, Protistan Diversity and Animal Diversity - Non Chordata (Combined Practical exam Semesters I and II in the II Semester)	2	2	10	40
	Complementary Course I	CH2B01B23	Chemistry 2 (Theory) Basic Organic Chemistry	2	2	15	60
		CH2BP01B23	Chemistry Practicals Volumetric Analysis (Combined Practical exam of Semesters I & II in the II Semester)	2	2	10	40
	Complementary Course II	BO2B01B23	Botany 2 (Theory) Cryptogams and Gymnosperms	2	2	15	60
		BO2BP01B23	Botany Practicals Anatomy, Applied Botany, Cryptogams and Gymnosperms (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	EN3A05B23	English 5 Literature and/as Identity	5	4	20	80
	Common Course II	FR3A05B23	Second Language-3 French - An Advanced course in French -I	5	4	20	80
		MA3A05B23	Malayalam- - Drisyakalasaahithyam				
		HN3A05B23	Hindi – Naatak Aur Lambi Kavita				
	Core Course III	ZY3C03B23	Animal Diversity - Chordata	3	3	15	60
	Core Course Practical	ZY4CP02B23	Animal Diversity – Chordata, Research methodology, Biophysics and Biostatistics (Practical exam in the IV Semester)	2	-	-	-
	Complementary Course I	CH3B01B23	Chemistry 3 Inorganic and Organic Chemistry	3	3	15	60
		CH4BP01B23	Chemistry Practicals Organic Chemistry Practicals (Micro) (Practical exam in the IV Semester)	2	-	-	-
	Complementary Course II	BO3B01B23	Botany 3 Angiosperm Taxonomy and Economic Botany	3	3	15	60
		BO4BP01B23	Botany Practicals Angiosperm Taxonomy, Economic botany, Plant Physiology and Crop Pathology (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	EN4A06B23	English – 6 Illuminations	5	4	20	80
	Common Course II	FR4A06B23	Second language 4 French – An Advanced course in French –II	5	4	20	80
		MA4A06B23	Malayalam – Malayala Gadhyaarachanakal				
		HN4A06B23	Hindi – Gadya Aur Ekanki				
	Core Course IV	ZY4C04B23	Research methodology, Biophysics and Biostatistics	3	3	15	60
	Core Practicals	ZY4CP02B23	Animal Diversity –Chordata, Research methodology, Biophysics and Biostatistics (Combined Practical exam of Semesters III IV in the IV Semester)	2	2	10	40
	Complementary Course I	CH4B01B23	Chemistry 4 Advanced Bio-Organic Chemistry	3	3	15	60
		CH4BP01B23	Chemistry Practicals Organic Chemistry Practicals (Micro) (Combined Practical exam of Semesters III & IV in the IV Semester)	2	2	10	40
	Complementary Course II	BO4B01B23	Botany 4 Plant Physiology and Crop Pathology	3	3	15	60
		BO4BP01B23	Botany Practicals Angiosperm Taxonomy, Economic botany, Plant Physiology and Crop Pathology (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	ZY5C05B23	Core Course 5 Environmental Biology and Human rights	3	3	15	60
		ZY5C06B23	Core Course 6 Cell Biology and Genetics	3	3	15	60
		ZY5C07B23	Core Course 7 Evolution, Ethology and Zoogeography	3	3	15	60
		ZY5C08B23	Core Course 8 Human Physiology, Biochemistry and Endocrinology	3	3	15	60
	Open Course	Offered by other departments	---	4	3	20	80
	Core Practical	ZY6CP03B23	Environmental Biology, Toxicology, Cell Biology and Genetics (Practical exam and Credits in the VI Semester)	4	-	-	-
		ZY6CP04B23	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology (Practical exam and Credits in the VI Semester)	4	-	-	-
	Field study/ Project	ZY6PRB23	Project work and Field Visit/Study Tour, Visit to research institutes, Group activity (Credit 2 in 6 th 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	ZY6C09B23	Core Course 9: Developmental Biology	3	3	15	60
		ZY6C10B23	Core Course 10: Microbiology and Immunology	3	3	15	60
		ZY6C11B23	Core Course 11: Biotechnology, Bioinformatics and Molecular Biology	3	3	15	60
		ZY6C12B23	Core Course 12: Occupational Zoology (Apiculture, Vermiculture Sericulture and Aquaculture)	3	3	15	60
		ZY6C13AB23 ZY6C13BB23 ZY6C13CB23 ZY6C13DB23	Choice Based Core Course (Electives) 1 - Nutrition, Health and Life Style Management 2 - Ecotour and Sustainable Development 3 - Agricultural Pest Management 4 - Vector and Vector borne diseases	4	3	20	80
	Core Practical	ZY6CP03B23	Environmental Biology, Toxicology, Cell Biology and Genetics (Practical exam in the VI Semester)	-	2	10	40
		ZY6CP04B23	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology (Practical exam in the VI Semester)	-	2	10	40
		ZY6CP05B23	Developmental Biology, Microbiology and Immunology (Practical exam in the VI Semester)	4	2	10	40
		ZY6CP06B23	Biotechnology, Bioinformatics, Molecular Biology and Occupational Zoology (Practical exam in the VI Semester)	4	2	10	40
	Project	ZY6PRB23	Project work and Field Visit/Study Tour, Visit to research institutes, Group activity	1	2	20	80
	Total			25	25		

RECORDS

1. General Perspectives in Science, Protistan Diversity and Animal Diversity – Non Chordata.
2. Animal Diversity –Chordata, Research Methodology, Biophysics and Biostatistics.
3. Environmental Biology, Toxicology, Cell Biology and Genetics
4. Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology
5. Developmental Biology, Microbiology and Immunology
6. Biotechnology, Bioinformatics, Molecular Biology and 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 to do one group activity in the fifth semester and submit the report in the sixth semester for external practical examination along with a study tour report. A maximum of ten students can choose any one group activity like aquarium management, vermicomposting, bee keeping, 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	ZY1C01B23	General Perspectives in Science and Protistan Diversity	Core	2	36	2
1	ZY2CP01B23	Practical: General Perspectives in Science, Protistan Diversity and Animal Diversity – Non Chordata	Core	2	36	-
		Total credits				2
		SEMESTER -2				
2	ZY2C02B23	Animal Diversity- Non Chordata	Core	2	36	2
2	ZY2CP01B23	Practical: General Perspectives in Science, Protistan Diversity and Animal Diversity – Non Chordata	Core	2	36	2
		Total credits				4
		SEMESTER -3				
3	ZY3C03B23	Animal Diversity - Chordata	Core	3	54	3
3	ZY4CP02B23	Practical: Animal Diversity – Chordata, Research Methodology, Biophysics and Biostatistics	Core	2	36	-
		Total credits				3
		SEMESTER -4				
4	ZY4C04B23	Research Methodology, Biophysics and Biostatistics	Core	3	54	3
4	ZY4CP02B23	Practical: Animal Diversity – Chordata, Research methodology, Biophysics and Biostatistics	Core	2	36	2
		Total credits				5
		SEMESTER -5				
5	ZY5C05B23	Environmental Biology and Human rights	Core	3	54	3
5	ZY5C06B23	Cell Biology and Genetics	Core	3	54	3
5	ZY5C07B23	Evolution, Ethology and Zoogeography	Core	3	54	3
	ZY5C08B23	Human Physiology, Biochemistry and Endocrinology	Core	3	54	3
5	Offered by other Departments	Open Course	Open course	4	72	3

5	ZY6CP03B23	Practical: Environmental Biology, Toxicology, Cell Biology and Genetics	Core	4	72	-
5	ZY6CP04B23	Practical: Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology	Core	4	72	-
		Total Credits				15
		SEMESTER -6				
6	ZY6C09B23	Developmental Biology	Core	3	54	3
	ZY6C10B23	Microbiology and Immunology	Core	3	54	3
6	ZY6C11B23	Biotechnology, Bioinformatics and Molecular Biology	Core	3	54	3
6	ZY6C12B23	Occupational Zoology (Apiculture, Vermiculture, Sericulture and Aquaculture)	Core	3	54	3
	ZY6C13AB23	Nutrition, Health and Life Style Management	Core	4	72	3
6	ZY6CP03B23	Practical: Environmental Biology, Toxicology, Cell Biology and Genetics	Core	-	-	2
6	ZY6CP04B23	Practical: Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology	Core	-	-	2
6	ZY6CP05B23	Practical: Developmental Biology, Microbiology and Immunology	Core	4	72	2
6	ZY6CP06B23	Practical: Biotechnology, Bioinformatics, Molecular Biology and Occupational Zoology	Core	4	72	2
6	ZY6PRB23	Project work and Field Visit/Study Tour, Visit to research institutes, Group activity (for 5 th and 6 th Semesters)		1	36	2
		Total Credits				25

*** 2 Hours / week will be allotted for Practicals for each core course in all semesters. Choice based core 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.**

<u>SCHEME OF OPEN COURSES FOR OTHER STREAMS - Electives:</u> <u>DISTRIBUTION OF HOURS AND CREDIT</u>					
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	ZY5D01AB23	Human Genetics, Nutrition and Public Health	4	72	3
5	ZY5D01BB23	Vocational Zoology (Apiculture, Vermiculture and Ornamental Fish Culture)	4	72	3
5	ZY5D01CB23	Man, Nature and Sustainable Development	4	72	3

<u>SCHEME OF CHOICE BASED CORE COURSES - DISTRIBUTION OF HOURS AND CREDIT</u>						
Sl. No.	Semester	Course code	Course title	Inst Hrs/ week	Total Hrs/ Sem	Credits
1	6	ZY6C13AB23	Nutrition, Health and LifeStyle Management	4	72	3
2	6	ZY6C13BB23	Ecotourism and Sustainable Development	4	72	3
3	6	ZY6C13CB23	Agricultural Pest Management	4	72	3
4	6	ZY6C13DB23	Vector and Vector borne diseases	4	72	3

<u>SCHEME OF COMPLEMENTARY ZOOLOGY COURSES FOR B.Sc. BOTANY /HOME SCIENCE: DISTRIBUTION OF HOURS AND CREDIT</u>					
Name of semester	Course Code	Title of the Course	Inst Hrs/ week	Total Hrs/ Sem	Credit
Semester 1	ZY1B01B23	Non Chordate Diversity	2	36	2
	ZY2BP01B23	Non Chordate and Chordate Diversity (Practicals)	2	36	-
Semester 2	ZY2B01B23	Chordate Diversity	2	36	2
	ZY2BP01B23	Non Chordate and Chordate Diversity (Practicals)	2	36	2
Semester 3	ZY3B01B23	Physiology and Immunology	3	54	3
	ZY4BP01B23	Physiology, Immunology and Applied Zoology (Practicals)	2	36	-
Semester 4	ZY4B01B23	Applied Zoology	3	54	3

	ZY4BP01B23	Physiology, Immunology and Applied Zoology (Practicals)	2	36	2
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<u>SCHEME OF COMPLEMENTARY ZOOLOGY COURSES FOR B.Sc. PSYCHOLOGY: DISTRIBUTION OF HOURS AND CREDIT</u>					
Name of semester	Course Code	Title of the Course	Inst Hrs/ week	Total Hrs/ Sem	Credit
Semester 1	ZY1B02B23	Body Systems and Behaviour	2	36	2
Semester 2	ZY2B02B23	Biological Basis of Behaviour II	2	36	2
Semester 3	ZY3B02B23	Neurophysiology of Behaviour	3	54	2
Semester 4	ZY4B02B23	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	Durat ion	Marks		Credits
				Hrs	ISA	ESA	
1	ZY1C01B23	General Perspectives in Science and Protistan Diversity	Core Course 1	3	15	60	2
2	ZY2C02B23	Animal Diversity – Non Chordata	Core Course 2	3	15	60	2
3	ZY3C03B23	Animal Diversity- Chordata	Core Course3	3	15	60	3
4	ZY4C04B23	Research Methodology, Biophysics and Biostatistics	Core Course4	3	15	60	3
5	ZY5C05B23	Environmental Biology and Human rights	Core Course 5	3	15	60	3
5	ZY5C06B23	Cell Biology and Genetics	Core Course 6	3	15	60	3
5	ZY5C07B23	Evolution, Ethology and Zoogeography	Core Course 7	3	15	60	3
5	ZY5C08B23	Human Physiology, Biochemistry and Endocrinology	Core Course 8	3	15	60	3

