# BISHOP CHULAPARAMBIL MEMORIAL COLLEGE KOTTAYAM



## DEPARTMENT OF ZOOLOGY SYLLABUS

2022-2023

### BISHOP CHULAPARAMBIL MEMORIAL COLLEGE, KOTTAYAM

#### **GRADUATE PROGRAMME OUTCOMES**

GPO NO.	Graduate Programme Outcomes
GPO No.1	Disciplinary Knowledge & Critical Thinking
	Articulate knowledge of one or more disciplines that form a part of UG pro- gramme. Critically think, analyse, apply and evaluate various information and follow scientific approach to the development of knowledge.
GPO No. 2	<b>Communication Skill</b> Communicate thoughts and ideas clearly in writing and orally. Develop careful listen- ing, logical thinking and proficiency in interpersonal communication.
GPO No. 3	<b>Environmental Awareness</b> Sustainable approach to use of natural resources. Capable of addressing issues, promoting values and give up practices that harm the ecosystem and our planet.
GPO No. 4	<b>Ethical Awareness</b> Uphold ethics/morals in all spheres of life. Identify and avoid unethical behavior in all aspects of work.
GPO No. 5	<b>Social Commitment</b> Be aware of individual roles in society as nation builders, contributing to the better- ment of society. Foster social skills to value fellow beings and be aware of one's re- sponsibilities as international citizen.
GPO No. 6	<b>Lifelong learners</b> Equip students to be lifelong learners. Be flexible to take up the changing demands of work place as well as for personal spheres of activities.

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

## B.Sc. Zoology Model I

PSO No.	Programme Specific Outcomes	GPO NO.
1.	Understand the general perspectives in basic sciences, distribution and classifica- tion of animals, salient features, structure, organization, diversity and interactions with their environment.	1
2.	Understand the internal structure of cell, functions of cell organelles and corre- latesthe physiological and biochemical aspects of animal as well as human body.	1
3.	Understand the complex evolutionary history of origin of life, animal phylogeny, animal behaviour, ecological concepts, importance of biodiversity, environmental protection and conservation of nature and natural resources.	1,3
4.	Understand the concepts of heredity and variations, genetic disorders and its application in human traits, human reproduction and assisted reproductive technologies and reproductive health.	1
5.	Apply the knowledge of apiculture, vermicomposting, aquaculture and animal breeding to carry out self-employment, entrepreneurship and development of smallscale industries.	3,5,6
6.	Develops practical skills in the areas of biochemistry, physiology, biotechnolo- gy genetics, microbiology, developmental biology, bioinformatics, taxonomy, appliedzoology and ecology.	1,6
7.	Apply their knowledge to carry out research in biology, biological data manage- mentand generation of data bank for uploading of nucleotide sequences.	1,2
8.	Designs and constructs novel plans for dealing emerging diseases, pollution, water scarcity, natural disasters and resource management.	3,4,5
9.	Contributes and evaluates their knowledge about environment and its sustainabil- ity, its relation to human kind, agriculture, medicine and sociobiology in nation building.	3,4,5
10.	Understand the importance of maintaining good physical, mental and social health and to apply different strategies such as balanced diet, life skill education and safetyeducation in day-to-day life.	2,3,4,5

#### **COURSE DETAILS OF B.Sc. ZOOLOGY MODEL 1**

Semester	<b>Course Code</b>	Course
First	ZY1CRT01 ZY1CMT01	General perspectives in Science & Protistan Diversity (Core) Gen- eral perspectives in Science & Protistan Diversity (Practical) Non Chordate Diversity (Complementary offered to Botany, FACS, FSQC)
		Non Chordate Diversity (Practical)
Second	ZY2CRT02 ZY2CRP01	Animal Diversity- Non Chordata (Core) An- imal Diversity- Non Chordata (Practical)
	ZY2CMT02	<ul><li>Chordate Diversity (Complementary offered to Botany, FACS, FSQC)</li><li>Chordate Diversity (Practical)</li></ul>
Third	ZY3CRTO3 ZY3CRPO3	Animal Diversity - Chordata (Core) An- imal Diversity - Chordata (Practical)
	ZY3CMT03	Physiology and Immunology (Complementary offered to Botany, FACS, FSQC)
		Physiology and Immunology (Practical)
Fourth	ZY4CRT04 ZY4CRP02 ZY4CMT04	Research methodology, Biophysics & Biostatistics (Core) Re- search methodology, Biophysics & Biostatistics (Practical) Applied Zoology (Complementary offered to Botany, FACS, FSQC) Applied Zoology(Practical)
Fifth	ZY5CRT05 ZY5CRP05 ZY5CRT06 ZY5CRP06 ZY5CRT07 ZY5CRP07 ZY5CRT08 ZY5CRP08 ZY5OPT02	Environmental Biology& Human rights (Core) Environmental Biology& Human rights (Practical) Cell Biology & Genetics (Core) Cell Biology & Genetics (Practical) Evolution, Ethology & Zoogeography(Core) Evolution, Ethology & Zoogeography(Practical) Human Physiology, Biochemistry & Endocrinology (Core) Human Physiology, Biochemistry & Endocrinology (Practical) Public health and Nutrition (Open course)
Sixth	ZY6CRT09 ZY6CRP09 ZY6CRT10 ZY6CRP10 ZY6CRT11 ZY6CRP11 ZY6CRT12 ZY6CRP12 ZY6CBT04	Developmental Biology (Core) Developmental Biology(Practical) Microbiology & Immunology(Core) Microbiology & Immunology(Practical) Biotechnology, Bioinformatics and Molecular Biology(Core) Biotechnology, Bioinformatics and Molecular Biology(Practical) Occupational Zoology (Core) Occupational Zoology (Practical) Nutrition, Health & life style management (Elective)

#### **COURSE DETAILS**

Course Details							
Code	ZY1CRT01						
Title	General Perspectives In Science and Protistan Diversity						
Degree	B.Sc.						
Branch	Zoology						
Semester	Ι						
Туре	Core Course						
Credits	2						
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly						

СО	Expected Course outcomes	Cognitive							
No.		level							
1.	Understand the relevance of Science, scope of Zoology	U							
	and the various branches of Zoology.								
2.	Analyze the different methods used in scientific studies.	An							
3.	Examine the concepts, importance and various	Ар							
	approaches in taxonomy.								
4.	Understand the basics of animal classification	U							
5.	Discuss protistan diversity and its significance.	U							
6.	Analyze various parasitic protists, their life cycle, mode	An							
	of infection and pathology.								
7.	Create an active plan for prevention of vectors of	С							
	parasitic protists and disease outbreaks.								
*PSO-P1	ogram Specific Outcome; CO-Course Outcome; Cognitive	Level: R-Remember; U-							
Underst	Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create								

	<b>General Perspectives in Science and Protistan Diversity</b>															
ZY1CRT01																
со	PSO											PO				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	2	2	2	2	0	0	0	1	1	3	0	0	2	2	2
2	0	1	0	0	2	2	3	2	0	1	3	3	2	2	2	2
3	3	2	2	2	0	3	2	0	2	0	3	0	3	2	2	2
4	3	0	2	0	0	3	2	0	0	0	3	0	1	0	1	2
5	3	0	0	1	1	1	2	1	1	1	3	0	2	2	2	2
6	3	0	1	0	1	0	1	3	0	3	3	0	2	2	2	2
7	3	3	2	0	0	2	2	3	0	2	3	2	2	2	2	2

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Mod- ule	Course Description	Hours	CO No.
1	Introduction to Scientific Studies	4	
1.1	Types of knowledge: practical, theoretical, and scientific knowledge.	1	1
1.2	What is science, features of science, Deductive and induc- tive models.	1	1, 2
1.3	Scientific temper, empiricism.	1	1, 2
1.4	Vocabulary of science.	1	1, 2
2	What is Biology	4	
2.1	Life and its manifestations.	2	1
2.2	History of Biology: Biology in ancient times Landmarks in the progress of Biology.	1	1
2.3	Branches of Zoology, Scope of Zoology	1	1
3	Taxonomical Principles and tools	10	
3.1	Systematic, Taxonomy, Phylogeny, Approaches to taxonomy.	2	3

3.2	Molecular taxonomy, Barcoding.	2	3
3.3	Zoological nomenclature, International Code of Zoologi- calNomenclature (ICZN), Law of Priority.	2	3
3.4	Five Kingdom Classification; Linnaean classification, Basis forAnimal kingdom classification [Levels of organization, Symmetry, Coelom].	2	4
3.5	Taxonomic key, Types: Single access key- Dichotomous [linked and nested] and Polytomous key, Multi access key, Computer aided Interactive Key- Advantages and Disad- vantages	2	3

4	Protistan Diversity	18	
4.1	Kingdom Protista Type: Paramecium	6	4, 5
	Salient features of Kingdom Protista		
4.2	Phylum Rhizopoda: Eg. Amoeba	1	4, 5
	Phylum Actinopoda: Eg. Actinophrys		
	Phylum Dinoflagellata: Eg. Noctiluca		
4.3	Phylum Parabasalia: Eg. Trychonympha	1	4, 5
	Phylum Metamonada : Eg. Giardia		
	Phylum Kinetoplasta : Eg. Trypanosoma		
4.4	Phylum Euglenophyta : Eg. Euglena	1	4, 5
	Phylum Cryptophyta : Eg. Cryptomo-		
	nas Diadam Oraliante Escolution		
	Phylum Opalinata : Eg. Opalina		
4.5	Phylum Bacillariophyta :Eg. Diatoms	1	4 5
4.5	Phylum Chlorophyta :Eg. Volvox	1	4, 5
	Phylum Choanoflagellata :Eg. Proterospongia		
	Phylum Ciliophora : Eg. Balantidium coli		
4.6	Phylum Sporozoa : Eg. <i>Plasmodium</i>	1	4, 5
	Phylum Microsporidia :Eg. Nosema		
	Phylum Rhodophyta :Eg. Red Alga		
4.7	Parasitic protists (diseases mode of transmission and	3	6, 7
	prophylactic measures) - Entamoeba, Trypanosoma		
4.8	Plasmodium (detailed account of life cycle)	2	6, 7
4.9	Leishmania	2	6, 7

#### References

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- II. S. Viswanathan Printers & Publishers. Pvt. Ltd.
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   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.
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- Pechenik J A (2005) Biology of Invertebrates, (Tata McGraw Hill Publishing Co.,NewDelhi.)
- Prema A.K., Joseph M.L. and Terrence Rebello V. (Eds) (2011).Invertebrate Diversity of Kerala.Zoological Society of Kerala, Kottayam.
- Taylor, Green, Stout (2008) Biological Science, Cambridge University, Press, p
- Thomas, A.P. (Editor) 2009. Biology Perspectives and Methods. Green Leaf Pubslishers, Kottayam.
- Thomas A P (Editor) 2010 The Invertebrates, Green leaf publications Kottayam.