6	ZY6C09B23	Developmental Biology	Core Course 9	3	15	60	3
6	ZY6C10B23	Microbiology and Immunology	Core Course 10	3	15	60	3
6	ZY6C11B23	Biotechnology, Bioinformatics and Molecular Biology	Core Course 11	3	15	60	3
6	ZY6C12B23	Occupational Zoology (Apiculture, Vermiculture Sericulture and Aquaculture)	Core Course 12	3	15	60	3
Zoology Open Course Sem 5 (<i>Select any1 from 3</i>)	ZY5D01AB23	Human Genetics, Nutrition and Public Health	Open course (for other streams)-1	3	20	80	3
	ZY5D01BB23	Vocational Zoology (Apiculture, Vermiculture and Ornamental Fish Culture)	Open course - 2				
	ZY5D01CB23	Man, Nature and Sustainable Development	Open course - 3				
Sem 6 Choice – based Course (<i>Select any1 from the four</i>)	ZY6C13AB23	Nutrition, Health and Life Style Management	Choice Based Core Course- 1	3	20	80	3
	ZY6C13BB23	Ecotourism and Sustainable Development	Choice Based Core Course- 2				
	ZY6C13CB23	Agricultural Pest Management	Choice Based Core Course- 3				
	ZY6C13DB23	Vector and Vector borne diseases	Choice Based Core Course- 4				

b) SCHEME OF PRACTICAL EXAMINATIONS–CORE COURSE

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

Seme ster	Code	Practical No.	Course Title	Duration	Marks		Credits
				Hrs	ISA	ESA	
2	ZY2CP01B23	I	General Perspectives in Science, Protistan Diversity and Animal Diversity – Non Chordata	3 Hrs	10	40	2
4	ZY4CP02B23	II	Animal Diversity – Chordata, Research methodology, Biophysics and Biostatistics	3 Hrs	10	40	2
6	ZY6CP03B23	III	Environmental Biology, Toxicology, Cell Biology and Genetics	3 Hrs	10	40	2
6	ZY6CP04B23	IV	Evolution, Ethology, Zoogeography, Human Physiology, Biochemistry and Endocrinology	3 Hrs	10	40	2
6	ZY6CP05B23	V	Developmental Biology, Microbiology and Immunology	3 Hrs	10	40	2
6	ZY6CP06B23	VI	Biotechnology, Bioinformatics, Molecular Biology and Occupational Zoology	3 Hrs	10	40	2
6	ZY6PRB23	Project	Project work and Field Visit/Study Tour, Visit to research institutes, Group activity	-	20	80	2

c) Total Credits for Core Course

Theory	
Core + Choice Core Based (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**

	ISA	ESA
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- 30 Marks (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 HOME SCIENCE)**

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	ISA	ESA	
1	ZY1B01B23	Non Chordate Diversity	Complementary Course	3	15	60	2
2	ZY2B01B23	Chordate Diversity	Complementary Course	3	15	60	2
3	ZY3B01B23	Physiology and Immunology	Complementary Course	3	15	60	3
4	ZY4B01B23	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	ISA	ESA	
2	ZY2BP01B23	I	Non Chordate and Chordate Diversity (Practicals)	3 Hrs	10	40	2
4	ZY4BP01B23	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	ISA	ESA	
1	ZY1B02B23	Body Systems and Behavior	Complementary Course	3	20	80	2
2	ZY2B02B23	Biological Basis of Behaviour II	Complementary Course	3	20	80	2
3	ZY3B02B23	Neurophysiology Of Behavior	Complementary Course	3	20	80	2
4	ZY4B02B23	Biophysiology of Behaviour	Complementary Course	3	20	80	2

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) and 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

<u>ISA - Theory</u>	<u>Marks</u>
Attendance	5
*Assignment	5
Test papers (2 x 5)	10
Total	20

Attendance:

<u>Percentage of Attendance</u>	<u>Marks</u>
Above or equal to 90%	5
Above or equal to 85% but less than 90 %	4
Above or equal to 80% but less than 85 %	3
Above 75% but less than 80 %	2
75 %	1
Less than 75%	0

For all courses with practical

- a) **End–Semester Assessment (ESA) :** .60 marks
 b) **In-Semester Assessment (ISA) :** .15 marks

<u>ISA - Theory</u>	<u>Marks</u>
Attendance	5
*Assignment	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

<u>ISA components</u>	<u>Marks</u>
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) End - Semester Assessment : 80
 (b) In- Semester assessment : 20

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

Projects which are preferably socially relevant/ industry oriented/ research oriented are to be undertaken by the students and the reports have to be submitted.

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.

<u>Components of Project - Internal Evaluation</u>	<u>Marks</u>
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.

(i) ***Assignment** (project/field work/ Industrial Visit) for Semester I & II- to be given by language teachers, report of which has to be submitted and for those programmes which do not have additional language the students must undertake the assignment (project/field work/ Industrial Visit) for any one core paper

(ii) *** Assignment:** for core papers (III & IV Semester), the student must undertake a Project/ Field work/ Industrial Visit/ Internship and the report of the same should be submitted for evaluation. The marks awarded to this can be considered for assignment of any one core paper

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 two years and shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the 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 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 10 point scale based on the total percentage of marks (ISA + ESA) for all courses (theory, practical, project)

% of marks	Grade	Grade point
Equal to 95 and above	S - Outstanding	10
Equal to 85 and < 95	A ⁺ - Excellent	9
Equal to 75 and < 85	A - Very good	8
Equal to 65 and < 75	B ⁺ - Good	7
Equal to 55 and < 65	B - Above average	6
Equal to 45 and < 55	C - Satisfactory	5
Equal to 35 and < 45	D - Pass	4
Below 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 Credit Point Average (SCPA) of a semester: $SCPA = TCP/TC$

TCP = Total Credit Point of that semester TC = Total Credit of that semester

Cumulative Credit Point Average (CCPA) is calculated: $CCPA = TCP/TC$

TCP = Total Credit Point of that programme TC = Total Credit of that programme

CREDIT POINT AVERAGE (CPA)

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

$$\text{CPA} = \text{TCP}/\text{TC}$$

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 CPA:

<u>CPA</u>	<u>Grade</u>
Equal to 9.5 and above	S - Outstanding
Equal to 8.5 and < 9.5	A ⁺ - Excellent
Equal to 7.5 and < 8.5	A - Very good
Equal to 6.5 and < 7.5	B ⁺ - Good
Equal to 5.5 and < 6.5	B - Above average
Equal to 4.5 and < 5.5	C - Satisfactory
Equal to 4 and < 4.5	D - Pass
Below 4	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 of other semesters, appear along with the next batch
- A student who registers her name for the end semester assessment for a semester 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 ESA for the same semester, subsequently.
- There shall be no improvement for internal evaluation.

All rules and regulations are subjected to change as and when modified by Mahatma Gandhi University, Kottayam to which St. Teresa's College (Autonomous), Ernakulam is affiliated.

SYLLABI FOR CORE COURSES

SEMESTER I

CORE COURSE

ZY1C01B23: GENERAL PERSPECTIVES IN SCIENCE AND PROTISTAN DIVERSITY

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

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 familiarize 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.

Skill in identifying animals and classifying them. Develop scientific temper, use vocabulary of science in communication and skilled science reporter

Course outcome

CO1: Explain perspectives in science. (Understand)

CO2: Differentiate the systematic principles for classification of animals. (Apply)

CO3: Identify Protistan Diversity. (Understand)

CO4: Distinguish parasitic protists. (Analyse)

PART I	PERSPECTIVES IN SCIENCE	8 Hrs
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Module I	Introduction to Scientific Studies	4 Hrs
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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
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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.

Textbooks:

- Mini, K.D. (Editor) 2022 Perspectives in Science, Zoological Society of Kerala, Kottayam.
- Prema A.K., Joseph M.L. and Terrence Rebello V. (Eds) (2011). Invertebrate Diversity of Kerala. Zoological Society of Kerala, Kottayam.
- Thomas, A.P. (Editor) 2009. Biology – Perspectives and Methods. Green Leaf Publishers, Kottayam.
- Thomas A P (Editor) 2010 The Invertebrates, Green leaf publications Kottayam.

References:

- Anderson D.T. 2001 Invertebrate Zoology Sec Edition Oxford University Press Barnes R.D. 1987. Invertebrate Zoology. W. B. Saunders. New York.
- Bowler Peter J. and Iwan Rhys Morus. 2005 Making Modern Science: A Historical Survey. University of Chicago Press, Chicago, IL:
- Dhami.P.S. and Dhami J.K. 1979 Invertebrate Zoology. R. Chand and Co. Delhi.
- EkambaranathaAyyar M. 1990.A Manual of Zoology. Volume i. Invertebrate part I and part II.S. Viswanathan Printers & Publishers. Pvt. Ltd.
- Ernst Mayr 1982. The Growth of Biological Thought: Diversity, Evolution and Inheritance. Published by Harvard University Press.
- Ervin Schrodinger 1944. What is life? Mind and Matter.Cambridge University Press.
- Hyman L. H. The Invertebrate Volumes.McGraw Hill.
- Jacques Monod 1971. Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology. Vintage Pub. NY
- Jordan. E. L., and Verma P.S. 2000. Invertebrate zoology. S. Chand and Co. ltd., New Delhi. Kapoor V.C.1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Pub.Co, New Delhi.
- Kotpal.R. L., 1988-92; (Protozoa).Rastogi Publishers, Meerut.

- Kotpal R. L, Agarwal S. K. and R. P. Khetharpal 2002.Modern Textbook of Zoology.
- Mayr, E. (1980). Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi)
- Parker and Hanswell, 2004, Text Book of Zoology, Vol I (Invertebrate), 7th Edition, A.Z.T,B.S. Publishers and Distributors, New Delhi – 110 051
- Pechenik J A (2005) Biology of Invertebrates, (Tata McGraw Hill Publishing Co., New Delhi.)
- Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p

MODEL QUESTION PAPER

B. Sc. DEGREE (C.B.C.S.) EXAMINATION

SEMESTER I- CORE COURSE

ZY1C01B23 - GENERAL PERSPECTIVES IN SCIENCE AND PROTISTAN DIVERSITY

Time: 3 Hours

Total Marks: 60 Marks

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

Qn. No	QUESTIONS	CO	Level of Question
1.	Define Law of priority.	2	U
2.	What is Systematics?	2	R
3.	Name any 2 organisms exhibiting radial symmetry	2	R
4.	Define Pseudoceolom. Give an example.	2	U
5.	What is a nested key?	2	U
6.	Write the generic name of a) Sun animalcule b) Slipper animalcule	3	R
7.	Name 2 pathogenic protists.	4	R
8.	Define volutin granules? Give an example.	3	R
9.	Define empiricism.	1	R
10.	What is Cryobiology?	1	U
11.	What does these vocabulary in science mean? a) Eury b) aer.	1	R
12.	Who proposed the theory of mutation and in which year?	1	R

(10 x 1=10 marks)

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

Qn. No	QUESTIONS	CO	Level of Question
13	Explain the life cycle of <i>Entamoeba</i> .	4	U
14	Explain various types of Symmetry.	2	U
15	Discuss different types of Taxonomic Keys.	2	U
16	Write Briefly on A) <i>Noctiluca</i> B) <i>Trichonympha</i> .	3	U
17	List the general characters of Protista.	3	R
18	Write a note on the levels of Biological organisation.	1	U
19	What is Science? Explain its features.	1	U
20	Write a note on the 5 characteristics that living things exhibit.	1	R
21	Write briefly on different types of coelom.	2	U

(6x 5 = 30 marks)

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

Qn. No	QUESTIONS	CO	Level of Question
22.	Compare the life cycle of <i>Plasmodium</i> in Man and mosquito. Sketch and label.	4	An
23	Discuss the process of Conjugation in <i>Paramecium</i> . Mention its significance.	3	U
24.	Discuss in detail the requisites and rules of Zoological Nomenclature. Add a note on Molecular taxonomy.	2	U
25.	Write an essay on the history of biology stating its landmarks in ancient, middle age and modern era.	1	R

(2 x 10 = 20 marks)

CO – Course Outcome**R – Remember, U- understand, Ap- Apply, An- Analyse**

SEMESTER II

CORE COURSE

ZY2C02B23: ANIMAL DIVERSITY – NON CHORDATA

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

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.

The course imparts skill to identify animals and their larva, environmental activist, skill to commercially utilize economically important animals. Skill in classifying and naming animals

Course Outcomes

CO1: Explain the classification of the lower groups of animal kingdom (Understand)

CO2: Differentiate the characteristics and identify the non-chordates phyla. (Apply)

CO3: Distinguish the economically important invertebrates. (Analyse)

CO4: Identify the larval forms of non-chordates. (Apply)

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*

Curriculum and Syllabi (2023 admission onwards)

Class II: Hexactinellida Eg. *Euplectella*

Class III: Demospongia Eg. *Cliona*.

General Topics: Canal system in sponges.

Eumetazoa:

Phylum Coelenterata – Type: *Obelia*

Classification upto classes

Class I: Hydrozoa Eg. *Halistemma*, *Physalia*. (mention Metagenesis)

Class II: Scyphozoa Eg. *Aurelia*.

Class III: Anthozoa Eg. *Adamsia*.

General Topics:

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

Phylum Ctenophora Eg. *Pleurobrachia*.

MODULE II

7 Hrs

Phylum Platyhelminthes

3 Hrs

Salient features; classification up to classes

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 Nematelminthes (Nematoda)

2 Hrs

Salient features, classification up to classes

Class: Phasmodia Eg. *Enterobius*

Class: Aphasmodia Eg. *Trichinella*

General Topic:

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

Phylum Annelida

2 Hrs

Salient features, Classification upto classes.

Class I: Archiannelida	Eg. <i>Polygordius</i>
Class II: Polychaeta	Eg. <i>Nereis</i>
Class III: Oligochaeta	Eg. <i>Megascolex</i> .
Class IV: Hirudinea	Eg. <i>Ozobranchus</i> , <i>Hirudinaria</i>

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. <i>Limulus</i>
Class 2. Arachnida	Eg. <i>Palamnaeus</i> - Scorpion
Class 3 Pycnogonida	Eg. <i>Pycnogonum</i> – Sea spider

3. Subphylum- Crustacea

Class 1 Branchiopoda	Eg. <i>Daphnia</i>
Class 2 Ostracoda	Eg. <i>Cypris</i> -seed shrimp
Class 3 Copepoda	Eg. <i>Cyclops</i>
Class 4 Remipedia	Eg. <i>Speleonectes</i> (eyeless crustacean seen in caves)
Class 5. Branchiura	Eg. <i>Argulus</i> (common fish louse)
Class 6 Cirripedia	Eg. <i>Sacculina</i> (parasitic castrator of crabs)
Class 7 Malacostraca	Eg. <i>Squilla</i> (spot tail mantis shrimp)

4. Subphylum- Uniramia

Class 1 Chilopoda	Eg. <i>Scolopendra</i> (Centipede)
Class 2 Symphyla	Eg. <i>Scutigera</i> (garden centipedes or pseudocentipedes)
Class 3 Diplopoda	Eg. <i>Spirostreptus</i> (Millipede)
Class 4 Pauropoda	Eg. <i>Pauropus</i>
Class 5 Hexapoda	Eg. <i>Bombyx mori</i> – (silk moth) (Insecta)

MODULE IV

8 Hrs

Phylum Mollusca

3 Hrs

Salient features, Classification upto classes

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

Phylum Echinodermata

3 Hrs

Salient features, Classification upto classes

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

General Topic:

- Larval forms of Echinodermata.

Phylum Hemichordata:

Eg. *Balanoglossus*

2 Hrs

Minor Phyla

1. Chaetognatha	Eg. <i>Sagitta</i>
2. Sipunculida	Eg. <i>Sipunculus</i>

Textbooks:

- Prema A.K and Sosamma Oommen (Eds.) (2018). Animal Diversity Non Chordata. Zoological Society of Kerala, Kottayam.
 - Prema A.K., Joseph M.L. and Terrence Rebello V. (Eds) (2011). Invertebrate Diversity of Kerala. Zoological Society of Kerala, Kottayam.
- Curriculum and Syllabi (2023 admission onwards)*

- Thomas A P (Editor) 2010 The Invertebrates, Green leaf publications Kottayam.References:

References:

- Barnes, R.D. (1987). Invertebrate Zoology, W.B. Saunders, New York.
- Barrington, E.J.W.(1967). Invertebrate Structure and function. ELBS and Nelson, London.
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- James R.D. (1987). Invertebrate Zoology, W.B. Saunders, New York.
- Jordan E.L and Verma P.S (2007). Invertebrate Zoology. S.Chand and Co.New Delhi.
- Joy P.J., George Abraham K., Aloysius M. Sebastian and Susan Panicker (Eds) (1998). Animal Diversity, Zoological Society of Kerala, Kottayam
- Kapoor, V.C. (1994). Theory and Practice of Animal Taxonomy, Oxford and IBH Publishing Co., New Delhi.
- Kotpal.R. L., 1988-92 (All series). Protozoa, Porifera, Coelentereta, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Rastogi Publishers, Meerut.
- Kotpal R.L. Agarwal S.K. and R.P. Khetharpal (2002). Modern Text Book of Zoology. Rastogi Publications, Meerat – 250 002.
- Marshall, A.J. and Williams, W.D. (1972). Text Book of Zoology Vol. Invertebrates (ELBS and Macmillan, London).
- Mayr, E. (1980). Principles of Systematic Zoology (Tata McGraw Hill Publishing Co., New Delhi)
- Parker and Hanswell, 2004, Text Book of Zoology, Vol I (Invertebrate), 7th Edition, A.Z.T,B.S. Publishers and Distributors, New Delhi – 110 051
- Pechenik J A (2005) Biology of Invertebrates, (Tata McGraw Hill Publishing Co., New Delhi.)

SEMESTER I & II

CORE COURSE PRACTICAL

ZY2CP01B23: GENERAL PERSPECTIVES IN SCIENCE, PROTISTAN DIVERSITY AND ANIMAL DIVERSITY – NON CHORDATA

Credits: 2

Hours per week: 2

Total Lecture Hours: 72

Course Overview and Context

The course helps to understand the scientific classification of Protistan diversity and invertebrate phyla. It stimulates the curiosity in living things around them and also enables the student to classify various non-chordata fauna around them.

The course develops students' skills to recognise, categorise, and name various genera.

Course Outcomes

CO1: Dissect the prawn and cockroach nervous system and distinguish the body parts of non-chordates (Apply)

CO2: Differentiate the characteristics and identify the non-chordate phyla. (Apply)

CO3: Distinguish and classify the various protists and non-chordates (Analyse)

CO4: Illustrate the non-chordates (Apply)

SEMESTER I:

CORE COURSE – PRACTICAL I: 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.**
6. **Normality, Molarity, Equivalent weight, Percentage of solutions**

SEMESTER II:

CORE COURSE – PRACTICAL II: ANIMAL DIVERSITY – NON CHORDATA

1. Scientific Drawing:

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

2. Anatomy: Study of sections (Any two)

- (a) Hydra
- (b) Ascaris (male and female)
- (c) Earthworm
- (d) Fasciola

3. Dissections:

- (a) Prawn - Nervous system
- (b) Cockroach - Nervous system

4. Mounting:

- (a) Prawn appendages.
- (b) Mouth parts - Cockroach/ Plant bug/ House fly / Mosquito. (Any Three)

5. Identification:

- (a) 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.
- (b) 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)

6. Taxonomic identification with key:

Identification of insects up to the level of Order (any Four).

SEMESTER III

CORE COURSE

ZY3C03B23: ANIMAL DIVERSITY- CHORDATA

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course enables skill development in understanding the diversity, systematic position, and economic importance of chordates.

Course outcome

CO1: Summarize general characters, origin and outline classification of Chordata. (Evaluate)

CO2: Compare general characters and classification of Vertebrata. (Evaluate)

CO3: Distinguish different Orders coming under Tetrapoda. (Evaluate)

CO4: Illustrate salient characteristics of mammals and classify them into different orders.
(Analyze)

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 Retrogressive Metamorphosis)

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**

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 Crossopterygii (Coelocanth) 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: *Acipenser*

Super order 2. Holostei Eg: *Amia*

Super order 3. Teleostei Eg: *Sardine*

General topics:

- Accessory respiratory organs in fishes.
- Parental care in fishes.
- Scales in fishes.
- 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 /neoteny)

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:

- Migrations in birds
- 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: <i>Echidna</i> , <i>Ornithorhynchus</i>
Sub class II: Metatheria	Eg: <i>Macropus</i>
Sub class III: Eutheria	
Order 1 Insectivora	Eg: <i>Talpa</i>
Order 2 Dermoptera	Eg: <i>Galeopithecus</i>
Order 3 Chiroptera	Eg: <i>Pteropus</i>
Order 4 Primates	Eg: <i>Loris</i>
Order 5 Carnivora	Eg: <i>Panthera</i>
Order 6 Edentata	Eg: <i>Armadillo</i>
Order 7 Pholidota	Eg: <i>Manis</i>
Order 8 Proboscidea	Eg: <i>Elephas</i>
Order 9 Hydracoidea	Eg: <i>Procavia</i>
Order 10 Sirenia	Eg: <i>Dugong</i>
Order 11 Perissodactyla	Eg: <i>Rhinoceros</i>
Order 12 Artiodactyla	Eg: <i>Camelus</i> -mention ruminant stomach
Order 13 Lagomorpha	Eg: <i>Oryctolagus</i>
Order 14 Rodentia	Eg: <i>Hystrix</i> (Porcupine)
Order 15 Tubulidentata	Eg: <i>Orycteropus</i>
Order 16 Cetacea	Eg: <i>Delphinus</i>

General topics:

- Dentition in Mammals
- Aquatic Mammals and their adaptations.

Textbooks:

- Meera Jan Abraham (Editor) (2018). Chordate Diversity of Kerala, Zoological Society of Kerala, Kottayam
 - Prema A.K., Terrence V.R. and Mini K.D.(Eds.) (2011). Chordate Diversity of Kerala, Zoological Society of Kerala, Kottayam
- Curriculum and Syllabi (2023 admission onwards)*

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

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SEMESTER IV

CORE COURSE

ZY4C04B23: RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course emphasises the development of research skills as well as skills in interpretation through biological instruments and statistical tools.

Course Outcomes:

CO1: Employ basic methodology of research and bioethics in research. (Apply)

CO2: Design experiment employing animal collection methods. (Create)

CO3: Compare different types of microscopes and separation techniques (Analyse)

CO4: Apply principles of Biostatistics in solving problems (Apply)

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,

Curriculum and Syllabi (2023 admission onwards)

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 and techniques sampling techniques

Quadrat 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, Polarization microscopy, Video microscopy.

(b) Electron - Scanning (SEM), Transmission (TEM) and STEM Micrometry – Stage and Eyepiece micrometers Camera Lucida Instrumentation: pH Meter

Separation Techniques: Centrifuge, Chromatography, Electrophoresis Analytical techniques:

Colorimeter, Spectrophotometer, X-ray crystallography

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 and 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, and Standard error. (Merits and 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.

Textbooks:

- Shirley Annie Oommen (Editor) (2022). Research Methodology, Zoological Society of Kerala, Kottayam.

References:

- Gupta K.C, Bhamrah, H.S and G.S.Sandhu (2006) Research Techniques in Biological Sciences. Dominant Publishers and Distributors, New Delhi.
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- Aggarwal. S.K.(2009) Foundation Course in Biology, 2nd Ed.. Ane's Student Edition. Ane Curriculum and Syllabi (2023 admission onwards)

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- Ruxton, G.D. and Colegrave, N. (2006), Experimental design for the life sciences. Oxford University Press.
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- Taylor D.J. Green N.P.O and Stout G.W. (2008). Biological science (3rd edition- R.S. Oper Ed). Cambridge University press.

SEMESTER III & IV

CORE COURSE PRACTICAL

ZY4CP02B23: ANIMAL DIVERSITY - CHORDATA, RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

Credits: 2

Hours per week: 2

Total Lecture Hours: 72

Course Overview and Context:

The course provides a basic concept of the diversity in chordates and their systematic position and economic importance. It familiarizes with field techniques including collection and preservation of animals.

It imparts skill in the measurement of the microscopic objects. It also helps the students to apply statistical methods in biological studies.

Course Outcomes:

CO1: Identify, classify and sketch chordates. (Apply)

CO2: Compare vertebrate systems. (Analyse)

CO3: Identify animal collection tools, techniques and major laboratory equipments. (Apply)

CO4: Calibrate and measure microscopic objects using micrometer. (Apply)

CO5: Construct diagrams and solve problems applying statistical principles. (Apply)

SEMESTER III

CORE COURSE III: 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 and preserved specimen each/models may be used for study.