<b>Course Details</b>	Course Details							
Code	ZY1CRP01							
Title	Perspectives in Science and Protistan Diversity (P)							
Degree	B.Sc.							
Branch	Zoology							
Year/Semester	Ι							
Туре	Core Practical							
Credits	2							
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly							

CO No.	Expected Course outcomes	Cognitive level							
1	Understand the basis of classification and identification techniques used to differentiate the organisms.	U, Ap							
2	Identify the organisms using standard keys	Ар							
3.	Understand and identify the protistan through microscopic and pictorial representation.	U							
4.	Identification of Protistan from pond water	Ар							
*PSO-Pr	*PSO-Program Specific Outcome; CO-Course Outcome;								
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create									

General Perspectives In Science (P)																
CO	PSO												PO	)		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	1	3	0	1	3	1	0	1	1	3	1	0	1	0	1
2	3	1	3	1	1	3	1	1	0	1	3	3	1	0	1	1
3	3	2	1	0	0	3	2	0	1	0	3	1	0	0	0	1
4	3	1	1	1	1	3	1	1	0	0	3	0	2	1	1	1

Module	Course Description	Hrs	CO. No.
1	Perspectives in Science and Protistan Diversity	36	
1.1	Taxa, identification techniques- Bird body parts Butterfly/ dragonfly body parts	6	1
1.2	Identification using keys -Insect, Fish, Snake (Poisonous & NonPoisonous )	6	2
1.3	General identification - Protistan	8	3
1.4	Identification of any 4 economically important pro- tists/parasiticprotists	8	3
1.5	Identification of two Protistan from pond water	8	3

Course Details					
Code ZY1CMT01					
Title	Animal Diversity – Non Chordata (T)				
Semester	Ι				
Туре	Complementary Course				
Credits	2				
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly				

CO No.	Expected Course outcomes: ANIMAL DIVERSITY - NON CHORDATA	Cognitive level
1.	Understand the basics of taxonomical classification and thedi- versity of protozoans and higher invertebrates.	U
2.	Classify and describe the general features of Kingdom Protista with examples and to explain the parasitic protozoans.	U
3.	Classify and describe the salient features of acoelomates with examples by giving special reference to their morphological and ecological importance.	U
4.	Classify and describe pseudo coelomates with special reference to pathogenic nematodes.	U
5.	Understand and classify coelomates with interpretation of their evolutionary relationships.	U
6.	Understand the general features of minor Phyla	U
7.	Instigate curiosity of students in the biota around them and to generate a positive attitude towards its conservation.	Ар

\*PSO-Program Specific Outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Animal Diversity- Non Chordata																
ZY1CMT01																
со		PSO PO														
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	0	0	0	2	2	0	2	0	3	0	2	2	2	2
2	3	2	2	2	0	2	2	0	0	0	3	0	2	2	2	2
3	3	3	3	0	0	2	2	0	0	0	3	0	2	2	2	2
4	3	0	2	0	0	2	2	0	0	0	3	0	2	2	2	2
5	3	0	3	2	0	2	2	1	1	1	3	0	2	2	2	2
6	3	2	2	2	0	2	0	0	0	0	3	0	2	2	2	2
7	2	1	1	1	0	3	3	3	3	0	3	3	2	2	2	2

MODULE COURSE DESCRIPTION	Hrs.	CO. No.
<b>1.0 Introduction</b> : Five kingdom classification	1	1,7
1.1 <b>Kingdom Protista</b> : Salient features (any five important salient features) of each phylum with one example each (detailed account of example is not necessary).	8	2,7
Phylum Rhizopoda (eg: Amoeba)		
Phylum Actinopoda (eg: Actinophrys)		
Phylum Dinoflagellata (eg: Noctiluca)		
Phylum Parabasalia (eg: Trychonympha)		
Phylum Metamonda (eg: Giardia)		
Phylum Kinetoplasta (eg: Trypanosoma)		
Phylum Euglenophyta (eg: Euglena)		
Phylum Cryptophyta (eg: Cryptomonas)		
Phylum Opalinata (eg: Opalina)		
Phylum Bacillariophyta (eg: Diatoms)		
Phylum Chlorophyta (eg: Volvox)		
Phylum Choanoflagellata (eg: Proterospongia)		
Phylum Ciliophora (eg: Paramecium)		
Phylum Sporozoa (eg: Plasmodium)		
Phylum Microsporidia (eg: Nosema)		
Phylum Rhodophyta (eg: Red algae)		
1.2 <b>General Topic:</b> Pathogenic Protists – Plasmodium, Entamoeba	1	1,2,7
2.0 Phylum Porifera: Salient features (eg: Leucosolenia)	1	1,3,7
2.1 <b>Phylum Coelenterata:</b> Salient features and classification upto class	1	1,3,7
Class 1: Hydrozoa (eg: Physalia) Class 2: Schyphozoa (eg: Aurelia)		

	Class 3: Anthozoa (eg: Adamsia)		
2.2	General Topic: Corals and Coral reefs.	1	1,3,7
3.0	Phylum Platyhelminthes:	2	1,3,7
	Salient features and classification upto class. Class 1: Turbelleria (eg: Planaria) Class 2: Trematoda (eg: Fasciola) Class 3: Cestoda (eg: Taenia solium)		
\3.1	<b>Phylum Nematoda:</b> Salient features and classification up to class.	2	1,4,7
	Class 1: Phasmida (eg: Wuchereria) Class 2: Aphasmida (eg: Trichinella)		
3.2	<b>Phylum Annelida:</b> Salient features and classification up to class. Class 1: Polychaeta (eg: Nereis)	2	1,5,7
	Class 2: Oligochaeta (eg: Pheretima)		
	Class 3: Hirudinomorpha (eg: Hirudinaria )		
4.0	Phylum Arthropoda:	8	1,5,7
	Salient features. Type study – <i>Fennero penaeus</i> (Penaeus) – habitat, morphology, appendages, sexual dimorphism, diges- tive system, respiratory system, circulatory system, excretory system, nervous system, sense organs, reproductive system, larval stages.		
4.1	Classification up to class with one example each	3	1,5,7
	Subphylum Trilobitomorpha		
	Class 1: Trilobita (Extinct) (eg: Dalmanites)		
	Subphylum: Chelicerata		
	Class 1: Merostoma (eg: Limulus)		
	Class 2: Arachnida (eg: Spider)		
	Class 3: Pycnogonida (eg: Nymphon)		
	Subphylum Mandibulata		
	Class 1: Crustacea (eg: Daphnia)		
	Class 2: Chilopoda (eg: Centipede)		
	Class 3: Symphyla (eg: Scutigerella)		
	Class 4: Diplopoda (eg: Millipede)		

	Class 5: Pauropoda (eg: Pauropus)		
	Class 6: Insecta (eg: Butterfly		
5.0	Phylum Mollusca:	3	1,5,7
	Salient features and classification up to class Class 1:		
	Aplacophora (eg: Neomenia)		
	Class 2: Monoplacophora (eg: Neopilina)		
	Class 3: Polyplacophora (eg: Chiton)		
	Class 4: Bivalvia (eg: Perna)		
	Class 5: Gastropoda (eg: Xancus) Class 6: Cephalopoda (eg: Se-		
	pia) Class 7: Scaphopoda (eg: Dentalium)		
5.1	<b>Phylum Echinodermata :</b> Salient features and classification up to class.	2	1,5,7
	Class 1: Asteroidea (eg: Astropecten)		
	Class 2: Ophiuroidea (eg: Ophiothrix)		
	Class 3: Echinoidea (eg: Echinus)		
	Class 4: Holothuroidea (eg: Holothuria)		
	Class 5: Crinoidea (eg: Antedon)		
5.2	Phylum Hemichordata : Salient features (eg: Balanoglossus.)	1	1,6,7

#### **References:**

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Course Details					
Title	Animal Diversity-Non Chordata (P)				
Degree/Semester	B.Sc Zoology, I Semester				
Туре	Complementary Course				
Credits	1				
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly				

CO. No.	Expected course outcomes	Cognitive Level		
1	Use scientific drawing technique	Ар		
2	Identify common invertebrates	U		
3	Examine microscopic organisms	An		
4 Carry out dissections and temporary mounting Ap				
*PSO-Program Specific Outcome; CO-Course Outcome;				

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

	Non Chordate Diversity(Practical) I SEM COMPLEMENTARY															
СО	PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	2	0	0	0	3	1	0	0	0	3	0	0	0	0	1
2	3	2	2	0	0	3	1	1	1	0	3	0	1	0	0	1
3	3	2	0	0	0	3	1	1	0	0	3	0	0	0	0	1
4	3	2	0	0	0	3	1	0	0	0	2	0	0	1	0	1

Exp	Course Description	Hrs.	CO.No.
1	Scientific drawing - 5 specimens	10	1
2	Simple identification - 10 invertebrates, out of which 5 by their scientific names	8	2
3	T.S - Earthworm, T.S Fasciola	2	3
4	Dissection - Nervous system of Prawn	6	4
5	Dissection - Nervous system of Cockroach	6	4
6	Mounting - Prawn Appendages	4	4

Course Details				
Code ZY2CRT02				
Title	Animal Diversity – Non Chordata (T)			
Degree/Semester	B.Sc Zoology, II Semester			
Туре	Core Course			
Credits	2			
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly			

СО	Expected Course outcomes:	Cognitivelevel				
No.	ANIMAL DIVERSITY - NON CHORDATA					
1.	Understand the basics of taxonomical classification	U				
2.	Organize the diverse fauna around them into three branches of Kingdom Animalia.	An				
3.	Classify and describe the salient features of acoelomates with examples by giving special reference to their morpho- logical and ecological importance.	U				
4.	Classify and describe pseudo coelomates with special reference to pathogenic nematodes.	U				
5.	Understand and classify coelomates with interpretation of their evolutionary relationships.	U				
6.	Understand the general features of minor Phyla	U				
7.	Instigate curiosity of students in the biota around them and to generate a positive attitude towards its conservation.	Ар				
*PSO-Program Specific Outcome; CO-Course Outcome; Cognitive Level: R-Remember: U-Understanding: Ap-Apply: An-Analyze: E-Evaluate: C-						
Create	Create					

Animal Diversity- Non Chordata																
ZY2CRT02																
со		PSO												PO		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	0	0	0	2	2	0	2	0	3	0	2	2	2	2
2	3	2	2	2	0	2	2	0	0	0	3	0	2	2	2	2
3	3	3	3	0	0	2	2	0	0	0	3	0	2	2	2	2
4	3	0	2	0	0	2	2	0	0	0	3	0	2	2	2	2
5	3	0	3	2	0	2	2	0	0	0	3	0	2	2	2	2
6	3	2	2	2	0	2	0	0	0	0	3	0	2	2	2	2
7	2	1	1	1	0	3	3	3	3	0	3	3	2	2	2	2

MOD ULE	COURSE DECSRIPTION	Hrs.	CO.No.
1.0	Kingdom Animalia		
	Outline classification of Kingdom Animalia	1	1,2,3
	Three branches - Mesozoa, parazoa and Eumetazoa		
1.1	Mesozoa:		
	Phylum Orthonectida - eg. Rhopalura (mention 5 salient features)	1	1,2,3
1.2	Parazoa:		
	1. Phylum Placozoa – Eg. Trycoplax adherens		
	2. Phylum Porifera – Classification upto classes; Mention gemmules		
	Class I- Calcarea. Eg.Sycon.,	2	1 2 2
	Class II – Hexactinellida .Eg.Euplectella.	2	1,2,5
	Class III - Demospongia Eg.Cliona.		
	General Topics		
	1. Canal system in sponges.		
1.3	Phylum Coelenterata -Classification upto classes		
	Class I - Hydrozoa Eg. Eg. Obelia - mention Metagenesis	1	1 2 2
	Class II- Scyphozoa Eg. Rhizostoma.	1	1,2,3
	Class III- Anthozoa Eg. Metridium.		
1.4	General Topics:		
	1. Coral and coral reefs with special reference to conservation of reef fauna.	2	1,2,3,7
	2. Polymorphism in Coelenterates		
	Phylum Ctenophora - Eg. Pleurobrachia.		
2.0	Phylum Platyhelminthes	1	1,2,3
	Salient features; classification up to classes		
	Class I - Turbellaria. Eg. Planaria.		
	Class II –Trematoda Eg. Fasciola Class III- Cestoda Eg. Taenia saginata.		