- a. Frog Viscera
- b. Frog Digestive System

- c. Frog Arterial System
- d. Frog 9th and 1st Spinal nerve
- e. Frog Sciatic Plexus
- f. Frog Brain

3. Mounting: placoid scales, cycloid and ctenoid scales

4. Osteology:

Frog vertebrae - typical, atlas, 8th, 9th 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.

SEMESTER IV

CORE COURSE IV: RESEARCH METHODOLOGY, BIOPHYSICS AND BIOSTATISTICS

PART A - RESEARCH METHODOLOGY

Animal collection Tools, Techniques and 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)

Curriculum and Syllabi (2023 admission onwards)

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. Frequency distribution of the given samples to find out arithmetic mean, median, mode.
3. Range and standard deviation for a biological data
4. Correlation using any biological data.
5. Graphical representation of data. Construction of bar diagrams, Histograms, Pie diagram and Line graphs.

SEMESTER V

CORE COURSE

ZY5C05B23: ENVIRONMENTAL BIOLOGY AND HUMAN RIGHTS

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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 discuss 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.

The course also address the Environmental sustainability and imparts skills needed to promote, defend and apply human rights and intellectual property rights in daily life. Students develop skills to measure environmental parameters like species richness, evenness and identify different animal interactions.

As part of the introduction to environmental sustainability in the course, students are urged to preserve the environment. This also aids in comprehending social issues and human rights.

Course Outcomes:

CO1: Explain the concepts of Ecosystem and renewable resources. (Apply)

CO2: Discuss the concepts of Population, community and animal interaction. (Understand)

CO3: Distinguish biodiversity, articulate the measures for conservation of biodiversity and explain various environmental issues (Apply)

CO4: Explain the basic concepts and provisions of human rights (Apply)

MODULE 1: ECOSYSTEM

12 Hrs

Basic concepts of ecosystem

Components of ecosystem: Abiotic (Sunlight, temperature, soil, water, atmosphere) and Biotic

Curriculum and Syllabi (2023 admission onwards)

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 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.

Disaster Management: 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 and 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.

Textbooks:

Anila Kumary K.S, July 2021, Editor: Environmental Biology and Human rights, Zoological Society of Kerala.

References:

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- Misra S.P., Pandey S.N. 2009 Essential Environmental Students, Ane books Pvt. Ltd.
- P.D Sharma (2012), Ecology and Environment' - 11th Ed. Rastogi Publications
- R.B Singh & Suresh Mishra PaulamiMaiti (1996), Biodiversity – Perception, Peril and Preservation' — PHI Learning , Environmental Law in India: Issues and Responses
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- Sharma P.D. (2005)Environmental biology and Toxicology, Rastogi publication
- Meera Asthana and Astana D.K.1990 Environmental pollution and Toxicology Alka printers.
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- Alan Beeby, 2006 Anne – Maria Brennan First Ecology, Ecological principles and Environmental issues. International students edition Sec. edition Oxford University Press.
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- Landis, Wayne and Hing-hoYu, Baca Raton, 1995. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems: Lewis Publishers.

SEMESTER V

CORE COURSE

ZY5C06B23: CELL BIOLOGY AND GENETICS

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course imparts skills in identifying genetic disorders, cell organelles and stages of cell division.

Course Outcomes:

CO1: Compare the structure and functions of the cell organelles (Understand)

CO2: Explain Cell Communication and Cell Division. (Apply)

CO3: Explain the basis of human genetics, inheritance, modes of gene interactions and different genetic disorder (Apply)

CO4: Explain various strategies of sex determination and sex linked inheritance. (Apply)

CELL BIOLOGY

22 HRS

MODULE I

6 Hrs

Introduction of cell and Diversity of cells: History, Cell theory, Prokaryotes, Eukaryotes, Mycoplasmas, Virions and Viroids, Prions.

Cell membrane and 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 and organization, Heterochromatin, Euchromatin, Nucleosomes, Polytene chromosomes-Balbani 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. Erythroblastosis foetalis.

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's work 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).

Human Genetics: 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), Criss-cross inheritance. Inborn errors of metabolism such as phenylketonuria, alkaptonuria, Albinism. Multifactorial traits – polygenic disorder- cleft lip and cleft palate. Genetic Counseling, Eugenics and Euthenics -Brief account only

Textbooks:

- Joe Prasad Mathew and Reethamma O.V., Editors: 2019, Cell Biology and Genetics, *Curriculum and Syllabi (2023 admission onwards)*

Zoological Society of Kerala, P: 344.

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

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SEMESTER V

CORE COURSE PRACTICAL

ZY6CP03B23: ENVIRONMENTAL BIOLOGY, TOXICOLOGY, CELL BIOLOGY AND GENETICS

Credits: 2

Hours per week: 4

Total Lecture Hours: 72

Course Overview and Context:

The course provides a basic knowledge on the estimation procedures, enumeration of plankton, preparation of temporary whole mount, human blood smear and slide preparation for mitotic study. It creates an understanding of the basis of the pattern of inheritance of characters and disorders.

The course imparts skill development in the estimation of respiratory gases, identification of marine planktons and use of secchi disk, plankton net. The course helps with the development of skills in the identification of different stages of mitosis, different tissues, blood cells, and the Barr body.

A field visit to the important areas of biodiversity will introduce the student to environmental sustainability and protection.

Course outcomes

CO1: Administer experiments in Environmental Biology and Cell Biology. (Apply)

CO2: Survey important biodiversity areas. (Analyze)

CO3: Solve the problems in Genetics. (Apply)

CORE COURSE V: 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)

CORE COURSE: CELL BIOLOGY AND 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 group inheritance
2. Study of normal male and female human karyotype (use photographs or Xerox 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

SEMESTER V

CORE COURSE

ZY5C07B23: EVOLUTION, ETHOLOGY AND ZOOGEOGRAPHY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

This course imparts skill in identifying animal behavior and offers employability in animal keeping.

Course Outcomes:

CO1: Explain the evolutionary history of living and non-living world (Apply).

CO2: Describe the concepts and theories related to evolution (Understand).

CO3: Summarise the concepts of speciation, isolation and animal distribution (Understand).

CO4: Illustrate types of learning, animal behaviour pattern and social organisation of animals (Apply).

PART I - EVOLUTION

30 Hrs

MODULE I – Origin of 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. Evolution of man.

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

Palaeartic 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.

Textbooks:

- Dr.Seema K, Editor: 2019, Evolution, Zoological Society of Kerala.

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SEMESTER V

CORE COURSE

ZY5C08B23: HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course imparts skill in the identification of endocrine glands, hormones, and disorders of the organ systems in man.

Course Outcomes:

CO1: Differentiate the nutrient biochemistry, digestion, metabolism and nutritional disorders of Man. (Understand)

CO2: Explain the structure, function, and disorders of the organ systems in man. (Apply)

CO3: Classify the enzymes based on the chemical nature, mode of action and the factors influencing enzyme action. (Understand)

CO4: Distinguish different endocrine glands, hormones and its role in homeostasis. (Apply)

HUMAN PHYSIOLOGY

31 Hrs

MODULE I

8hrs

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

13 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.

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 III

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 and 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 IV

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: Major fat soluble and water soluble vitamins. Biological importance of vitamins.

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.

METABOLISM

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

8 Hrs

MODULE V

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, Placenta), Homeostasis and feedback mechanism.

Textbooks:

- Prema A. K, Editor: 2022, Ecophysiology of Man, Zoological Society of Kerala.

References:

- Albert L. Lehninger, Michael Cox and David L. Nelson; 2004; Biochemistry Lehninger. Palgrave – Macmillan.
- Arthur C. Guyton and John E. Hall; 2016; Text Book of Medical Physiology: Guyton, 13th edition; Elsevier
- Barrington, E. J. W.; 1975; General and Comparative Endocrinology, Oxford, Clarendon Press.
- Bhagavan, N.V. 2007. Medical biochemistry, fourth edition Academic Press, Awapara J, 1968. Introduction to Biological chemistry. Prentice Hall. New Jersey
- Geetha N. 2014. Textbook of Medical Physiology:. Paras Medical Publishers, 3rd edition Jain, A K.; 2016; Textbook of Physiology., Avichal Publishing Company
- Martin, C.R. 1985. Endocrine Physiology: Oxford University Press.
- Melmed, Shlomo, Williams, Robert Hardin; 2011; Textbook of Endocrinology: Elsevier, 12th edition
- Prosser and Brown; 1962; Comparative Animal Physiology:, W. B. Saunders Co., West Washington Square, Philadelphia 5.
- Rastogi, S. C.; 2007; Outlines of Biochemistry. CBS Publishers, New Delhi.
- Robert K. Murray and Victor W. Rodwell; 2012; Harper's Illustrated Biochemistry, Harper; 29th edition (Lange basic science.)
- Sarada Subramanyam and K. Madhavankutty; 2014; Textbook of human physiology., S.Chand & Company Ltd,
- Satyanarayana U. and Chakrapani, U.; 2013. Biochemistry Elsevier; 4 edition.

SEMESTER V

CORE COURSE PRACTICAL

ZY6CP04B23: EVOLUTION, ETHOLOGY, ZOOGEOGRAPHY, HUMAN PHYSIOLOGY, BIOCHEMISTRY AND ENDOCRINOLOGY

Credits: 2

Hours per week: 4

Total Lecture Hours: 72

Course Overview and Context

This course helps the student gain an understanding on the distribution pattern of animals on earth, its evolution and causative factors. It imparts basic knowledge on animal behavioural patterns. It also throws light on the experimental methods and designs that can be used for further study and research in Physiology.

The course provides skill development in the enumeration of blood, haemoglobin, PCV and analysis of sugars, proteins, lipids.

Course outcomes

CO1: Illustrate the concepts in Evolution, Ethology and Zoogeography. (Apply)

CO2: Administer experiments in Physiology, Biochemistry and Endocrinology. (Apply)

CORE COURSE: EVOLUTION, ETHOLOGY AND ZOOGEOGRAPHY

1. Identification of Zoogeographical realms using map.
2. Study on endemic species of each realm.
3. Show the discontinuous distribution of lung fishes, camel and 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 and T-maze

Curriculum and Syllabi (2023 admission onwards)

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)

CORE COURSE: HUMAN PHYSIOLOGY, BIOCHEMISTRY AND 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 R_f 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 and Corpora allata (Demonstration)
2. Effect of adrenalin on heart beat of Cockroach (Demonstration)

SEMESTER VI

CORE COURSE

ZY6C09B23: DEVELOPMENTAL BIOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course introduces the students to the concepts of reproductive physiology and provides knowledge and skills in experimental embryology. The course provides skill development in the identification of different types of eggs, cleavage, stages of chick embryo development, stages of zygote development in frogs and chicks.

Male and female gender notions are covered in the course.

Course Outcomes:

CO 1: Explain the basic concepts and theories in Developmental Biology and Reproductive Physiology. (Apply)

CO 2: Distinguish different developmental stages. (Apply)

CO 3: Explain embryology of Frog, Chick and Man. (Apply)

CO 4: Describe Experimental embryology, Teratogenesis and Developmental defects. (Understand)

CO 5: Explain placenta, prenatal diagnosis and regeneration. (Apply)

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
Curriculum and Syllabi (2023 admission onwards)

(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 and 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

20 Hrs

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

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 and 48 hour chick embryo. Extra embryonic membranes in chick.

Human development: Fertilization, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation. Human intervention in reproduction, contraception and birth control. Infertility, In vitro fertilization (test tube baby).

MODULE IV

5 Hrs

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.

Textbooks:

- Usha K. R., Editor: 2012, Developmental Biology, Zoological Society of Kerala.

References:

- Anthony S. Fauci, Eugene Braunwald, Dennis L. Kasper, Stephen L. Hauser, Dan L. Longo, Larry Jameson and Joseph Loscalzo; 2008; Harrison's Principles of Internal Medicine; Churchill Livingstone 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

ZY6C10B23: MICROBIOLOGY AND IMMUNOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course provides knowledge and skills in the identification of diseases caused by bacteria, viruses, and fungi, auto immune diseases, antigen-antibody reactions, blood groups, sterilization techniques, media preparation, culture methods, and culture plating techniques for the isolation of microbes.

Course outcomes

CO1: Differentiate various techniques of sterilization, media preparation and culture methods.
(Understand)

CO2: Summarize the fine structure, growth and reproduction of bacteria and viruses.
(Understand)

CO3: Explain the diseases caused by bacteria, virus and fungus. (Apply)

CO4: Distinguish the applications of Antigen – antibody reactions. (Analyze)

CO5: Explain basic concepts of Immunology. (Apply)

MICROBIOLOGY

33 Hrs

MODULE I

10 Hrs

Introduction: History and scope of microbiology. Outline classification of Microbes. (Bacteria,

Fungus and 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 and 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

21 Hrs

MODULE IV

9 Hrs

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

A brief account on biological function of complement system.

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 and cell mediated immunity Monoclonal and polyclonal antibodies

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

Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency - AIDS.

Hypersensitivity- Type I, (Eg. Anaphylaxis) II (Transfusion reaction), III (Arthus reaction) and IV (Mantoux Test) (in brief).

A brief account on organ transplantation.

Vaccines

3 Hrs

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

Textbooks:

- Mini K. D, Editor: 2013, Microbiology, Zoological Society of Kerala.
- Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.
- Susan Panicker & George Abraham (Editors) (2008), MicroBiology and Immunology, Zoological Society of Kerala, Kottayam.

References:

- Ananthanarayan R & Jayaram Paniker C K. (2009) Text Book of Microbiology Orient Longman Private Ltd.
- Kuby J, Kindt T., Goldsby R. and Osborne B. (2007). Kuby immunology
- Sharma K. (2005) Manual of Microbiology: Tools and Techniques, Ane books
- Coleman: (2002). Fundamentals of Immunology
- Darla J. Wise & Gordon R. Carter: (2004): Immunology a Comprehensive Review Iowa state University Press. A Blackwell science company,
- Hans G. Sch, Legal General Microbiology, Seventh Ed. Cambridge Low Price Ed.

- Helen Hapel, Maused Harney Siraj Misbah and Next Snowden: (2006) Essentials of Clinical Immunology Fifth Ed. Blackwell Publishing Company,
- Heritage, J, E.G.V. Evaus and R.A.Killungten (2007): Introductory Microbiology Cambridge University Press 6. Ivan Roitt I (2002) Essentials of Immunology ELBS.

SEMESTER VI

CORE COURSE PRACTICAL

ZY6CP05B23: DEVELOPMENTAL BIOLOGY, MICROBIOLOGY AND IMMUNOLOGY

Credits: 2

Hours per week: 4

Total Lecture Hours: 72

Course Overview and Context

The course acquaints the students with the knowledge of the use of instruments used in microbial sciences, microbial culture techniques, media preparation and Gram staining. It provides basic understanding of the embryology of Frog and Chick and congenital defects and the underlying causes.

The course provides skill development in the identification of different stages of chick embryo development, stages of zygote development in frogs and chicks, and skill development in culture plating techniques, gram staining, and the identification of blood groups.

Course outcomes

CO1: Administer experiments in Developmental Biology, Microbiology and immunology.

(Apply)

CO2: Dissect and display male and female reproductive organs in Fish. (Apply)

CO3: Calculate fecundity and gonado-somatic index of fish. (Apply)

CORE COURSE– 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 and man
6. 18-hour, 24-hour, 33 hour and 48 hour chick embryo.
7. Candling method.

8. Vital staining-demonstration.
9. Male and female reproductive organs in Fish/ Cockroach.
10. Calculate the fecundity of fish.
11. Calculate the gonado-somatic index of given fish.

CORE COURSE– MICROBIOLOGY AND 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) MacConkey'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.

SEMESTER VI

CORE COURSE

ZY6C11B23: BIOTECHNOLOGY, BIOINFORMATICS AND MOLECULAR BIOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course imparts skill in the identification of different blotting techniques and sequences of protein and nucleotide. Develops skill in using bioinformatic sites for evolutionary studies and drug development studies.

Course Outcomes

CO1: Explain the basic techniques and applications of biotechnology. (Apply)

CO2: Summarize the basic bioinformatics and its applications in biology. (Understand)

CO3: Describe the basic concepts in molecular biology. (Understand)

CO4: Explain gene expression and gene regulation. (Apply)

BIOTECHNOLOGY

20 Hrs

MODULE I

11 Hrs

Introduction: Scope, Brief History

Tools and Techniques in Biotechnology: Enzymes (restriction endonucleases, ligases, linkers and adapters), Vectors (Plasmids, Phage vectors, Cosmids, Artificial Chromosomes) Host cells. Basic steps and 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 hybridization, In situ
Curriculum and Syllabi (2023 admission onwards)

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 and 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 and Biopiracy. Protection of biotechnological inventions. Intellectual Property Rights, Patenting and patent protection.

BIOINFORMATICS

14 Hrs

MODULE III

8 Hrs

Definition, Nature and 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

Curriculum and Syllabi (2023 admission onwards)

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 GENSNIIP. 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 and 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 and repressible systems) Operon concept - Lac operon and Tryptophan operon, Brief account of Eukaryotic gene regulation.

Textbooks:

- Jinsu Varghese, Editor: 2019, Gene to Genome, Zoological Society of Kerala.
- Thomas AP (Editor). 2011 Cell & Molecular Biology, The Fundamentals. Green leaf publications .TIES Kottayam.
- Zoological Society of Kerala Study material. (2011) Cell and Molecular Biology.

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 Bjorn Kristiansen, 2008. Basic Biotechnology 3 rd ed. Cambridge University.
- Janarathanan S & Vincent S. 2007. Practical Biotechnology, Method of Protocols. University Press.
- John E. Smith. Biotechnology Cambridge Low priced ed. (Third Ed) 2005 Madigan,
- Martinko and Parker 2002, Biology of Microorganisms, Brock Eighth Ed. Prentice Hall.
- Singh B.D. Biotechnology 2002, Kalyan Publishers New Delhi.
- 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
- Claverie & Notredame, Bioinformatics - A Beginners Guide, Wiley-Dreamtech India Pvt Ltd, 2003
- Jin Xiang 2008 Essential Bioinformatics 1st Ed. Cambridge University Press.
- Neil C. Jones and Pavel A. Pevzner. 2004 An introduction to Bioinformatics Algorithms. Ane Book Pvt Ltd.
- Nikolay Kolchamvov and Ralf Hofstaedt-2008 Bioinformatics of Genome Regulation and structure. Springer International Ed.
- Paul.G. Hegg's and Teresa .K. Altwood- 2005, Bioinformatics and Molecular Evolution, Blackwell publishers.
- Xiong, Jin. [2006], *Essential Bioinformatics*, Cambridge University Press, New York.

- Rashidi, Hooman H. and Buehler, Lukas K. [2001]. *Bioinformatics: Basics applications in biological science and medicine*, CRC Press, Washington, D.C.
- Rastogi et. al., *Bioinformatics: Methods and Applications*, Prentice Hall of India.

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.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Gupta, P. K (2002) *Cell and Molecular Biology*, (2ed), Rastogi Publications., Meerut.
- James Darnell. (1998) *Molecular Biology*. Scientific American Books Inc.

SEMESTER VI

CORE COURSE

ZY6C12B23: OCCUPATIONAL ZOOLOGY

(APICULTURE, VERMICULTURE, SERICULTURE AND AQUACULTURE)

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

The course provides skill development in the identification of ornamental fishes, culturable fishes, earthworms, honey bees, shell fishes, fish parasites, bee keeping equipments and determining the adulteration in honey and skill in the identification of different blotting techniques and sequences of protein and nucleotide.

Course Outcomes

CO1: Manage apiculture unit. (Create)

CO2: Establish a vermicomposting unit. (Apply)

CO3: Explain basic concepts in Sericulture. (Understand)

CO4: Prepare an aquaculture unit. (Apply)

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 and life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc. Preparation of vermibed, Maintenance and 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 and Preservation.

Aquarium management - Setting up of an aquarium, Biological filter and 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.

Textbooks:

- Sojomon Mathew, Editor: 2019, Occupational Zoology, Zoological Society of Kerala.

References:

- NPCS Board, The complete book on Bee keeping and honey processing, NIIR Project consultancy services, 106E, Kamala nagar, Delhi- 110007.
- Shukla G.S, & Updhyay V.B, Economic zoology, Rastogi Publ. Meerut. Pradip.V.Jabde , Text book of applied zoology, 2005
- Applied Zoology, Study Material Zoological Society of Kerala, CMS college Campus Clive. A Edwards, Norman. Q. & Rhonda. 2011. Vermitechnology: earthworms, organic waste & environmental management.
- Chauhan, H.V.S. Poultry, Disease, diagnosis and treatment, Wiley eastern Ltd Delhi.
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SEMESTER VI

CORE COURSE PRACTICAL

ZY6CP06B23: BIOTECHNOLOGY, BIOINFORMATICS, MOLECULAR BIOLOGY AND OCCUPATIONAL ZOOLOGY

Credits: 2

Hours per week: 4

Total Lecture Hours: 72

Course Overview and Context

The course introduces the student to some of the present and future applications of bio-sciences. It equips the students with the knowledge of modern developments and recent trends in biological sciences. It imparts skills in various methods of animal breeding and rearing techniques.

This course equips students with self employment capabilities and acquaints them with skills in various rearing techniques in Apiculture, Vermiculture, Sericulture and Aquaculture.

Course outcomes

CO1: Describe biomolecules and biological techniques (Understand)

CO2: Explain the basics in bioinformatics (Understand)

CO3: Illustrate the skill in animal rearing (Apply)

CORE COURSE : 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 of both.
2. Download/ use print out/ pictures of a protein sequence, identify it and 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 (DNA, DNA replication, RNA different types) using models or diagrams.

CORE COURSE: 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 and 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.

SYLLABI FOR CHOICE BASED CORE COURSES

SEMESTER VI

CHOICE BASED CORE COURSE- ELECTIVE I

ZY6C13AB23: NUTRITION, HEALTH AND LIFESTYLE MANAGEMENT

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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 outbreaks that are associated with community are also dealt in the paper.

The course imparts skill as a dietician and nutrition analyst. Lifeskill management and development, skill in conducting fitness and health awareness campaigns for public.

Course Outcomes

CO1: Relate the principles of nutrition, food safety and their role in the health of man.

(Understand)

CO2: Differentiate the key concepts and parameters of health. (Understand)

CO3: Distinguish the various lifestyle diseases and their causes. (Understand)

CO4: Practice good lifestyle habits to maintain good health. (Apply)

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) and 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 and 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.

Textbooks:

- K Leena Joseph, Editor: 2019, Nutrition, Health and Management, Zoological Society of Kerala.

References:

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SEMESTER VI

ZOOLOGY CORE CHOICE BASED CORE COURSE -ELECTIVE II ZY6C13BB23: ECOTOURISM AND SUSTAINABLE DEVELOPMENT

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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.

The course introduces the importance of sustainable development.

The course helps in skill development as an environment and animal welfare activist and as a science reporter. Skill as an ecotourism adviser.

Course Outcomes

CO1: Explain the key concepts and influencing factors of Tourism. (Understand)

CO2: Identify the major areas of eco-tourism. (Remember)

CO3: Distinguish the possible trends, problems and prospects of eco-tourism. (Understand)

CO4: Discuss the need for sustainable and guided ecotourism. (Understand)

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

Curriculum and Syllabi (2023 admission onwards)

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 Reserve People initiatives.

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

Ecotourism guiding and case studies Activity

Field visit to ecologically relevant places and 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
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SEMESTER VI

ZOOLOGY CORE CHOICE BASED CORE COURSE - ELECTIVE III

ZY6C13CB23: AGRICULTURAL PEST MANAGEMENT

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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 management and promote organic food farming for a sustainable environment and healthy society.

The course introduces the importance of environmental sustainability.

Course imparts skill in pest control and pest management

Course Outcomes

CO1: Explain the key concepts of agricultural practices and its pests. (Understand)

CO2: Distinguish various agricultural pests and their host plants. (Understand)

CO3: Identify different pest control practices. (Remember)

CO4: Discuss on the major pests of crops and stored grains and their control. (Understand)

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
Curriculum and Syllabi (2023 admission onwards)

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:

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
Curriculum and Syllabi (2023 admission onwards)

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*, *Pentalonia nigronervosa*

Pests of vegetables- Brinjal: *Leucinodes orbonalis*, *Euzophera perticella*, *Henosepilachna vigintioctopunctata*, *Urentius hystricellus*.