2.1	General Topics:	2	
	1. Life history of Fasciola hepatica.		
	2. Platyhelminth parasites of Man and Dog (Schistosoma, Taenia solium, Echinococcus ).		
2.2	<b>Phylum Nemathelminthes(Nematoda)</b> Salient features, classification up to classes Class: Phasmidia Eg. Enterobius,	1	1,2,4
	Class: Aphasmidia Eg. Trichinella		
2.3	General Topic	1	1,2,4
	Pathogenic nematodes in man. (Wuchereria bancrofti, Ascaris lubricoides, Ancylostoma		
2.4	duodenale, Trichinella).	2	125
2.4		2	1,2,3
	Salient reatures, Classification upto classes.		
	Class I- Archiannelida Eg. Polygordius		
	Class II -Polychaeta Eg. Chaetopterus		
	ClassIII- Oligochaeta Eg. Megascolex.		
	Class IV- Hirudinea Eg. Ozobranchus, Hirudinaria		
3.0	Phylum Onychophora	1	1,2,5
	Eg. Peripatus (Mention its affinities).		
3.1	Phylum Arthropoda	5	1,2,5
	Salient features, Classification upto classes		
	Type: Prawn – Fenneropenaeus (Penaeus)		
3.2	1. Sub Phylum - Trilobitomorpha	8	1,2,5
	Class -Trilobita (mention the salient features).		
	Eg.Triarthrus – A trilobite (extinct)		
	2. Subphylum – Chelicerata		
	Class 1 Merostomata (Xiphosura) (Eg. Limulus)		
	Class 2.Arachnida (Eg., Palamnaeus- Scorpion)		
	Class 3 Pycnogonida (Eg. Pycnogonum – Sea spider)		
	3. Subphylum- Crustacea		
	Class 1 Branchiopoda Eg. Daphnia		

	Class 2 Ostracoda Eg. Cypris -seed shrimp		
	Class 3 Copepoda Eg. Cyclops		
	Class 4 Remipedia Eg. Speleonectes (eyeless crustacean seen in caves)		
	Class 5.Branchiura Eg., Argulus (common fish louse)		
	Class 6 Cirripedia Eg. Sacculina (parasitic castrator of crabs)		
	Class 7 Malacostraca Eg. Squilla (spot tail mantis shrimp)		
	4. Subphylum- Uniramia		
	Class 1 Chilopoda Eg. Scolopendra – (Centipede)		
	Class 2 Symphyla Eg. Scutigerella – (garden centipedes or pseudocentipedes)		
	Class 3 Diplopoda Eg. Spirostreptus- (Millipede)		
	Class 4 Pauropoda Eg. Pauropus		
	Class 5 Hexapoda (Insecta) Eg.Bombyx mori – (silk moth		
4.0	Phylum Mollusca	3	1,2,5
	Salient features, Classification upto classes		
	Class I- Apalcophora Eg. Neomenia		
	Class II- Monoplacophora Eg. Neopilina		
	Class III Amphineura Eg. Chiton		
	Class IV Gastropoda Eg. Aplysia		
	Class V Scaphopoda Eg. Dentalium		
	Class VI Pelecypoda (Bivalvia) Eg. Pinctada		
	Class VII Cephalopoda Eg. Sepia		105
4.1	Phylum Echinodermata	2	1,2,5
	Classification upto classes		
	Class I- Asteroidea Eg. Astropecten		
	Class II- Ophiuroidea Eg. Ophiothrix		
	Class III- Echinoidea Eg. Echinus		
	Class IV- Holothuroidea Eg. Holothuria		
	Class V – Crinoidea Eg.Antedon		
4.2	General Topics	1	1,2,5

	1. Water vascular system in Echinodermata		
5.0	Phylum Hemichordata:	2	1,2,6
	Eg. Balanoglossus Minor Phyla		
	1. Chaetognatha Eg. Sagitta Sipunculida Eg. Sipun-		
	culus		

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

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9. Joy P.J., George Abraham K., Aloysius M. Sebastian and Susan Panicker (Eds) (1998). Animal Diversity, Zoological Society of Kerala, Kottayam

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

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18. Thomas A P (Editor) 2010 The Invertebrates, Green leaf publications Kottayam

Course Details						
Title	ANIMAL DIVERSITY-NON CHORDATA (P)					
Semester	П					
Туре	Core Course					
Credits	1					
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly					

CO.No	Expected course outcomes	Cognitive Level				
1	Use scientific drawing technique	Ар				
2	Identify common invertebrates	U				
3	Examine microscopic organisms	An				
4	Carry out dissections and temporary mounting	Ар				
*PSO-Program Specific Outcome; CO-Course Outcome;						
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create						

Non Chordate Diversity (Practical)																
CO PSO								PO	)							
	1	2	3	4	5	6	7	8	9	10	1 2 3 4 5 6				6	
1	3	2	0	0	0	3	1	0	0	0	3	0	0	0	0	1
2	3	2	2	0	0	3	1	1	1	0	3	0	1	0	0	1
3	3	2	0	0	0	3	1	1	0	0	3	0	0	0	0	1
4	3	2	0	0	0	3	1	0	0	0	2	0	0	1	0	1

Exp	Course Description	Hrs.	CO.No.
1	<b>Scientific drawing</b> - Make scientific drawings of 5 locally available invertebrate specimens belonging to different	6	1
	Phyla.		
2	Anatomy:- Study of sections. (Any two) 1. Hydra. 2. Ascaris(male and female) 3. Earthworm 4. Fasciola	4	3
3	<b>Dissections</b> 1. Prawn - Nervous system 2. Cockroach - Nervous system	8	4
4	Mounting:- 1. Prawn appendages. 2. Mouth parts - Cockroach/ Plant bug/ House fly / Mosquito. (Any Three)	5	4
	Identification:-		
5	<b>General identification &amp; classification</b> - The students are expected to identify, classify and	8	2
	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, Echino- dermata-3		
	Identification of (a) Parasitic protist – any 2 (b) larval forms of Fascio- la- any 2 (c)		
	Nematode parasites of man- any 3 (Slides/figures may be used for study)		
	Taxonomic identification with key:-		
6	Identification of insects up to the level of Order (any Four).	5	2

Course Details	Course Details				
Code	ZY2CMT02				
Title	Chordate Diversity (T)				
Degree/semester	B.Sc Zoology, II Semester				
Туре	Complementary Course				
Credits	2				
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly				

СО	Expected Course outcomes:	Cognitive level
No.	CHORDATE DIVERSITY	
1.	Understand the diversity, classification and phylogeny of Chordates.	U
2.	Outline and parse the adaptive features exhibited by the vertebrates.	An
3.	Compare the anatomy and physiological peculiarities of Chordates through type study of <i>Euphlyctis hexadactyla</i>	U
4.	Understand the economic importance and evolutionary significance of selected Chordate groups.	U
5.	Determine the classification category of a given chordate based on the external observable features.	Ap
*PSO-]	Program Specific Outcome; CO-Course Outcome;	

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

						(	Chord	ate Di	versit	y						
							ZY	2CM	Г02							
СО					F	PSO							Р	0		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	1	3	0	0	2	1	0	0	0	3	1	2	0	0	1
2	3	1	2	0	0	1	0	0	0	0	3	0	1	0	0	1
3	3	2	2	0	0	2	0	0	0	0	3	0	1	1	0	1
4	3	0	3	0	0	2	0	0	0	0	3	1	1	1	0	1
5	3	1	2	0	0	2	0	0	0	0	3	1	1	0	0	1

MOD ULE	COURSE DECSRIPTION	Hrs.	CO.No.
1.0	<b>Phylum Chordata</b> : Fundamental characters and outline classification upto class.	1	1,2,5
1.1	Sub phylum Urochordata: General characters,	3	1,2,5
Classifi	cation:		
Class 1	: Larvacea (eg: Oikopleura)		
Class 2	: Ascidiacea (eg: Ascidia), Retrogressive metamorphosis.		
Class 3	: Thaliacea (eg: Salpa)		
Sub phy	ylum Cephalochordata: Salient features (eg: Branchiostoma)		
2.0	Sub phylum Vertebrata	2	1,2,5
Salient	features		
Divis	ion Agnatha : salient features and classification Class 1: Cyclostoma (eg:		
Class	2: Class Ostracodermi (eg: <i>Cenhalansis</i> )		
2.1	Division Gnathostomata: Salient features Super class Pisces	1	1.2.5
Super c	lass Tetrapoda.	1	1,2,3
2.2 drichthy	Super class Pisces: Salient features and classification Class 1: Chon-	2	1,2,5
Class 2	: Osteichthyes (eg: Latimeria)		
2.3	General Topic: Accessory respiratory organs in fishes.	1	1.2.5
3.0	Super class Tetrapoda: Salient features	1	1,2,5
3.1 <i>la</i> - Hal tem, dig nervous	Class 1: Amphibia : Salient features. Type study: <i>Euphlyctis hexadacty</i> - bitat, morphology, sexual dimorphism, coelom and viscera, skeletal sys- gestive system, respiratory system, circulatory system, excretory system, s system, sense organs, reproductive system, development.	9	1,2,3,5
3.2	Classification up to order:		
	Order 1: Urodela (eg: Amblystoma)		
	Order 2: Anura (eg: Bufo)	4	1,2,5
	Order 3: Apoda (eg: Icthyophis)		
4.0	Class Reptilia: Salient features and classification up to subclass	1	1,2,5
4.1	Sub class 1: Anapsida (eg: Chelone)		
	Sub class 2: Diapsida (eg: Chamaeleon)	2	1,2,5

	Sub class 3: Parapsida (eg: Icthyosaurus)General Topics: Poisonous and non poisonous snakes of Kerala.		
4.2	<ul> <li>Class Aves: Salient features and classification up to subclass</li> <li>Sub class Archeornithes (eg: Archaeopteryx)</li> <li>Sub class Neornithes (eg: Struthio)</li> <li>General Topics: Flight adaptation of birds</li> </ul>	3	1,2,4,5
5.0	Class Mammalia: Salient features and classification up to subclass .	6	1,2,5
	<ul> <li>Sub class 1: Protheria (eg: Echidna)</li> <li>Sub class 2: Metatheria (eg: Macropus)</li> <li>Sub class 3: Eutheria (eg: Elephas)</li> <li>Ceneral Topic: General adaptation of aquatic mammals with example</li> </ul>		

#### REFERENCES

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<b>Course Details</b>	
Code	ZY2CMP02
Title	CHORDATE DIVERSITY (P)
Semester	II
Туре	COMPLEMENTARY COURSE
Credits	1
Name of Teacher	Ms. Emi Mathew, Mr. Varun Jolly

CO No.	Expected Course outcomes:	Cognitive level						
	ANIMAL DIVERSITY – CHORDATA (P)							
1.	Understand and classify the local chordate diversity.	U						
2.	Examine the morphology, anatomy and osteology of chordates.	An						
3.	Carry out identification of snakes using taxonomic keys.	Ар						
4.	Carry out temporary mounting.	Ар						
*PSO-Prog	gram Specific Outcome; CO-Course Outcome;							
Cognitive Create	Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create							

						Chor	date l	Divers	sity (P	ractic	al)					
CO	PSO									Р	0					
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	2	2	0	0	3	0	0	0	0	3	1	2	0	0	1
2	3	3	2	0	0	3	0	0	0	0	3	0	1	2	0	1
3	3	0	3	0	0	3	0	0	0	0	3	1	1	1	0	1
4	3	2	0	0	0	3	0	0	0	0	3	0	0	1	0	1

MODULE	COURSE DESCRIPTION	Hrs.	Co No.
1.0	Simple identification of 10 chordates, out of which 5 by theirscientific names	8	1
2.0	Osteology - Vertebrae and girdles of Frog	6	2
3.0	Snake identification - 3 poisonous and 3 non poisonous snakeswith key	6	3
4.0	Mounting of placoid scales of shark	6	4
5.0	Dissections: Frog: Photographs/Diagrams/ models may be used for the study.	10	2
	1. Frog - Viscera		
	2. Frog - Digestive System		
	3. Frog - Arterial System		
	4. Frog - Brain		

Course Details					
Code	ZY3CRT03				
Title	Animal Diversity – Chordata (T)				
Semester	III				
Туре	Core Course				
Credits	3				
Name of Teacher	Ms. Priya Thomas, Mr. Varun Jolly				