Pests of Gourds: *Bactocera cucurbitae*, *Anadevidia peponis*, *Epilachna spp.* *Raphidopalpa foveicollis*, *Baris trichosanthus*.

Pest of stored grains: *Sitophilus oryzae*, *Corcyra cephalonica*, *Tribolium castaneum*, *Trogoderma granarium*, *Callosobruchus chinensis*

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:

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SEMESTER VI

CHOICE BASED CORE COURSE - ELECTIVE IV ZY6C13DB23: VECTOR AND VECTOR BORNE DISEASES

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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 the biosphere.

The course introduces the importance of environmental sustainability. Skill as a public health analyst, public health seivior and vector control expert

Course Outcomes

CO1: Discuss on various insect vectors and their host characteristics. (Understand)

CO2: Distinguish the major vector borne diseases. (Understand)

CO3: Identify fundamentals of epidemiology. (Remember)

CO4: Compare the disease-causing mosquitoes as a vector (Understand)

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 and 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.
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- Rozendaal, J. A. 1997. Vector Control. Methods for use by individuals and communities. World Health Organisation, Geneva.
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- 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.

SEMESTER V AND SEMESTER VI

CORE PROJECT

ZY6PRB23 - PROJECT WORK AND FIELD VISIT/STUDY TOUR, VISIT TO RESEARCH INSTITUTES, GROUP ACTIVITY

Credits: 2

Hours per week: 1

Total Lecture Hours: 36

Course Overview and Context

Students develop these abilities in the course, including how to select relevant research issues, plan experiments, analyse and interpret data, and present their research project.

The focus of the course is on developing research skills while emphasising employability and a variety of career-oriented skills.

The opportunity to identify projects that are significant from a social and ecological perspective is provided by the course. Field visits to environmentally significant locations educate about ecological sustainability.

Course outcomes

CO1: Explain the places of zoological importance. (Apply)

CO2: Manage group activity. (Create)

CO3: Write project report. (Create)

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 to do one group activity in the fifth semester and submit the report in the sixth semester for external practical examination along with study tour report. A maximum of ten students can choose any one group activity like aquarium management, vermicomposting, bee

Curriculum and Syllabi (2023 admission onwards)

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.

PROJECT

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.

SYLLABI FOR OPEN COURSES

SEMESTER V

OPEN COURSES FOR OTHER STREAMS - ELECTIVE I

ZY5D01AB23: HUMAN GENETICS, NUTRITION AND PUBLIC HEALTH

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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 outbreaks that are associated with community also dealt in the paper.

Lifeskill management and development, skill in conducting fitness, health and safety awareness Campaigns for public. Skill in water and environment quality checking.

Course outcomes:

CO1: Differentiate the key concepts of health and effects of exercise on body systems.

(Understand)

CO2: Classify the nutrients, its balance and imbalances in man. (Understand)

CO3: Apply the regular and alternative modes of life skills for the wellbeing of mind and body.

(Apply)

CO4: Explain public health diseases and sanitation measures. (Apply)

CO5: Distinguish the genetic disorders and its diagnosis in man. (Understand)

PART I: HEALTH, EXERCISE AND NUTRITION

36Hrs

MODULE 1 Definition and Meaning of Health

10Hrs

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

21 Hrs

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, Salmonellosis, Hepatitis A

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

Zoonotic disease-Leptospirosis and its control

Emerging diseases - Swine flu (H1N1), bird flu (H5N1), SARS, Covid, Nipah, Monkey Pox

Re-emerging diseases –TB, Malaria

Bio-terrorism - Anthrax

PART III: HUMAN GENETICS

15Hrs

MODULE 7 Human Genetics

10 Hrs

Human normal chromosome complement. Genetic disorders in man. Chromosomal anomalies. Eg. Down syndrome and Cri du 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 and Report Presentation

5 Hrs

Textbook:

- Soja Louis, Editor: 2019, Health and Nutrition, Zoological Society of Kerala.

References:

- 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 Medicine 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.

SEMESTER V

OPEN COURSES FOR OTHER STREAMS - ELECTIVE II **ZY5D01BB23: VOCATIONAL ZOOLOGY (APICULTURE,** **VERMICULTURE AND ORNAMENTAL FISH CULTURE)**

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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 Bees, Silk worm and Fishes imparts skill for self employment opportunities.

The course provides skill development in the identification of ornamental fishes, culturable fishes, earthworms, honey bees, shell fishes, fish parasites, bee keeping equipments and determining the adulteration in honey and skill in the identification of different blotting techniques and sequences of protein and nucleotide.

Course Outcomes

CO1: Differentiate the marine and freshwater fishes and their maintenance. (Apply)

CO2: Distinguish the fish diseases and its feed formulations for commercial ornamental fish culture. (Evaluate)

CO3: Explain the quail farming techniques and rearing equipments of honey bees. (Understand)

CO4: Prepare a vermiculture unit for waste management. (Apply)

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 aquarium and 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 Goldfish, Fighter, Gourami (*Osphroneus*), and Guppy (livebearer). Nutrition and types feed for aquarium fishes, Use of live fish feed organisms 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 a 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 earthworms, Life history, Species of earthworms used for vermiculture, 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.

Textbook:

- Sojomon Mathew, Editor: 2019, Occupational Zoology, Zoological Society of Kerala.

References:

- Applied Zoology, Study Material Zoological Society of Kerala, CMS College Campus, Kottayam.
- Addison Webb (1947), Bee Keeping- for profit and pleasure, Museum Press, agro bios India Ltd.
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- David Alderton (2008). Encyclopedia of Aquarium and Pond fish. Published by Dorling Kindersley, DK Books.
- Dey, V.K. (1997). A Hand Book on Aquafarming- Ornamental fishes. Manual. MPEDA Cochin.
- George Cust and & Peter Bird. (1978). Tropical Fresh water Aquaria, Published by Hamlyn London. Illustrated by George Thompson.
- Harisankar J. Alappat and Bijukumar. A. (2011) Aquarium Fishes. B. R. Publ. Corporation, Delhi.
- Herbert R. and Leonard P. Schultz Axelrod (1955) Handbook of Tropical Aquarium Fishes,

McGraw-Hill, 1955.

- Joy P.J., George Abraham K., Aloysius M. Sebastian and Susan Panicker (Eds) (1998) Animal Diversity, Zoological Society of Kerala, Kottayam
- Michael B. New; Alber G.J. Tacon (1994) Farm made aquafeeds FAO fisheries technical paper No.343, Rome, FAO. 1994
- Nalina Sundari, M.S and Santhi, R (2006) Entomology. MJP Publishers
- NPCS Board of Consultants & Engineers, Chennai.(2015) The complete book on Bee keeping and honey processing, 2nd Edition, NIIR Project consultancy services, 106- E kamala Nagar Delhi – 110007.
- Ronald J. Roberts (1978) Fish pathology, Cassel Ltd London.
- Vijayakumaran Nair, K, Manju, K.G. and Minimol, K. C. (2015) Applied Zoology, Academia press, Thiruvananthapuram.

SEMESTER V

OPEN COURSES FOR OTHER STREAMS ELECTIVE III

ZY5D01CB23: MAN, NATURE AND SUSTAINABLE DEVELOPMENT

Credits: 3

Hours per week: 4

Total Lecture Hours: 72

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. 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.

The course helps in skill development as an environment and animal welfare activist and as a science reporter.

Course Outcomes:

CO1: Explain the different resources available on earth and the evolution of man and nature.
(Analyze)

CO2: Discriminate global environmental problems, its impact on human wellbeing and summarize the concepts for Sustainable Development (Evaluate)

CO3: Explain the perspectives of Man on nature. (Understand)

CO4: Evaluate the global strategies for conservation of environment. (Analyse)

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

10 Hrs

Global Environmental Issues Threatening Natural Resources and Human Life, 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 UNFCCC 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:

- Conroy, G.C. 1997. Reconstructing Human Evolution: A Modern Synthesis. Norton, NY, USA.
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- Richard T. Wright & Bernard J. Nebel. 2002. Environmental Science-Toward a Sustainable future. Pearson Education Inc. NY, USA.
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- Donella H. Meadows et al. 1972. The Limits to Growth. Universe Books NY, USA.
- Encyclopedia Britannica .1987 .Evolution. Macropedia Vol.18 Knowledge in Depth pp930-979. encyclopedia Britannica Inc. UK
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- Rob DeSalle and Ian Tattersal.2008. Human Origins: What Bones and Genomes Tell Us about ourselves. Texas A&MUniversity Press, USA.
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**SYLLABI FOR
COMPLEMENTARY COURSES
(BOTANY & HOME SCIENCE)**

SEMESTER I

COMPLEMENTARY COURSE ZY1B01B23: NON CHORDATE DIVERSITY

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

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 protozoans, helminthes and vector arthropods which are the cause behind many diseases. It also high lights the importance of conservation of coral reefs.

The course develops students' skills to recognise, categorise, and name various genera.

Course Outcomes:

CO1: Classify Non chordates up to the level of class (Understand)

CO2: Differentiate beneficial and harmful non chordates. (Analyze)

CO3: Describe the ecological importance of Corals and Coral reefs. (Understand)

CO4: Describe the physiological and morphological distinctiveness of Non chordates. (Understand)

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: <i>Amoeba</i>)
Phylum Actinopoda	(eg: <i>Actinophrys</i>)
Phylum Dinoflagellata	(eg: <i>Noctiluca</i>)
Phylum Parabasalia	(eg: <i>Trichonympha</i>)
Phylum Metamonada	(eg: <i>Giardia</i>)
Phylum Kinetoplasta	(eg: <i>Trypanosoma</i>)

Phylum Euglenophyta	(eg: <i>Euglena</i>)
Phylum Opalinata	(eg: <i>Opalina</i>)
Phylum Chlorophyta	(eg: <i>Volvox</i>)
Phylum Choanoflagellata	(eg: <i>Proterospongia</i>)
Phylum Ciliophora	(eg: <i>Paramecium</i>)
Phylum Sporozoa	(eg: <i>Plasmodium</i>)
Phylum Microsporidia	(eg: <i>Nosema</i>)

General Topic: Pathogenic Protists – *Plasmodium*, *Entamoeba*

MODULE II

3Hrs

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: Turbellaria (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: Aphasmda (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: *Scutigera*)

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: Aplousobranchia (eg: *Neomenia*)

Class 2: Monoplousobranchia (eg: *Neopilina*)

Class 3: Polyplousobranchia (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: Asterozoa (eg: *Astropecten*)

Class 2: Echinozoa (eg: *Ophiothrix*)

Class 3: Echinoidea (eg: *Echinus*)

Class 4: Holothuroidea (eg: *Holothuria*)

Class 5: Crinoidea (eg: *Antedon*)

Phylum Hemichordata: Salient features (eg: *Balanoglossus*)

Textbooks:

- Priyalakshmi G. and Sany Mary Benjamin, Editors: 2022, Animal diversity, Zoological Society of Kerala

References:

- Animal Diversity (2002). Published by Zoological Society of Kerala.
- Barnes, R D, (1987). Invertebrate Zoology (W.B. Saunders, New York).
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MODEL QUESTION PAPER

B. Sc. DEGREE (C.B.C.S.) EXAMINATION

SEMESTER I - COMPLEMENTARY COURSE 1 (ZOOLOGY)

(Common for Botany & Home Science as core)

ZY1B01B23 - NON CHORDATE DIVERSITY

Time: 3 Hours

Maximum Marks: 60 Marks

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

Qn. No.	QUESTIONS	CO	Level of Question
1.	Write the generic name of a) sun animalcule b) venus flower basket.	1	R
2.	Write any 2 methods of sepia to escape from predators.	4	U
3.	Define a digenetic parasite. Give an example	2	R
4.	What are forcipules? In Which organism it is found?	4	U
5.	Name the first larvae of <i>Penaeus</i> ?	2	R
6.	Name an organism which can digest cellulose.	1	R
7.	Differentiate between polyp and medusa	3	U
8.	Write the common name for a) <i>Physalia</i> b) <i>Adamsia</i>	1	R
9.	Define measly pork?	2	R
10.	Define clitellum.	4	R
11.	Define petasma.	4	R
12.	What is Aristotles lantern?	4	R

(10 x 1=10 marks)

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

Qn. No.	QUESTIONS	CO	Level of Question
13.	Describe the life cycle of <i>Plasmodium</i> in mosquito	2	U
14.	Explain polymorphism with the help of an example.	3	U
15.	Write a detailed account on <i>Peripatus</i> .	1	R
16.	What is dendrobranchia and branchial formula?	4	U

17.	Discuss the lifecycle <i>Wuchereria</i> .	2	U
18.	Give an account on the classification of Echinodermata.	1	R
19.	List the salient features of platyhelminthes.	1	R
20.	Write short essay on the affinities of <i>Balanoglossus</i> .	4	U
21.	Compare the distinctive features of A) <i>Noctiluca</i> B) <i>Trypanosoma</i> .	1	U

(6x 5 = 30 marks)

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

Qn. No.	QUESTIONS	CO	Level of Question
22.	Describe the life history of <i>Entamoeba</i> . Sketch and label	2	U
23.	Explain the general characters of the phylum Mollusca and classify the phylum upto classes citing an example from each.	1	R
24.	Discuss the life cycle of <i>Fasciola</i> . Add a note on its Economic Importance.	2	U
25.	With suitable figures give an account on the Cephalic appendages of <i>Panaeus</i> .	4	R

(2 x 10 = 20 marks)

CO – Course Outcome

R – Remember, U- understand, Ap- Apply, An- Analyse

SEMESTER II

COMPLEMENTARY COURSE ZY2B01B23: CHORDATE DIVERSITY

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

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.