CO No.	Expected Course outcomes:	Cognitive level
	ANIMAL DIVERSITY – CHORDATA (T)	
1.	Understand the diversity, classification and phylogeny of Chordates.	U
2.	Outline and parse the adaptive features exhibited by the vertebrates.	An
3.	Compare the anatomy and physiological peculiarities of of Chordates through type study.	U
4.	Understand the economic importance and evolutionary Significance of selected Chordate groups.	U
5.	Determine the classification category of a given chordate based on the external observable features.	Ар
*PSO-Pro	gram Specific Outcome; CO-Course Outcome;	
Cognitive Create	e Level: R-Remember; U-Understanding; Ap-Apply; An-	Analyze; E-Evaluate; C-

				C	Chord	ate Di	iversi	ty III	SEM	MAI	N					
							ZY	'3CR'	Г03							
С																
0		-			PS	50			-	-			P	0	-	-
	1	2	3	4	5	6	7	8	9	10	1	1 2 3 4 5				6
1	3	1	3	0	0	2	1	0	0	0	3	1	2	0	0	1
2	3	1	2	0	0	1	0	0	0	0	3	0	1	0	0	1
3	3	2	2	0	0	2	0	0	0	0	3	0	1	1	0	1
4	3	0	3	0	0	2	0	0	0	0	3	1	1	1	0	1
5	3	1	2	0	0	2	0	0	0	0	3	1	1	0	0	1

MODU LE	COURSE DESCRIPTION	Hrs.	Co No.
1.0	Introduction	1	1,2,5
	General Characters and outline classification of Chordata up to class, Origin of Chordates – mention theories in brief		
1.1	Protochordates: General characters and Classification	1	1,2,5
1.2	Sub phylum:Urochordata	1	1,2,5
	Class I Larvacea Eg. Oikopleura		
	Class II Ascidiacea Eg: Ascidia		
	(Mention Retrogressive Metamor-		
	phosis)		
	Class III Thaliacea Eg: Doliolum		
1.3	Sub phylum: Cephalochordata	2	1,2,4,5
	Example - Amphioxus (Structure and affinities)		
2.0	Sub phylum: Vertebrata General characters and Classification	1	1,2,5
2.1	Division 1– Agnatha	1	1,2,5
	Class I Ostracodermi Eg: Cephalaspis		
2.2	Class II Cyclostomata Eg: Petromyzon Division 2 – Gnathostomata	1	125
2.2	Super class Pisces General Characters and Classification	1	1,2,5
2.3	Class: Chondrichthyes - General Characters Sub class – ElasmobranchI Eg: Narcine Sub class - Holocephali Eg: Chimaera	2	1,2,5
2.4	Class: Osteichthyes - General Characters Sub class – Choanichthyes	5	1,2,4,5
	Order 1 Crossopterigii(Coelocanths) Eg: Latimeria(Evolutionary Sig- nificance)		
	Order 2 Dipnoi Eg: Lepidosiren - Distribution, affinities and systematic position of lung fishes.		
	Sub class: - Actinopterygii		
	Super order 1. Chondrostei Eg: Acipencer Super order 2. Holostei Eg: Amia Super order 3. Teleostei Eg: Sardine		
2.5	General topics 1. Accessory respiratory organs in fishes. 2. Parental care in fishes. 3. Scales in fishes. 4. Migration in fishes	2	2
3.0	Super class: Tetrapoda	1	1,2,5
	General characters, Classification up to Orders		
3.1	Class Amphibia - Type Frog (Euphlyctis hexadactylus) Order I Anura Eg: Hyla	10	1,2,3,5

	Order II Urodela Eg: Amblystoma (mention axolotl larva and Paedomorphosis /neotony) Order III Apoda Eg: Ichthyophis.		
3.2	Class Reptilia 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: Cha- maleon Order III. Crocodilia Eg: Crocodylus Sub class IV: Synapsida Eg: Cynognathu	3	1,2,5
3.3	General topic : Identification of poisonous and non-poisonous snakes	1	1,2,5
3.4	Class Aves Sub class I: Archeornithes Eg: Archaeopteryx (Affinities) Sub class II: Neornithes Super order I: Palaeognathe Eg: Struthio	3	1,2,,45
	Super order II: Neognathe Eg: Brahminy kite		
3.5	General topics 1. Migrations in birds 2. Flight adaptations in birds	2	2
4.0	Class Mammalia Type: Rabbit (Oryctolagus cuniculus)	6	1,2,4,5
4.1	Brief mention of general characters and classification up to order with example. (Mention any five salient features of each order, detailed ac- counts of examples are not necessary) Sub class I: Prototheria Eg: Echidna, Ornithorhychus	1	1,2,5
	Sub class II: Metatheria Eg: Macropus		
4.2	<ul> <li>Sub class II: Hotomenta Eg: Macropus</li> <li>Sub class III: Eutheria Eg: Macropus</li> <li>Sub class III: Eutheria</li> <li>Order 1 Insectivora Eg: Talpa</li> <li>Order 2 Dermoptera Eg: Galeopithecus Order 3 Chiroptera Eg: Pteropus</li> <li>Order 4 Primates Eg: Loris Order 5 Carnivora Eg: Panthera Order 6</li> <li>Edentata Eg: Armadillo Order 7 Pholidota Eg: Manis Order 8 Proboscidea Eg: Elephas</li> <li>Order 9 Hydracoidea Eg: Procavia Order 10 Sirenia Eg: Dugong</li> <li>Order 11 Perissodactyla Eg:Rhinoceros</li> <li>Order 12 Artiodactyla Eg: Camelus-mention ruminant stomach Order</li> <li>13 Lagomorpha Eg: Oryctolagus</li> <li>Order 14 Rodentia Eg: Hystrix (Porcupine) Order 15 Tubulidentata Eg: Orycteropus Order 16 Cetacea Eg: Delphinus</li> </ul>	8	1,2,5
#### References

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   Zoological Society of Kerala, Kottayam
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Course Details						
TitleAnimal Diversity – Chordata (P)						
Semester	III					
Туре	Core Course					
Credits	1					
Name of Teacher	Ms. Priya Thomas, Mr. Varun Jolly					

CO No.	Expected Course outcomes:	Cognitivelevel				
	ANIMAL DIVERSITY – CHORDATA (P)					
1.	Understand and classify the local chordate diversity.	U				
2.	Examine the morphology, anatomy and osteology of	An				
	chordates.					
3.	Carry out identification of vertebrates using taxonomic	Ap				
	keys.					
4.	Use scientific drawing technique.	Ap				
*PSO-Program Specific Outcome; CO-Course Outcome;						
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create						

Chordate Diversity (P)																
СО		PSO PO														
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	2	2	0	0	3	0	0	0	0	3	1	2	0	0	1
2	3	3	2	0	0	3	0	0	0	0	3	0	1	2	0	1
3	3	0	2	0	0	3	0	0	0	0	3	2	0	0	0	1
4	2	0	1	0	0	3	0	0	0	0	3	1	0	0	0	1

MODULE	COURSE DE- SCRIPTION	Hrs.	Co No.
1.0	Scientific Drawing	5	4
1.1	Make scientific drawing of 5 locally available vertebrate speci- mensbelonging to different classes	3	4
2.0	Dissections	6	2
2.1	<ul> <li>Frog: Photographs/diagrams/one dissected &amp; preserved specimeneach/models may be used for study.</li> <li>1. Frog Viscera</li> <li>2. Frog Digestive System</li> <li>3. Frog Arterial System</li> <li>4. Frog 9th&amp; 1st Spinal nerve</li> <li>5. Frog Sciatic Plexus</li> <li>6. Frog Brain</li> </ul>	5	2
3.0	Mounting of placoid scales; study of cycloid and ctenoid scales	5	2
4.0	Osteology	5	2
4.1	Frog vertebrae - typical, atlas, 8th and 9th Rabbit – Atlas, Axis and typical vertebra Pectoral and pelvic girdles of Frog and Rabbit Bird - Keel and Synsacrum	5	2
5.0	Study of sections	5	2
5.0	Amphioxus T. S. through pharynx/T.S. through intestine	5	2
6.0	Identification:	10	3
6.1	General identification- Identify, classify and describe the follow- ing 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.	5	3
6.2	Taxonomic identification with key:- i) Identification of fishes up to the level of order. ii) Identification of snakes up to family.	5	3

Course title	Physiology And Immunology
Course code	ZY3CMT03
Programme	BSc. ZOOLOGY
Semester	III
Course type	Complementary
Credits	3
Name of Teacher	Ms. Priya Thomas, Ms. Ann Susan Mathew

CO No	<i>Expected Course Outcomes</i> Upon completion of this course, the students will be able to:	CognitiveLevel
1	Understand the physiology of various organ systems, including respiratory, circulatory, muscular, excretory and nervous systems with special reference to humans and their disorders.	U
2	Describe different types of nutrition, nutritional requirements and disorders	U
3	Discuss endocrine system, functions, diseases and hormone action	U
4	Explain basic concepts of Immunology and antigen antibody reactions	U
5	Identify various immune response systems, vaccines and immune disorders	An

	PHYSIOLOGY AND IMMUNOLOGY															
ZY3CMT03.																
СО	PSO										РС	)				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	3	2	2	0	2	2	0	0	0	3	0	2	1	1	1
2	0	2	2	0	0	2	2	0	0	2	3	2	0	2	1	1
3	2	2	2	0	0	2	2	0	0	0	3	2	2	2	2	1
4	2	2	0	0	0	2	2	0	0	0	3	2	2	2	2	2
5	2	2	0	0	0	0	2	0	0	0	3	2	2	2	2	2

MOD ULE	COURSE DESCRIPTION	HOURS	CO.NO.
1.1	<b>Nutrition:</b> Types of nutrition – autotrophy, heterotrophy. Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, Fe, I), vitamins (sources and deficiency disorders), nutritional disorders	5	2
1.2	<b>Respiration:</b> Transport of respiratory gases in blood - transport of oxygen, transport of carbon dioxide, chloride shift. Respiratory disturbances – Hypoxia, Hypercapnia, Asphyxia, physiological effect of smoking, carbon mon- oxide poisoning.	4	1
1.3	<b>Circulation:</b> Composition and functions of blood. Plasma and formed elements - WBC, RBC and platelets, Mecha- nism of blood coagulation – clotting factors, intrinsic and extrinsic pathways, anticoagulants. ECG, Blood pressure, Arteriosclerosis, Heamophilia, cerebral and pulmonary thrombosis.	5	1
2.1	<b>Excretion:</b> Structure of a nephron. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion. Urine concentration – counter current mechanism. Composition of urine – normal and abnormalconstituents. Hormonal regulation of kidney function. Kidney stone, dialysis	5	1
2.2	<b>Neuro physiology:</b> Structure of a neuron. Myelinated and non-myelinated nerve fibre, nerve impulse produc- tion (resting membrane potential, action potential), Im- pulse propagation, All or none law, saltatory conduction, synaptic transmission. Neurotransmitters (acetyl choline, adrenalin, dopamine), brain waves, EEG. Neural disor- ders - Parkinson's disease, Alzheimer's disease.	5	1
2.3	<b>Muscle physiology</b> : Types of muscles: striated, non stri- ated and cardiac. Ultra structure of striated muscle, Mechanism of muscle contraction, Cori cycle and muscle relaxation. Muscle fatigue, oxygen debt, Rigor mortis.	4	1
3.1	<b>Endocrinology:</b> Introduction to Endocrine system. Mechanism of hormone action	2	3
3.2	<b>Endocrine glands</b> - hypothalamus, pituitary gland, pine- al gland, thyroid gland, parathyroid gland, endocrine pancreas, adrenal gland, thymus gland, testis and ovary.	5	3

3.3	Physiological role of hormones, Hormonal disorders.	1	3
4.1	<b>Immunology:</b> Introduction to immunology, types of immunity – innate, acquired, passive, active, mechanism of innate immunity (barriers, inflammation, phagocytosis).	4	4
4.2	Types of antigens.	1	4
4.3	<b>Basic structure of immunoglobulins</b> , Classes of immunoglobulins and functions.	3	4
4.4	Antigen antibody reactions, Precipitation test, aggluti- nation test, WIDAL, VDRL, HIV test (ELISA),	4	4
5.1	Immune response system: (Brief accounts of the follow- ings) Primary and secondary lymphoid organs.	1	5
5.2	<b>Cells of Immune system</b> - T&B lymphocytes, natural killer cells, macrophages, plasma cells, memory cells.	1	5
5.3	Monoclonal antibodies, Hybridoma technology.	1	5
5.4	Immune disorders: Hypersensitivity, Auto immunity (rheumatoid arthritis) & Immunodeficiency (AIDS).	2	5
5.5	Vaccines - BCG, DPT, Polio vaccine.	1	5

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- *Biology* Published by Zoological Society of Kerala.

Course title	PHYSIOLOGY AND IMMUNOLOGY-PRACTICALS
Course code	ZY3CMP03
Programme	Bsc. ZOOLOGY
Semester	III
Course type	Complementary
Credits	1
Name of Teacher	Ms. Priya Thomas, Ms. Ann Susan Mathew

СО	Expected Course Outcomes	Cognitive Level					
No.	Upon completion of this course, the students will be able to:						
1	Develop skills in performing and interpreting various laboratory procedures to investigate blood parameters of Diagnostic significance.	An					
2	Analyse the action of salivary amylase on starch.	An					
3	Acquaint with various diagnostic instruments used in physiology.	U					
4	Acquire skills in qualitative analysis of nutrients and obtaining results through observation of appropriate reactions and documentation.	An					
*PSO	*PSO-Program Specific outcome; CO-Course Outcome;						
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create							

MODU	COURSE DESCRIPTION	HOURS	CO.NO.
LE			
1	Clinical analysis of blood - Preparation of Human Blood smear & identification of leucocytes, Estimation of Haemoglobin, Identification of human blood groups, A, AB, B and O, Rh factor	20	1
2	Qualitative analysis of Reducing Sugar, Protein and Lipid	10	4
3	Action of Salivary amylase on Starch	3	2
4	Study of Instruments: Sphygmomanometer , Stethoscope	2	3

Course	Details
Code	ZY4CRT04
Title	Research Methodology, Biophysics and Biostatistics
Degree	B.Sc.
Branch	Zoology
Semester	IV
Туре	Core Course
Credits	3
Name of Teacher	Ms. Priya Thomas, Mr. Varun Jolly

СО	Expected Course outcomes	Cognitive							
No.		level							
1.	Understand the scientific methods followed in research	U							
2.	Execute the different skills in research communication and documentation.	Ар							
3.	Apply various statistical methods in research studies.	Ар							
4.	Understand the principle and use of scientific instruments.	U, Ap							
5.	Identify the ethical values to be followed in biological studies.	An							
*PSO-P	*PSO-Program Specific Outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-								
Underst	Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create								

	Research Methodology IV SEM MAIN															
ZY4CRT04																
CO	PSO												P	0		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	0	0	0	1	3	0	0	0	3	2	0	1	0	1
2	3	0	0	0	0	1	3	0	0	0	3	2	0	0	0	1
3	3	0	0	0	0	1	3	0	0	0	3	3	0	0	0	1
4	3	0	0	0	0	3	3	0	0	0	3	3	0	0	0	1
5	3	0	0	0	0	2	3	0	0	0	3	2	0	3	0	1

Module Descript	Course	Hrs	CO.No
ion			
	RESEARCH METHODOLOGY		
	Module I	13	1,2
1.0	Basic concepts of research:		
1.1	Meaning, Objectives, Approaches, Types of research.	1	1
1.2	Research Process: Scientific method in research	1	1
1.3	Importance of literature reviewing in defining a problem,	2	1
1.4	Identifying gap areas from literature review.		2
1.4	Research Communication and scientific documentation:		2
1.4.1	Project proposal writing Research report writing, Thesis, dissertation, research article.	2	2
1.4.2	Presentation techniques: Oral presentation, Assignment, Seminar,	2	2
	Debate, Workshop, Colloquium, Conference		
1.5	Sources of Information:		
1.5.1	Primary and secondary sources. Library- Books, Journals,	2	1
	Periodicals, Reviews, Internet		
1.5.2	Search engines Online libraries, e-Books, e-Encyclopedia,	2	1
1.6	Institutional Websites.	1	1
1.6	Plagiarism Madala H	1	1
2.0		10	1
2.0	Animal Collection – Tools & techniques	12	1
2.1	Sampling techniques - Quadrate, Line transect	1	1
2.2	Measurements - Density, Abundance, Frequency	2	1
2.3	Biodiversity indices – concepts, Simpson index	2	1
2.4	Plankton, Insects, Fish, Bird.	2	1
2.5	Preservation techniques – Taxidermy	1	1
2.6	Rearing techniques: Laboratory and field.	2	1
2.7	Units of measurements- units, SI system, Equivalent weight,	2	1
	normality, molarity		
	BIOPHYSICS		
	Module III	14	4
3.0	Basic understanding on principle and uses of the following:		
3.1	Microscopy:		4
3.1.1	(a) Light microscopy, Bright field (Compound Microscope), Phase contrast, Dark field microscopy, Fluorescence,	4	4
	Polorization microscopy, Video microscopy.		

3.1.2	(b) Electron – Scanning (SEM), Transmission (TEM) and STEM	4	4
2.2	Instrumentation: pH Mater	1	1
3.3	Separation Techniques:	1	4
2.4.1	Centrifuce Characterentry Electrophonosis	2	4
2.5	A nelytical techniques:	Δ	4
2.5.1	Analytical techniques.	2	4
5.5.1	PLOETINGS	3	4
4.0	Module IV	5	5
4.0		5	5
4.1		1	5
4.1.1	animal rights and animal laws in India: Prevention of crueity to animals Act 1960, Biodiversity Act 2003.	1	5
4.2	Concept of 3 R – conservation	1	5
4.3	Animal use in research and education.		5
4.3.1	Laboratory animal use, care and welfare, Animal protection	1	5
	initiatives- Animal Welfare Board of India, CPCSEA.		
4.3.2	Ethical commitment. Working with human: Consent, harm, risk	1	5
	and benefits.		
	BIOSTATISTICS		
5.0	Module V	10	3
5.1	Sample & Sampling techniques:		
5.1.1	Collection of data, classification of data, frequency distribution	1	3
	tables		
5.1.2	graphical representation: - Bar diagrams, Histogram, Pie diagram	1	3
	and Frequency curves - Ogives.		
5.2	Measures of Central Tendency: Mean, Median, Mode.	2	3
5.3	Measures of dispersion: Range, Quartile Deviation, Mean Devia- tion, Standard Deviation,	2	3
	Standard error.		
5.4	Correlation: Definition, Types of correlation	1	3
5.5	Test of Hypothesis and Test of Significance:		3
5.5.1	Basic concept, Levels of significance, test of significance	1	3
5.5.2	Procedure for testing hypothesis	1	3
5.5.3	Types of hypothesis- Null hypothesis and Alternate hypothesis	1	3

### References

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Course Details							
Code	ZY4CRP04						
Title	Research Methodology, Biophysics and Biostatistics						
Degree	B.Sc.						
Branch	Zoology						
Semester	IV						
Туре	Core Practical						
Credits	2						
Name of Teach- er	Ms. Priya Thomas, Mr.Varun Jolly						

СО	Expected Course outcomes	Cognitive						
No.		level						
1.	Apply animal sampling, collection and preservation	Ар						
	techniques.							
2.	Determine the use of microscopes and other scientific	Ар						
	instruments.							
3.	Solve statistical problems using computer applications.	Ар						
*PSO-Program Specific Outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-								
Under	Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create							

Exp. No	Course Description	Hrs	СО
	RESEARCH METHODOLOGY	12	
1	Animal collection Tools, Techniques & Estimation		1
	1. Quadrate study	2	1
	2. Transect study 3. Sampling Methods	2	
	4. Species area curve	4	
	5. Simpson index	2	
		2	
	BIOPHYSICS	12	
1	Study of simple and compound light microscopes	1	2
2	Micrometry – calibration and measurement of microscopic	1	2
	objects –low power		
3	Camera Lucida drawings	3	2

4	Paper chromatography	3	2
5	Instrumentation – pH Meter, Colorimeter/	4	2
	Spectrophotometer, Centrifuge		
	BIOSTATISTICS	12	
1	MS Excel : To create mean and median, Construction of	2	3
	bar diagram, Pie diagram and Line graphs.		
2	MS Access: To create grade of students	2	3
3	Internet: Access a web page on any biological topic.	2	3
4	Frequency distribution of the given samples to find out	2	3
	Arithmetic mean, median, mode.		
5	Range and standard deviation for a biological data	2	3
6	Correlation using any biological data.	2	3

Course Details	
CODE	ZY4CMT04
Title	Applied Zoology (T)
Semester	IV
Туре	Complementary Course
Credits	3
Name of Teacher	Ms. Priya Thomas, Ms. Ann Susan Mathew

CO No.	Expected Course outcomes: APPLIED ZOOLOGY (T)	Cognitivelevel					
1.	Understand the common cultivable fishes, types of aq- uaculture, its management and fish processing and preservation.	U					
2.	Construct aquaculture units for self-employment	С					
3.	Design and management of aquariums.	С					
4.	Understand the various silk worm rearing techniques and mounting of silkworm.	U					
5.	Use vermicomposting technique for better waste management.	Ар					
6.	Carry out apiculture for self-employment or as a hobby.	Ар					
7.	Understand the various species of earthworms, silk worms, honey bees and be products.	U					
8.	Identify diseases of fishes, earthworms, silkworms and honeybees.	U					
*PSO-Program Specific Outcome; CO-Course Outcome;							
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create							

	APPLIED ZOOLOGY															
ZY4CMT04																
со					F	SO							Р	0		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	0	0	0	0	3	2	2	2	1	0	3	0	2	2	2	2
2	0	0	0	0	3	2	2	2	1	0	3	0	0	0	0	1
3	0	0	0	0	3	2	2	2	1	0	3	2	2	2	2	1
4	0	0	0	0	3	2	2	2	1	0	3	2	2	2	2	1
5	0	0	0	0	3	2	2	2	1	0	3	2	2	2	2	1
5	0	0	0	0	3	2	2	2	1	0	3	2	2	2	2	1
6	0	0	2	0	3	2	2	2	1	0	3	2	2	2	2	1
7	3	0	2	0	3	2	2	2	1	0	3	2	2	2	2	1
8	3	0	2	0	3	2	2	2	1	0	3	2	2	2	2	1

MOD U	COURSE DESCRIPTION	Hrs.	Co No.			
1.0	<b>Aquaculture:</b> Advantages of aquaculture, Traditional methods of aquaculture, Biotic and abiotic factors in water, Pond culture – construction and maintenance.	5	1			
1.1	Types of aquaculture, composite fish culture, integrated fish culture,					
	induced breeding of carp & prawn, Importance of algae in aquaculture.					
1.2	Aquarium management - Setting up of an aquarium, biological filter and aeration. Common cultivable fishes of Kerala.					
1.3	Fish diseases, Prawn culture, mussel culture, pearl culture, Fish processing and preservation.					
2.0	<b>Sericulture</b> : Four species of silkworms, life history of silkworm, silk worm rearing techniques					
	Mounting of silkworm - Chandrika, defective cocoons, harvesting and sti- fling of coccons.	4	4			
	Silkworm diseases and pest, preventive and control measures	4	8			
3.0	<b>Vermiculture:</b> Species of earthworms, ecological classification of earthworms, life cycle and reproduction of earthworm. Physical & chemical effects of earthworms on soil.	3	7			

3.1	Vermicomposting – site selection, preparation of pit, maintenance, moni- toring and harvesting of vermicompost.	3	5
4.0	<b>Apiculture:</b> Species of honey bees, organization of honey bee colony. Bee keeping methods and equipments.	5	7
4.1	Apiary management and maintenance. Bee pasturage, byproducts of honey bees and their uses.	4	6
4.2	Diseases, pests of honey bees and control measures.	3	8