The course enables skill development in understanding the diversity, systematic position, and economic importance of chordates.

Course Outcomes:

CO1: Explain the classification of the higher groups of animal kingdom (Understand)

CO2: Differentiate the characteristics, systems and identify the chordate phyla. (Apply)

CO3: Distinguish the economically important vertebrates. (Analyse)

CO4: Summarize the adaptations in various classes of chordates. (Understand)

MODULE I

4 Hrs

Phylum Chordata: Fundamental characters and outline classification upto class.

Subphylum Urochordata:

General characters, Classification:

Class 1: Larvacea (eg: *Oikopleura*)

Class 2: Ascidiacea (eg: *Ascidia*), Retrogressive metamorphosis.

Class 3: Thaliacea (eg: *Salpa*)

Subphylum Cephalochordata: Salient features (eg: *Branchiostoma*)

MODULE II

6 Hrs

Subphylum Vertebrata: Salient features

Division Agnatha: salient features and classification

Class 1: Cyclostoma (eg: *Petromyzon*)

Class 2: Class Ostracodermi (eg: *Cephalopsis*)

Division Gnathostomata: Salient features; Superclass Pisces Superclass Tetrapoda.

Superclass 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

Superclass 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: *Ichthyophis*)

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: *Ichthyosaurus*)

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.

Textbooks:

- Priyalakshmi G. and Sany Mary Benjamin, Editors: 2022, Animal diversity, Zoological Society of Kerala

References:

- Animal Diversity (2002). Zoological Society Of Kerala Study Material Series. Published by Zoological Society of Kerala
- Deoras, P.J. (1981). Snakes of India (National Book Trust of India.)
- Ekamberanatha Ayyar M. (1990) A Manual of Zoology, Volume I. Vertebrate Part I and Part II S. Viswanathan Printers & Publishers Pvt. Ltd.
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- Groove, A.J. and Newell, G.E. (1974). Animal Biology - Indian Reprint Universal Book Stall, New Delhi.
- Induchoodan, (1986), Kweralthile Pakshikal (Kerala Sahitya Academy, Trichur).
- Kapoor, V.C. 1994, Theory and Practice of Animal Taxonomy (Oxford and IBM Publishing Co. New Delhi.
- Lagler, K.F. , Bardach, J.E. , Miller, R.R. Passino, D.R.M. 1977 Ichthyology (John Wiley and Sons).
- Mayer, E. (1980). Principles of Systematic Zoology (Tata McGraw Hill Publishing Co. New Delhi.

- Newman, H.H. (1939). Phylum Chordata, (Macmillan Pub. Co. New York)
- Nigam H.C. (1978) , Zoology of Chordata (S. Chand and Co. New Delhi).
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- Parter S.H. (1971). The Book of Indian Animals (Bombay Natural History Society). Salim Ali, (1969). Birds of Kerala (Oxford University Press).
- Sinha A.K., Adhikari S. Ganguly, B.B. (1988). Biology of Animals Vol. II (New Central Book Agency, Calcutta.)
- Whitaker, R. (1978) Common Indian Snakes – A field Guide Macmillan and Co. of India Ltd.) Young J.Z. (1981). The life of Vertebrate s (Oxford University Press).

SEMESTER I & II

COMPLEMENTARY PRACTICAL

ZY2BP01B23: NON CHORDATE AND CHORDATE DIVERSITY

Credits: 2

Hours per Week: 2

Total Lecture Hours: 72

Course Overview and Context

The course gives an overall idea on classification of chordates and highlights the differences between non-chordates and chordates. It familiarize the students with the diverse group of organisms around them.

The student develop skill to dissect the non chordates.

Course Outcome

CO1: Dissect the prawn and cockroach nervous system and distinguish the body parts of non-chordates and chordates (Understand)

CO2: Distinguish the characteristics and identify the non-chordates and chordates. (Apply)

CO3: Classify the various non-chordate and chordate phyla (Analyze)

CO4: Illustrate the non-chordates (Apply)

COMPLEMENTARY COURSE 1 - 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

COMPLEMENTARY COURSE 2 - CHORDATE DIVERSITY

1. Scientific drawing - 5 specimens
2. Simple identification of 10 chordates, out of which 5 by their scientific names
3. Osteology - Vertebrae and girdles of Frog
4. Snake identification - 3 poisonous and 3 non poisonous snakes with key

5. Mounting of placoid scales of shark; cycloid and ctenoid scales
6. 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

SEMESTER III

COMPLEMENTARY COURSE

ZY3B01B23: PHYSIOLOGY AND IMMUNOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

Course Overview and Context

The course provides an in depth 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.

Course Outcomes:

CO1: Illustrate the basic concepts and disorders of nutrition, circulation, respiration. (Analyze)

CO2: Compare the physiology and disorders of excretory, muscular and nervous system. (Analyze)

CO3: Summarize the role of endocrine system in maintaining homeostasis. (Evaluate)

CO4: Distinguish immunological concepts, Immune disorders and application of antigen antibody reactions. (Evaluate)

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: 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, Hemophilia, cerebral and pulmonary thrombosis.

MODULE II

14 hrs

Excretion: Structure of a nephron. Urine formation – glomerular filtration, 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

6 Hrs

First aid and emergency care- Burns, choking, drowning, fractures, fainting, electric shock, cardiac arrest, snake bite, CPR.

MODULE V

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, HIV test (ELISA).

Immune response system: (Brief accounts of the followings) Primary and secondary lymphoid organs, Cells of Immune system - T and B lymphocytes, natural killer cells, macrophages, plasma cells, memory cells. Immune disorders: Allergic reactions, Auto immunity and Immunodeficiency (AIDS). Vaccines - BCG, DPT, Polio vaccine. (Brief description only)

Textbooks:

- C. P Anitha Devi and Priya Thomas, Editors: 2019, Physiology & Applied Zoology, Zoological Society of Kerala.

References:

- Barret K.E et.al, 2009. Ganong's Review of Medical Physiology 23rd edn. by Mc Graw Hill, New Delhi.
- Best, C H, Taylor, N B 1991 Physiological basis of Medical practice 12th edn. edited by John B. West.
- Chakrabarti B K, Ghosh H N & Sahana S N 1984: Human Physiology, the New Book Stall, Calcutta, India
- Chatterjee C.C 1973: Human Physiology, Vol I 8th edn. Medical Allied Agency, Calcutta
- Chatterjee C.C 1975: Human Physiology Vol II 9th edn New Central Book Agency Calcutta.
- Hall J.E and C Guyton 2010 Text Book of Medical Physiology. 12th edn. Publishers
- Saunders Knut Schmidt Nilesen 2007 Animal Physiology – Adaptation and environment. Cambridge University press 5 th ed.
- Prosser C L, Brown J R, Frank A 1962: Comparative Animal Physiology 2nd edn. Saunders. Roger Eckert; D Randall; George Augustine 1988: Animal Physiology, Mechanism and Adaptations, W.H Freeman, New York
- 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 IV

COMPLEMENTARY COURSE ZY4B01B23: APPLIED ZOOLOGY

Credits: 3

Hours per week: 3

Total Lecture Hours: 54

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.

Students gain knowledge and skills in fish, silkworm, and honey bee farming through this course. It also promotes student entrepreneurship.

Course Outcomes:

CO1: Develop skills in fish breeding techniques and various aquaculture practices. (Create)

CO2: Analyse the life history and rearing techniques of silkworm (Analyse)

CO3: Practice earthworm rearing techniques and methods of vermicomposting (Apply)

CO4: Illustrate social life in honey bees and management of an apiary in relation with entrepreneurship development. (Apply)

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 and 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 and 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.

Textbooks:

- C. P Anitha Devi and Priya Thomas, Editors: 2019, Physiology & Applied Zoology, Zoological Society of Kerala.

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
- Edwards, C.A. & Lafty, J.R. 1972 Biology of Earthworms (Chapman and Hall Led. London)
- Jhingran, V.G., 1985 Fish and Fisheries of India (Hindustan Publ. Corporation, New Delhi)
- Krishnaswami, S., 1986 Improved Method of Rearing Young age Silk worms (Central Silk board, Bangalore)
- Krishnaswami, S., 1986, New Technology of Silkworm Rearing (Central Silk Board Bangalore)
- Kurien, C.V. & Sebastian V.C., Prawn Fisheries in India (Hindustan Publ. Corporation, New Delhi)

- Lee, K. E., 1985 Earthworms, Their Ecology and relationships with Soils and Land use. Academics Press.
- Menon, K.N., 1970 Malsyakrishi (State Institute of language, Trivandrum) Mysore Silk Association, 1986, Silkworm rearing and Diseases of Silkworms
- Padmanabha Aiyer, K.S., 1992, Records of the Indian Museum Vol. XXXI, Part I, PP. 13- 76 An account of the Oligochacta of the Travancore
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- Singh, S., 1962 Bee keeping in India (ICAR, New Delhi.
- Sinhan, V.R.P. & Ramachandran, V., 1985, Fresh water Fish Culture (ICAR, New Delhi).

SEMESTER III & IV

COMPLEMENTARY PRACTICAL

ZY4BP01B23: PHYSIOLOGY, IMMUNOLOGY AND APPLIED ZOOLOGY

Credits: 2

Hours per Week: 2

Total Lecture Hours: 72

Course Overview and Context

This course acquaints the students with various rearing techniques in Apiculture, vermiculture, Sericulture and Aquaculture and physiology and immunology experiments.

The course offers skill development in applied branches of Zoology and Self employment opportunities.

Course Outcomes:

CO1: Analyse the presence of reducing sugar, protein and lipid (Analyse)

CO2: Determine human blood groups and leucocytes and estimate haemoglobin (Apply)

CO3: Explain the action of salivary amylase, principle and use of sphygmomanometer and stethoscope. (Understand)

CO4: Compare economic importance and morphology of culturable fishes, earthworms, honey bees and silkworm. (Analyse)

COMPLEMENTARY COURSE 3: PHYSIOLOGY AND IMMUNOLOGY

1. Preparation of Human Blood smear and 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 and uses) -Sphygmomanometer, Stethoscope.

COMPLEMENTARY COURSE 4: 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)

Curriculum and Syllabi (2023 admission onwards)

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

**SYLLABI FOR
COMPLEMENTARY COURSE
(PSYCHOLOGY)**

SEMESTER: I

COMPLEMENTARY COURSE

ZY1B02B23: BODY SYSTEMS AND BEHAVIOUR

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

Course overview and context:

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

The students develop the skill to identify physiological basis behind emotions and its influence on behavior.

Course Outcomes:

CO1: Discuss the biological basis of human behaviour (Understand)

CO2: Explain the functional relevance of important physiological systems including the cardio-respiratory and digestive systems (Understand)

CO3: Illustrate the structure of visual and auditory sense organs in relation to their function and the nervous pathways by which information is transmitted to the central nervous system (Apply)

CO4: Identify the physiological basis of emotionality (Understand)

MODULE 1: Introduction to Physiological psychology (12 hrs)

Digestive System: Structure of the digestive system and associated glands.

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

Respiratory system: Breathing and respiration. Parts of the respiratory system and its functions.