#### REFERENCES

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Course Details			
Code	ZY4CMP04		
Title	Applied Zoology (P)		
Semester	IV		
Туре	Complementary Course		
Credits	1		
Name of Teacher	Ms. Priya Thomas, Ms. Ann Susan Mathew		

CO No.	Expected Course outcomes: APPLIED ZOOLOGY (P)	Cognitivelevel			
1	Identify the types of culturable fishes, earthworms, silk worms and honey bees.	U			
2	Determine the castes of honey bees.	Ар			
3	Determine various bee keeping equipments	Ар			
4	Identify bee products, silk, Chandrika, Netrika and vermicompost	U			
*PSO-Program Specific Outcome; CO-Course Outcome;					
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create					

MOD- UL E	COURSE DESCRIPTION	Hrs.	Co No.
1.0	<b>General identification</b> , economic importance, morphology, scientific names and common names of the following		
	<ul> <li>a. Economic importance and morphology of culturable fishes (Catla,Rohu, Grass carp, Common carp, Silver carp, Etroplus, Ti- lapia)</li> <li>b. Two species of earthworms used in Vermiculture</li> <li>c. Two species of honey bees</li> <li>d. Silkworm. Cocoon/Adult</li> </ul>	15	1
2.0	Castes of honey bees	6	2
3.0	Bee keeping equipments - Bee hive, Smoker, honey extractor	5	3
4.0	Identification and uses - Bee wax, Honey, Silk, Vermicompost	6	4
5.0	Chandrika / Netrika used in sericulture	4	4

Course	Details
Code	ZY5CRT05
Title	<b>Environmental Biology And Human Rights</b>
Degree	B.Sc
Semester	V
Туре	Core course
Credits	3
Name of Teacher	Mr. Varun Jolly

СО	Expected Course Outcomes	CognitiveLevel
No	Upon completion of this course, the students will be able to:	
1	Develop knowledge on basic concepts of Environmental Sciences, types of natural resources, human impacts on it and its management practices.	R
2	Develop skills to utilize environment sustainably and to enrich it.	U
3	Understand important theories and concepts of environmental sciences, population and commu- nity, Biodiversity and its conservation.	U
4	Explicate environmental hazards, their risk and the socio – economical ramifications.	E
5	To determine the causes and potential solutions of major environmental problems.	U
6	Identify issues and problems relating to Human Rights.	U
7	Analyse country's current scenario in terms of human rights.	An
8	Impact awareness on various environmental acts in India.	С

- PSO- Program Specific Outcome; CO- Course Outcome;
- Cognitive Level: R- Remember; U- Understanding: Ap- Apply; An- Analyse; E-Evaluate;

C- Create.

Environmental Biology and Human Rights																
	ZY5CRT05															
CO					PS	<b>50</b>							Р	0		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	2	0	3	0	0	2	2	3	3	1	3	0	3	1	0	1
2	1	0	3	0	0	2	2	3	3	1	3	1	3	0	0	1
3	3	0	3	0	0	3	2	2	3	1	3	1	3	0	3	1
4	1	0	3	0	0	2	2	3	3	1	3	0	3	3	0	1
5	1	0	3	0	0	2	2	3	3	1	3	0	3	2	0	1
6	0	0	3	0	0	2	2	2	3	1	3	2	3	1	3	1
7	0	0	3	0	0	2	2	2	3	1	3	2	3	1	3	1
8	1	0	3	0	0	2	2	2	3	1	3	2	3	0	3	1

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Module Descript	Course	Hrs	CO.No
ion			
1.0	Module I	8	1,3
1.1	BASIC CONCEPTS OF ECOSYSTEM	2	1,3
	Structure and function of an ecosystem, Biotic and Abiot- iccomponents of ecosystem, producers, consumers and decomposers, energy flow in the ecosystem.		
1.1.1	Food chains, food webs and ecological pyramids. Laws of Thermodynamics	1	3
1.1.2	Introduction, types, characteristic features, structure and function of the given ecosystem- Forest ecosystem, grassland, desert	1	1
1.1.3	Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, Estuaries), Wetland &Biome.	1	1
1.1.4	Concept of limiting factors- Liebig's and Shelford's laws of limiting factors. Biogeochemical cycles- concept.	1	3
1.1.5	Gaseous and sedimentary cycles, carbon cycle, nitrogen cycle	1	3
1.2	Natural Resources and associated problems - Introduction,	1	1
	renewable and non-renewable resources		
2.0	Module II	7	3
2.1	CONCEPTS OF POPULATION AND COMMUNITY:	2	3
	Concept of population: Population attributes- Population growth forms, Basic concepts of growth rates, density, natality, mortality, growth curves (brief account only).		

2.2	Animal interactions- Positive- Commensalism, mutualism, proto-cooperation, Negative- predation, parasitism, competition,	2	3
	antibiosis.		
2.3	<b>Characteristics of a community</b> -Species diversity- richness, eveness, stratification, dominance	1	3
2.3.1	Ecological indicators, ecotone and edge effect, keystone species, Concepts of ecological niche and guild	1	3
2.3.2	Ecological succession and community evolution- climax	1	3
3.0	Module III	16	3,4,5
3.1	<b>BIODIVERSITY AND ENVIRONMENTAL ISSUES:</b>	2	3
	Introduction to Biodiversity: Types of biodiversity- Alpha, Beta and Gamma diversity. Concept and importance of biodiversity.		
3.1.1	India as a mega-diversity nation, Biodiversity hotspots	1	3,4
3.2	Environmental Issues:	3	4,5
3.2.1	Global Environmental Issues: Ozone depletion, Greenhouse ef- fect, Global warming, Climate change, Carbon trading, carbon credit; Carbon sequestration, Acid rain, Oil spills, Nuclear acci- dents, IPCC/UNFCC.		
3.2.2	National Environmental issues: Deforestation, forest fire, pollu- tion(air, water, soil, noise thermal, nuclear) solid waste	3	4,5
	management, sewage, drinking water crisis and water logging.		
3.2.3	Local Environmental issues: Landscape alteration, sand mining,	2	4,5
	quarrying, changing crop pattern, conversion of paddy lands.		
3.3	Toxic products and disaster: Types of toxic substances –	3	4,5
	degradable, non-degradable, Impact on human – case studies: En- do sulphan tragedy, Bhopal disaster Flood, drought, cyclone,		
	earthquake and landslide		
3.4	<b>Threats to water resources of Kerala</b> : Degrading Mangrove and wetland ecosystems of Kerala. RAMSAR sites, Marine ecosystem crisis- pollution, overfishing etc. Impact of tourism on Environment	2	4,5
4.0	Module IV	5	3.8
4.1	CONSERVATION OF BIODIVERSITY	1	3
	Protected area concept – Sanctuary, National Park, Biosphere re- serve, Core Zone, Buffer Zone, Corridor concept. Conservation reserves	-	
4.2	<b>Concept of threatened fauna</b> – IUCN categories - extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern and data deficient. Red and Green Data	1.5	3
	Books.		
4.3	Man-animal conflict		
4.4	Water conservation- rainwater harvesting, watershed management	1.5	3
4.5	<b>Environmental laws</b> : The Wildlife Protection Act, 1972, Biodiversity Act, 2002.	1	8

5.0	Module V	18	6,7
5.1	Human Rights: Introduction to Human rights, meaning, Concept and development, History of human rights. Universality of Human Rights	5	6,7
5.2.0	Human Rights and United Nations: Human rights coordination within UN system.	4	6,7
	Commission of Human Rights.		
5.2.1	The committee on the elimination of discrimination against	4	6,7
	Women. Human rights committee.		
5.3	Human Rights in Indian constitution, Science Technology and Human Rights, State human rights commission, Human rights	5	6,7
	awareness in Education.		

#### References

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### **Human Rights**

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Course	Details
Code	ZY5CRP05
Title	Environmental Biology And Toxicology (P)
Degree	B.Sc
Semester	V
Туре	Core practical
Credits	1
Name of Teacher	Mr. Varun Jolly

CO	Expected Course Outcomes	<b>Cognitive Level</b>
No	Upon completion of this course, the students will be able to:	
1	Analyse the different soil and water quality parameters	An
2	Understand the current environmental issues	U
3	Classify the various ecosystems and animal interactions	Ар
4	Identify planktons and equipments used in ecology	R
5	Create love towards nature	С
	DSO Program Specific Outcome: CO Course Ou	taoma

PSO- Program Specific Outcome; CO- Course Outcome;

Cognitive Level: R- Remember; U- Understanding: Ap- Apply; An- Analyse; E-Evaluate; C- Create.

	<b>Environmental Biology and Human Rights (Practical)</b>															
ZY5CRP05																
CO					PS	РО										
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	1	0	1	0	0	3	1	2	1	0	3	1	2	1	0	1
2	0	0	3	0	0	1	1	1	2	0	3	1	3	1	1	1
3	3	0	2	0	0	1	1	0	0	0	3	0	3	0	0	1
4	3	0	1	0	0	3	2	1	2	0	3	1	2	0	0	1
5	1	0	3	0	0	0	0	0	1	1	3	1	3	1	2	1

Modul	Course Description	Hrs	СО
e			
1	Estimation of dissolved Oxygen	4	1
2	Estimation of carbon dioxide	4	1
3	Estimation of soil organic carbon (Demonstration)	2	1
4	Identification of marine/ fresh water planktons	4	4
5	Counting of plankton using plankton counting chamber	4	4
6	Study of equipments - Sechi disc, Plankton net	2	1,4
7	Study of sandy shore fauna, rocky shore fauna	2	2,3
8	Study of animal Association	4	3
9	Field study and report of any two important areas of bio diversity (compulsory): Field study report: Forest, sea shore, mangrove, wetland, bird sanctuary, wildlife sanctuary, sacred groves	10	3,5

Course	Details
Code	ZY5CRT06
Title	Cell Biology & Genetics
Degree	B.Sc.
Branch	Zoology
Year/Semester	III/V
Туре	Core Course
Credits	3
Name of Teacher	Ms. Priya Thomas

CO No.	Expected Course outcomes	Cognitive level
1.	Understand the basics of cell theory, structure and function of cell, different cell organelles and division of cells.	U
2.	Understand the concepts of Mendelian genetics.	U
3.	Examine Mendelian and non Mendelian types of inheritence.	Ар
4.	Understand the genetic basis of sex determination and sex linked inheritance.	U
5.	Evaluate the types, causes and significance of linkage, recombination and mutation.	U
6.	Understand the genetic disorders and symptoms.	Е
7.	Understand the applications of genetics in human welfare.	U
	PSO-Program Specific Outcome; CO-Course Outcome;	
	Cognitive Level: R-Remember; U-Understanding; Ap-	
	Apply; An-Analyze; E-Evaluate; C-Create	

	Cell Biology and Genetics															
ZY5CRP06																
СО	PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	1	3	1	0	0	1	2	2	0	0	3	0	3	2	0	1
2	1	0	0	3	0	3	1	2	0	0	3	0	0	2	0	1
3	1	0	1	3	0	2	1	2	0	0	3	0	0	2	0	1
4	1	1	0	2	0	2	1	0	0	0	3	0	0	2	0	1
5	1	1	1	3	0	3	3	2	0	0	2	0	3	2	0	3
6	1	1	1	3	0	3	1	0	0	0	2	0	1	2	0	1
7	1	0	0	3	0	2	1	2	0	3	2	0	1	3	0	1

Modul	Course Description	Hours	CO No.
e	CELL BIOLOGY AND GENETICS	54	
1	CELL BIOLOGY	22	
1.1	History, Cell theory, Prokaryotes, Eukaryotes	2	1
1.2	Mycoplasmas, Virus, Virions and Viroids, Prions.	1	1
1.3	Molecular models of cell membrane (Sandwich model, Unit membrane model, Fluid mosaic model).	1	1
1.4	Cell properties - permeability, Transport [Diffusion, Osmosis, Passive transport, Active transport, bulk transport], Cell coat and Cell recognition.	2	1
1.5	Structure and functions of Endoplasmic reticulum.	1	1
1.6	Structure and functions of Ribosomes (Prokaryotic and Eukaryotic).	1	1
1.7	Structure and functions of Golgi complex.	1	1
1.8	Sructure and functions of Lysosomes, Polymorphism, GERL concept.	2	1
1.9	Structure and functions- Mitochondria.	2	1
1.10	Structure and functions of interphase nucleus, Nuclear membrane, pore complex, structure and functions of nucleolus. Nucleosomes	1	1
1.11	Chromosomes- Structure &organization, Heterochromatin, Euchromatin,	1	1
1.12	Polytene chromosomes-Balbiani rings, Endomitosis, Lamp brush chromosomes.	1	1
1.13	Basic principles of cell communications, Cell signaling.	1	1
1.14	Types of signaling, Signaling molecules (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and derivatives),	1	1
1.15	Cell cycle - G 1, S, G 2 and M phases.	1	1
1.16	Mitosis and Meiosis.	2	1
1.17	The difference between Mitosis and Meiosis.	1	1
2	GENETICS	32	
2.1	Mendel's experiments, Monohybrid Cross, Dihybrid Cross.	1	2
2.2	Mendel's Laws.	1	2
2.3	Test Cross, Back Cross, Reciprocal Cross,	1	2
2.4	Chromosome Theory of Inheritance.	1	2
2.5	Allelic Interaction: Incomplete Dominance (Four O Clock	1	3

	Plant) Co- Dominance (Skin colour in Cattle)		
2.6	Allelic Interaction: Lethal Alleles: Dominant lethal gene	1	3
	[Creeper chicken], recessive lethal gene [Cystic fibrosis].	-	c
2.7	Non Allelic Interaction: Complementary genes (Flower	1	3
	colour in Sweet Pea). Supplementary (Coat colour in mice).	-	c
2.8	Epistasis – dominant (Plumage in poultry) and recessive	1	3
	(Coat colour in mice).	-	c
2.9	Polygenes (Skin colour inheritance in man). Pleiotropism	1	3
,	(Vestigial wing gene in Drosophila)	1	2
2.10	ABO Blood group system. Rh group and its inheritance.	1	3
2.10	Ervthroblastosis foetalis	1	2
2.11	Chromosome theory of sex determination (Autosome and	2	4
2.11	Sex chromosomes) male heterogamy female heterogamy	-	•
	(XX-XY, XX-XOZZ-ZW, ZZ-ZO).		
2.12	Genic Balance theory of Bridges Barr bodies Lyon's	1	4
2.12	hypothesis	1	•
2.13	Gynandromorphism sex mosaics intersex (Drosophila)	2	4
2.15	Cynandromorphism, sex mosales, mersex (brosophila).	-	•
2.14	Hormonal [free martin in calf] and Environmental (Bonelia)	1	4
	influence on Sex determination		
2.15	Linkage and recombination of genes based on Morgan's	2	5
	work		
	in Drosophila, Linked genes, Linkage groups, Chromosome		
	theory of Linkage. Types of inkage- complete and		
	incomplete.		
2.16	Recombination, cross over value, chromosome mapping.	1	5
2.17	Characteristics of Sex Linked inheritance, X Linked	2	4
	inheritance of man (Hemophilia), Y linked inheritance		
• 10	[Holandric genes].	_	
2.18	Incompletely Sex Linked genes or pseudoautosomal genes	1	4
	(Bobbed bristles in Drosophila), Sex limited genes (Beard		
	(in man) and Nev influenced genes (inheritance of haldness		
	In man) and Sex influenced genes (infletitance of baldness		
2	in man).	10	
3	in man). HUMAN GENETICS	10	
3	in man) and sex influenced genes (infleritance of baldness in man). HUMAN GENETICS	10	
<b>3</b> 3.1	In man) and sex mindenced genes (inneritance of baldness in man).         HUMAN GENETICS         Types of mutations - Somatic, germinal, spontaneous,	<b>10</b> 1	5
<b>3</b> 3.1	In man) and Sex influenced genes (infleritance of baldness in man).         HUMAN GENETICS         Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.	<b>10</b>	5
<b>3</b> 3.1 3.2	In man) and Sex influenced genes (infleritance of baldness in man).         HUMAN GENETICS         Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.         Chromosomal structural mutations.	<b>10</b> 1 1	5
<b>3</b> 3.1 3.2 3.3	<ul> <li>In man) and Sex influenced genes (infleritance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations</li> </ul>	<b>10</b> 1 1	5 5 5
<b>3</b> 3.1 3.2 3.3	In man) and Sex mindenced genes (inneritance of baldness in man).         HUMAN GENETICS         Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.         Chromosomal structural mutations.         Chromosomal numerical mutations.	<b>10</b> 1 1 1	5 5 5
<b>3</b> 3.1 3.2 3.3 3.4	In man) and Sex influenced genes (infleritance of baldness in man). <b>HUMAN GENETICS</b> Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.         Chromosomal structural mutations.         Chromosomal numerical mutations.         Gene mutations	<b>10</b> 1 1 1 1 1 1	5 5 5 5
<b>3</b> 3.1 3.2 3.3 3.4	In man) and Sex influenced genes (infleritance of baldness in man). <b>HUMAN GENETICS</b> Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.         Chromosomal structural mutations.         Chromosomal numerical mutations.         Gene mutations.	<b>10</b> 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5 5 5 5
<b>3</b> 3.1 3.2 3.3 3.4 3.5	<ul> <li>In man) and Sex influenced genes (inferitance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement,</li> </ul>	<b>10</b> 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5 5 5 5 5 5
<b>3</b> 3.1 3.2 3.3 3.4 3.5	<ul> <li>In man) and Sex influenced genes (inferitance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> </ul>	10       1       1       1       1       1       1       1	5 5 5 5 5 5
3         3.1         3.2         3.3         3.4         3.5         3.6	<ul> <li>In man) and Sex influenced genes (inferitance of balaness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities</li> </ul>	10       1       1       1       1       1       1       1       1       1       1       1	5 5 5 5 5 6
3         3.1         3.2         3.3         3.4         3.5         3.6	<ul> <li>In man) and Sex influenced genes (inferitance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal</li> </ul>	10       1       1       1       1       1       1       1       1	5 5 5 5 5 5 6
3         3.1         3.2         3.3         3.4         3.5         3.6	<ul> <li>In man) and Sex influenced genes (infleritance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome)</li> </ul>	10       1       1       1       1       1       1       1       1	5 5 5 5 5 6
3         3.1         3.2         3.3         3.4         3.5         3.6         3.7	<ul> <li>In man) and Sex Influenced genes (inferitance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome)</li> <li>Single gene disorder (Brief mention), Autosomal single</li> </ul>	10       1       1       1       1       1       1       1       1       1       1       1       1       1       1	5 5 5 5 5 6 6
3         3.1         3.2         3.3         3.4         3.5         3.6         3.7	<ul> <li>In man) and Sex influenced genes (inferitance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome)</li> <li>Single gene disorder (Brief mention), Autosomal single gene disorder (sickle cell anaemia).</li> </ul>	10       1       1       1       1       1       1       1       1       1       1       1       1       1	5 5 5 5 5 6 6
3         3.1         3.2         3.3         3.4         3.5         3.6         3.7         3.8	<ul> <li>In man) and Sex mindenced genes (innernance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome)</li> <li>Single gene disorder (Brief mention), Autosomal single gene disorder (sickle cell anaemia).</li> <li>Inborn errors of metabolism- phenylketonuria, alkaptonuria,</li> </ul>	10       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	5 5 5 5 5 6 6 6
3         3.1         3.2         3.3         3.4         3.5         3.6         3.7         3.8	<ul> <li>In man) and Sex influenced genes (infernance of baldness in man).</li> <li>HUMAN GENETICS</li> <li>Types of mutations - Somatic, germinal, spontaneous, induced, autosomal and allosomal mutations.</li> <li>Chromosomal structural mutations.</li> <li>Chromosomal numerical mutations.</li> <li>Gene mutations.</li> <li>Gene mutations.</li> <li>Karyotyping, Normal Human chromosome Complement, Pedigree analysis.</li> <li>Aneuploidy and Non- disjunction. Autosomal abnormalities (Down syndrome, Cry du chat syndrome)Sex chromosomal abnormalities (Klinefelters syndrome, Turner's syndrome)</li> <li>Single gene disorder (Brief mention), Autosomal single gene disorder (sickle cell anaemia).</li> <li>Inborn errors of metabolism- phenylketonuria, alkaptonuria, Albinism.</li> </ul>	10       1       1       1       1       1       1       1       1       1       1       1       1       1	5 5 5 5 5 6 6 6

	palate.		
3.10	Genetic Counseling, Eugenics and Euthenics.	1	7

#### Reference

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2. Klug, W.S and Cummings, M.R. (2011). Concepts of Genetics (7th edn). Pearson Education Inc.India.

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11. Hartl, L.D. and E.W.Jones. (2009). Genetics: Analysis of Genes and Genomes (7th edn) Jones and Barlett Publishers Inc, USA.

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13. Sobti, R.C. and Pachauri, S.S. (2009). Essentials of Biotechnology. Ane's Book Pvt. Ltd.New Delhi.

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Course	Details
Code	ZY5CRP06
Title	Cell Biology & Genetics (P)
D	
Degree	В.5с.
Branch	Zoology
Year/Semest	III/V
er	
Туре	Core Practical
Credits	2
Name of	Ms. Priya Thomas
Teacher	

CO No.	Expected Course Outcomes	Cognitive Level
1.	Identification of mitotic stages, polytene chromosomes,	R, An
	epithelial tissue, striated muscles, smooth muscle,	
	cartilage, bone, cell organelles, human blood cells and barr	
	body.	
2.	Squash preparation of onion root tip.	Ар
3.	Preparation of temporary whole mount and human blood	Ар
	smear.	
4.	Carry out genetic calculations and pedigree analysis.	Ар
5.	Identify normal and abnormal human karyotypes	R, An
6.	Carry out sexing of Drosophila	Ар

	Cell Biology and Genetics (Practical)																	
ZY5CRP06																		
СО		PSO											РО					
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6		
1	2	0	1	0	0	3	1	0	0	0	3	0	3	2	0	1		
2	2	0	1	3	0	3	1	0	0	0	3	0	0	2	0	1		
3	2	0	1	3	0	3	1	0	0	0	3	0	0	2	0	1		
4	2	0	1	1	0	3	1	0	0	0	3	0	0	2	0	1		
5	2	0	1	1	0	3	1	0	0	0	2	0	3	2	0	3		
6	1	0	0	3	0	3	1	0	0	0	2	2	0	2	0	1		

Module	Course Description	Hrs	CO. No.		
1	CELL BIOLOGY	18			
1.1	Squash preparation of onion root tip for mitotic stages.	4	1,2		
1.2	Mounting of polytene chromosome (Drosophila/Chironom ous.) Demonstration	2	1		
1.3	Tissues (permanent slides of epithelial tissues, striated muscle, smooth muscle, cartilage, bone)	2	1		
1.4	Identification of cell organelles	2	1		
1.5	Preparation of temporary whole mount.	2	2		
1.6	Preparation of permanent whole mount (demonstration)	2	1		
1.7	Preparation of human blood smear and identification of Leucocytes	4	1,2		
2	GENETICS	18			
2.1	Genetic problems on Monohybrid, Dihybrid Crosses and Blood group inheritance	6	4		
2.2	Study of normal male and female human karyotype (use photographs or Xerox copies)	2	5		
2.3	Abnormal human karyotypes - Down, Edwards , Klinefelter and Turner syndromes(use	2	5		

	photographs or Xerox copies)		
2.4	Sexing of Drosophila.	4	6
2.5	Study of Barr body in human buccal epithelium	4	1

Course	Details
Code	ZY5CRT07
Title	Evolution, Ethology &Zoogeography
Semester	V
Туре	Core Course
Credit	3
Name of Teacher	Ms. Ann Susan Mathew