Respiration: Phases of respiration (external respiration (inhalation and exhalation process), gas transport (transport of oxygen and carbon dioxide) and internal respiration). Respiratory pigments: Haemoglobin, Myoglobin (Structure and Function). Respiratory disturbances (Hypoxia,

Hypercapnia, Hypocapnia, Asphyxia). Dysbarism, Oxygen toxicity, Physiological effect of smoking, carbon monoxide poisoning, Oxygen therapy and artificial respiration. Neural centres of respiration.

MODULE 2: Nervous and Sensory Systems

(10 hrs)

Nervous system: Central and Peripheral Nervous system (Brief Account).

Visual System: Structure and function of human eye. Nervous connections of the eye- optic nerve, lateral geniculate nucleus, Superior colliculus, Visual cortex- vision, eye defects & diseases (short sight and long sight, night blindness, color blindness, glaucoma, and astigmatism). Neural basis of visual integration.

Auditory system: Anatomy of the Auditory system (outer ear, middle ear and inner ear), Nervous connections of the ear, pathway- Organ of Corti, Ventral cochlear nucleus, inferior colliculus, medial geniculate body, auditory cortex. Neural basis of auditory integration.

MODULE 3: Cardiovascular System

(8 hrs)

Structure of the human heart and its working: Detailed structure of the heart and associated arteries and veins. Double circulatory system. (Mention also the SA node, AV node & Purkinje System). Structure of arteries, veins, and capillaries, pulmonary and systemic circulation.

Blood: Functions, and components (Plasma, RBC, WBC and platelets).

Effect of stress and fear on heart rate.

MODULE 4: Emotionality

(6 hrs)

Physiological basis for emotionality: Emotions, components of emotion (physiological, behavioral, and cognitive), Theories of emotions (in brief): James Lange theory, Cannon Bard theory, Schachter- Singer theory.

Hypothalamus and Limbic system: Structure of hypothalamus and its role in emotions. Components of limbic system-Limbic cortex, hippocampus, mammillary bodies, Amygdala, Fornix. Limbic system & emotions

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, (4th ed.). USA: Sinauer Associates, Inc.
- Schneider, A.M. & Tarshis, B. (1986). An Introduction to Physiological Psychology. (3rd ed.).

SEMESTER: II

COMPLEMENTARY COURSE
ZY2B02B23: BIOLOGICAL BASIS OF BEHAVIOUR

Credits: 2

Hours per week: 2

Total Lecture Hours: 36

Course Overview and Context:

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

The course helps students develop the skills required to differentiate the different gene mutation disorders and equips the students to identify and manage the physiological response to stress.

Course Outcomes:

CO1: Discuss an overview of human genetic concepts and disorders that have a genetic component (Understand)

CO2: Identify the physiological basis of human basic biological needs (Understand)

CO3: Illustrate the physiological, psychological and metabolic mechanisms of stress (Apply)

CO4: Trace the physical and behavioral changes that takes place during brain's natural sleep wake cycle (Understand)

MODULE 1: Genetics, Mutations and Genetic disorders (10hrs)

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 (7 hrs)

Sexual behavior: Defining human sexual behavior, Dynamics, Primary and secondary sex characteristics, external cues. Hormones and its impact- Gonadotropin and Gonadal hormones. Female sex hormones (estrogen, and progesterone), Hormones and menstrual cycle – pituitary and ovarian hormones, Stages of the menstrual cycle. Male sex hormones. The brain and sexual behavior (Brief).

Prenatal and Post Sexual Development (brief). HPG Axis in males and females - Hypophyseal portal system. Sexual Dimorphism (brief).

Hunger and Thirst: Physiology of appetite and hunger regulation of food intake- Appetite hormones (Ghrelin, insulin, leptin, orexin. Obestatin and PYY - briefly). Role of Hypothalamus in hunger.

Physiology of thirst. Role of Hypothalamus in thirst.

Physiological motives and emotion- fear and anger. Role of amygdala. Physiological changes during fear/anger.

MODULE 3: Physiology of Stress (9 hrs)

Stress: Definition, Types – Eustress and Distress.

Stress response, Physiological changes during stress- Indicators of stress: hormonal (cortisol, serotonin, catecholamines, vasopressin, gonadotropins, TSH, Growth Hormone), anatomical (Central nervous system and endocrine system, respiratory and cardiovascular systems, digestive system, muscular system, sexual and reproductive system) and physiological. General Adaptation Syndrome. Stress and disease - Immune system. Stress, emotionality and endorphins.

MODULE 4: Physiology of sleep and arousal (10 hrs)

Sleep: Sleep and its stages, and factors affecting sleep. Theories of sleep- Restorative theory, cognitive function theory, adaptive theory, energy conservative theory. Sleep disorders: meaning and types. Sleep and Circadian Rhythms. Conceptions of sleep. Circadian rhythms and biological clock. Neurotransmitters that effect sleep - GABA, Serotonin, Norepinephrine, and Dopamine.

Arousal: Reticular activating system, Types of arousal - Physiological and Psychological.

Physiological measures of alertness and arousal-EEG. Physiological conceptions of wakefulness and sleep.

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.

References:

- Ahluwalia, K. B; (1994) Genetics.4th Print, Wiley Eastern Ltd.
- Gardner; Eldon J. S, Michael J.S., & Peter.Principles of Genetics (4thed). 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., Leiman, A. L., Breedlove, & Marc, S., (1996). Biological Psychology, Sinauer AssociatesInc.
- Schneider, A.M. & Tarshis, B. (1986).An Introduction to Physiological Psychology.(3rd ed.). New York: Random House Inc.

SEMESTER: III

COMPLEMENTARY COURSE

ZY3B02B23: NEUROPHYSIOLOGY OF BEHAVIOUR

Credits: 2

Hours per week: 3

Total Lecture Hours: 54

Course overview and context:

This course focuses on the relationship between brain and behavior and neurons and behavior. The course equips the students with the skills required to analyse phenomena relating to day-to-day functioning of human body. It enables the students to identify the various issues that may be developed in neurotransmitters, psychoneuroimmunology.

Course Outcomes:

- CO1:** Discuss the structure of neuron and illustrate the communication process within a neuron (Understand)
- CO2:** Describe the structure and functions of central nervous system (Understand)
- CO3:** Classify the autonomic nervous system (Understand)
- CO4:** Distinguish between the two hemispheres of the brain (Understand)

MODULE 1: Nervous system and Communication within a neuron and neurotransmitters: (18hrs)

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. Synapse - Presynaptic and postsynaptic neurons. Neurotransmitters- Role of neurotransmitters in transmission of impulses. Excitatory and inhibitory post synaptic potentials.

MODULE 2: The Anatomy of the Central Nervous system (10 hrs)

Central Nervous system: CNS and its division, functions of CNS.

Brain: Meninges- Definition, Meningitis and Meningiomas (Brief).

Forebrain: Telencephalon - Structure and functions, Cerebral cortex-Lobes of the brain. Limbic

Curriculum and Syllabi (2023 admission onwards)

system - Hippocampus, Cingulate cortex, Mammillary bodies, Amygdala, Fornex, and Septum. Basal Ganglia - structure and functions, basal ganglia diseases (brief). **Diencephalon:** Thalamus - and Hypothalamus - Structure and functions, hormones of hypothalamus (oxytocin, vasopressin, Corticotropin Releasing Hormone, Gonadotropin Releasing Hormone, Somatostatin, Growth Hormone, Thyrotropin Releasing Hormone) Disorder of hypothalamus (hypopituitarism, hypothyroidism, and sexual development disorder). Pituitary gland, and Pineal gland.

Midbrain and Hindbrain: Structure and functions

Spinal cord: Spinal cord - Structure and functions, Spinal nerves, Spinal cord injury (brief), Reflex action - reflex arc, Vertebral column and its functions

MODULE 3: The Anatomy of the Peripheral Nervous system (12hrs)

Peripheral Nervous system: Autonomic and Somatic nervous system (brief).

Autonomic Nervous system: Structure and functions. Disorders of ANS (Autonomic Paralysis, Baroreceptor failure, and Orthostatic hypotension)

Sympathetic and Parasympathetic Nervous system - Function. Neurons of Sympathetic Nervous System, Dysfunctions of Sympathetic Nervous System. Nerve fibers of Parasympathetic Nervous system.

MODULE 4: The Hemispheres of the Neocortex (14hrs)

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.

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
Curriculum and Syllabi (2023 admission onwards)

Ltd.

- Guyton, A. Medical Physiology (8thed.), 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 (3rded.)Prentice-Hall of India Pvt. Ltd.
- Rosensweig, M.R., Breedlove, S. M., & Watson, N. V. (2004).Biological Psychology, (4thed.). USA: Sinauer Associates, Inc.
- Schneider, A.M. & Tarshis, B. (1986).An Introduction to Physiological Psychology. (3rded.). New York: Random House, Inc.
- Pinel, J. P. (2007). Biopsychology.India: Dorling Kindersley Pvt. Lt

SEMESTER: IV

COMPLEMENTARY COURSE

ZY4B02B23: BIOPHYSIOLOGY OF BEHAVIOUR

Credits: 2

Hours per week: 3

Total lecture Hours: 54

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.

It helps students to understand the branch of psycho-neuroimmunology and to understand the physiological basis of basic processes.

The students develop the necessary skills to identify different disorders related to memory and learning.

Course Outcomes

CO1: Discuss mechanisms that regulate immune responses, maintain tolerance and the interactions among behavioral, neural, endocrine, and immune processes (Understand)

CO2: Explain the functional relevance of endocrine glands and its hormones and the influence of limbic system on human behavior (Understand)

CO3: Illustrate Physiological mechanisms of learning and memory (Apply)

CO4: Explain the influence of chemicals such as neurotransmitters and other molecules such as psychopharmaceuticals and neuropeptides that control and influence the physiology of the human nervous system. (Understand)

MODULE 1: The immune system and Psychoneuro-immunology (16hrs)

Immune System- Active and passive immunity, innate immunity, Humoural immunity, cell mediated immunity, non-specific defenses; Immunological memory(in brief), vaccines; immunosuppression; Disorders of immune system: Immunodeficiency, Hypersensitivity reactions, autoimmunity.

Psychoneuroimmunology-Connections between emotions (definition), nervous system and immune functions, Placebo effect- mechanism of the effect and types, Effect of meditation and
Curriculum and Syllabi (2023 admission onwards)

biofeedback (in brief).

MODULE 2: The Endocrine system and Psychoneuro-endocrinology (10 hrs)

Endocrine system, glands and hormones – definition and parts of endocrine glands (Pituitary, Pineal, Pancreas, Thyroid, Adrenal gland, Thymus, Testis and ovary).

Hypothalamus- Autonomic nervous system: Hypothalamo hypophysial endocrine system - definition, HPT axis, HPA axis.

Hormonal influence on learning and memory and behavior: Hormones and Behaviour (emotion) (in brief), limbic system- functions, components.

MODULE 3: Mechanisms of Learning and Memory (14hrs)

Physiological basis of learning

Anatomical requirements for Learning- how learning occurs in brain (brief).

Memory- Types of memory, Physiological mechanisms for memory in the brain- trace theory, displacement theory, interference theory, triggers for memory retrieval (in brief).

Neuroplasticity – Plasticity hypothesis and different types of Neuroplasticity.

Memory retrieval disorders- Two stage theory, Amnesia, Dementia and Alzheimer's disease.

MODULE 4: Brain Chemistry, Drugs and Mental illness (14 hrs)

Brain metabolism- definition, substrates used for energy production in cerebral tissue (glucose), Glycolytic pathway, significance of oxygen supply.

Blood brain barrier- definition and functions

Major neurotransmitters in the brain- transmission of neurotransmitters, properties of neurotransmitters, acetylcholine, dopamine, GABA, glutamate, glycine, Norepinephrine, serotonin and oxytocin.

Opioid peptides and receptors in the brain- working of opioids, types of opioid peptides, opioid receptors (in brief)

Brain chemistry and the use of psychiatric drugs-Effect of insufficient neurotransmitter level in brain (in brief), Mental illness and associated drugs (symptoms and associated drugs for depression, anxiety disorder, PTSD, and schizophrenia; psychosocial interventions for mental illness (in brief)

Note – Activity based assignments and seminars

Curriculum and Syllabi (2023 admission onwards)

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.

References:

- Ahluwalia, K. B. (1994) Genetics. 4th Print, Wiley Eastern Ltd.
- Gardner; Eldon J. S, Michael J.S., & Peter; Principles of Genetics, (4thed.). 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 (3rded.)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, Inc.
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