CO NO.	EXPECTED COURSE OUTCOME-	COGNITIVE LEVEL
	Upon completion of this course the students will be ableto ;	
1	Understand the concept of unity of life, theories onthe origin of organic evolution and its evidenc- es.	U
2.	Acquire basic skills in the observation and study ofnature, rich diversity of organisms and their ecological and evolutionary significance and sci- entific investigation on biological origin of life from simple to more complex forms.	Ар
3.	Describe the causes of diversification of life, con- ceptof speciation its types and the current status of different species.	U
4.	Understand the different techniques used for fos- sil study with reference to geological time scale.	U
5.	Compare animals with reference to their distribu- tion on earth, geological parameters affecting dis- tributionand different bio geographical realms.	U
6.	Understands and develops skills to analyse the dif- ferent behavioral patterns of animals, leaning and their sociobiology.	А
7.	Plan and design the application of population genetics in modern evolutionary biology and inphylogeny studies.	Ар

	V SEM EVOLUTION ZOOGEOGRAPHY & ETHOLOGY															
	ZY5CRT07															
С	PO	PO	PO	PO	PO	PO	PS	PSO								
0	1	2	3	4	5	6	01	O2	03	O4	05	06	07	08	09	10
1	2	1	3	2	1	1	2	1	3	0	0	0	1	0	1	0
2	3	1	3	2	1	1	2	1	3	0	0	0	1	1	1	0
3	2	1	3	2	1	1	3	0	2	0	0	0	1	1	1	0
4	2	1	2	1	0	0	2	2	2	0	0	1	2	1	1	0
5	1	1	2	1	1	0	3	0	2	0	0	0	1	1	3	0
6	1	1	2	2	1	0	1	0	2	0	0	0	2	0	1	0
7	1	1	1	1	0	1	2	0	3	3	0	0	3	0	1	0

MODULE	COURSE DESCRIPTION	Hrs.	CO.N
			0.
PART I – E	VOLUTION	( <b>30 H</b>	rs.)
1.0	Module I - Origin of life	8	1,4
1.1	Theories - Panspermia theory or Cosmozoic theory, Theory of spontaneous generation	3	1
	(Abiogenesis or Autogenesis), Special creation, Biogenesis,		
	Endosymbiosis.		
1.2	Chemical evolution - Haldane and Oparin theory, Miller- Urey experiment;	2	1
1.3	Direct evidences of evolution – Recapitulation Theory of Haeckel,	3	1, 4
	Fossilization, Kinds of fossils, fossil dating, Homologous organs and analogous or- gans.		
2.0	Module II - Theories of organic evolution	9	1, 7
2.1	Lamarckism and its Criticism, Weismann's Germplasm the- ory, Darwinism and its Criticism,	4	1
2.2	Population genetics and evolution: Hardy-Weinberg Equilib- rium, gene pool, gene frequency. Factors that upset Hardy-Weinberg Equilibrium, Effects of genetic drift on	5	1,7
	population: Bottleneck effect and founder effect		
3.0	Module III – Nature of evolution	13	2,3
------------	---	---------	-----
3.1	Species and Speciation: Species concept, subdivisions of species (sub species, sibling species, cline and deme), Speciation: Types of speciation, Phyletic speciation (autogenous and allogenous transfor- mations), True speciation, Instantaneous and gradual specia- tion, allopatric and sympatric speciation	4	2,3
3.2	Isolation: Types of isolating mechanisms-Geographic isola- tion (mention examples) and Reproductive isolation. Role of isolating mechanisms in evo- lution	3	2,3
3.3	Microevolution, Macroevolution (Adaptive radiation - Darwin finches) Mega evolution, Punctuated equilibrium, Geological time scale, and Mass ex- tinction (brief account only). Evolution of Horse	3 3	2,3
PART II –	ETHOLOGY (	14 Hrs	5.)
4.0	Module IV – Introduction	1	6
	Definition, History and scope of ethology	-	0
5.0	Module V – Learning, imprinting and behaviour	9	6
5.1	Types of learning with examples; patterns of behaviors – types of rhythms, navigation,	5	6
	homing instinct, hibernation, aestivation		
5.2	Pheromones- types and their effect on behavior, hormones and their action on behavior (aggressive and paren- talbehavior)	4	6
6.0	Module VI – Social organization	4	6
	Social organization in insects (ants) and mammals (monkey), Courtship behaviour and reproductive strategies		
PART III -	ZOOGEOGRAPHY	(10 Hrs	s.)
7.0	Module VII – General Topics	4	5
	Continental drift theory, Types and means of animal distribution,		
	Factors affecting animal		
8.0	distribution; insular fauna – oceanic islands and continental islands Module VIII - Zoogeographical realms	6	5
	<ul><li>Palaearctic region, Nearctic region, Neotropical region, Ethiopianre- gion, Oriental region,</li><li>Australian region (brief account with physical features and fauna,</li><li>Wallace's line, Weber's</li></ul>		
1	line Disconstruction of India with an exist reference to Western Chots		

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## **EVOLUTION**

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# ZOOGEOGRAPHY

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- 2. Chandran Subash M.D. (1997). On the ecological history of the Western

Ghats.CurrentScience, Vol.73, No.2.146-155.

3. Chundamannil Mammen.1993, History of Forest management in Kerala.

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6. Nair, C.S. (1991). The Southern Western Ghats: A Biodiversity Con-

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8. Tiwari, S. (1985), Readings in Indian Zoogeography (vol.1). Today & Tomorrow Printers& Publishers.

Course	Details
Code	ZY5CRP07
Title	Evolution, Ethology & Zoogeography (P)
Semester	V
Туре	Course Course
Credits	1
Name of Teacher	Ms. Ann Susan Mathew

CO NO.	EXPECTED COURSE OUTCOME- Upon	COGNITIVELEVEL
	completion of this course the students will be ableto ;	
1	Identify various zoo geographical realms, en- demicspecies and distribution of animals.	U
2	Understand the concept of homology, analogy and adaptive radiation.	U
3	Understand the route of HMS Beagle	U
4	Examine connecting links	An
5	Identify various stages of horse evolution	U
6	Identify various behavioral patterns and the use of pheromones.	U

Evolution, Ethology & Zoogeography - (Practical - V SEM)																
	ZY5CRP07															
CO	PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	2	0	0	3	1	0	0	0	2	2	1	0	0	1
2	3	0	3	0	0	2	1	0	0	0	2	1	0	0	0	1
3	3	0	1	0	0	3	0	0	0	0	1	2	0	0	0	1
4	3	0	3	0	0	1	1	0	0	0	1	2	0	0	0	1
5	3	0	3	0	0	1	1	0	0	0	1	2	0	0	0	1
6	2	0	3	0	0	3	1	0	0	0	1	0	1	1	0	1

MOD-	COURSE DESCRIPTION	Hrs.	CO.N
ULE			0.
1.0	Identification of Zoogeographical realms using map	4	1
2.0	Study on endemic species of each realm	5	1
3.0	Show the discontinuous distribution of (lung fishes, camel, elephant)	4	1
4.0	Providing a map trace the route of HMS Beagle	3	3
5.0	Providing a map mark any two continental/oceanic islands.: Greenland, Madagascar,	2	1
	New Zealand, New Guinea, Maldives, Iceland, Hawaii – any two		
6.0	Contributions of scientists (showing photos) - Any four	3	1
7.0	Identification of different stages of horse evolution	3	5
8.0	Study on Homology and Analogy	2	2
9.0	Study on connecting links (Peripatus, Archaeopteryx, Protopter- us, Echidna)	2	4
10.0	Pheromone traps	2	6
11.0	Skinner box & T Maze	2	6
12.0	Experiment to demonstrate phototaxis and chemotaxis using Drosophi- la/House fly	2	6
13.0	Identification of behaviour (Grooming/courtship dance of flamin- gos/stickle back fish/	2	6
	Tail wagging dance/ Aggressive behaviour/ Auto/Allo grooming, Flehmen response)		
	showing pictures (Any five)2		

Course title	Human Physiology, Biochemistry, And
	Endocrinology
Course code	ZY5CRT08
Semester	V
Course type	Core
Credits	3
Name of Teacher	Ms. Emi Mathew

СО	Expected Course Outcome	CognitiveLevel				
No.	Upon completion of this course, the students willbe able to:					
1	Develop skills in performing and interpreting various laboratory procedures to investigate bloodparameters of diagnostic significance.	An				
2	Identify the instruments used inPhysiological analysis.	An				
3	Acquire skills in qualitative analysis of nutrients and obtaining results through observation of ap- propriate reactions and documentation.	An				
4	Develop skills in identification of amino acids andtheir Rf values by using chromatography.	Ар				
5	Visualise the endocrine glands in brain and analyse the effect of hormones on heartbeat ofcockroach.	An				
*PSO_F	*PSO_Program Specific outcome: CO_Course Outcome:					

ogram Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

	HUMAN PHYSIOLOGY, BIOCHEMISTRY, AND ENDOCRINOLOGY															
	ZY5CRT08															
СО	PSO												РО			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	1	2	1	0	0	3	2	1	1	1	3	0	0	2	2	2
2	1	0	0	0	0	3	1	0	0	0	3	3	2	2	2	2
3	0	0	0	0	0	3	2	2	0	0	3	0	3	2	2	2
4	0	0	0	2	0	3	2	0	0	0	3	0	0	0	0	2
5	0	0	0	0	0	3	2	0	0	0	3	0	2	2	2	2

MODUL E	COURSE DESCRIPTION	HOURS	CO.NO.
1.1	<b>Nutrition:</b> Nutritional requirements – carbohydrates, proteins, lipids, minerals (Ca, P, Fe, I), vitamins (sourcesand deficiency disorders). Importance of dietary fibre and antioxidants. Balanced diet, Recommended DietaryAllowance (RDA). Nutrition during pregnancy and lactation, Infant nutrition, Malnutrition(PEM).	4	1,2
1.2	<b>Digestion:</b> Anatomy and histology of digestive glands (liver, pancreas, salivary, gastric and intestinal). Digestionand absorption of carbohydrates, proteins and fats. Nervous and hormonal control of digestion.	4	1
2.1	<b>Respiration:</b> Phases of respiration (external respira- tion,gas transport and internal respiration). Respira- tory pigments: Haemoglobin, Myoglobin (Structure and Function). Transport of respiratory gases - transport of oxygen, oxyhaemoglobin curve, factors affecting oxyhaemoglobin curve, transport of carbon dioxide, (chloride shift). Control of respiration.	2	1
2.2	Respiratory disturbances (Hypoxia, Hypercap- nia, Asphyxia).Physiological effect of smoking, carbonmonoxide poisoning, Oxygen therapy and artificial respiration.	2	2
2.3	<b>Circulation:</b> ESR, Haemopoiesis, blood pressure, ECG.Haemostasis (blood coagulation) – clotting fac- tors, intrinsic and extrinsic pathways, anticoagulants and its mechanism of action.	2	1
2.4	Cardiovascular diseases (Jaundice, Atherosclerosis, Myocardial infarction, Thrombus, Stroke).Angiogram andangioplasty.	2	2
3.1	<b>Excretion: H</b> istology of Bowman's capsule and tub- ularpart. Urine formation – glomerular filtration, tubular reabsorption, tubular secretion. Urine con- centration – counter current mechanism. Acid – base balance,	2	1
3.2	hormonal regulation of kidney function. Renal disor- ders(kidney stone, acute and chronic renal failure, and dialysis).	2	1,2
3.3	Homeostasis: Definition, concept and im- portance inbiological system. Thermal regulation and thermal adaptation in homeotherms.	1	3

			1
4.1	<b>Nerve physiology:</b> 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.	3	1
4.2	Neurotransmitters (acetyl choline, adrenalin, dopamine). EEG. Memory, Neural disorders (brief account on Dys- lexia, Parkinson's disease, Alzheimer's disease, Epilep- sy).	2	1,2
4.3	<b>Muscle physiology:</b> Ultra structure of striated muscle, muscle proteins (myosin, actin, tropomyosin, troponin), Muscle contraction and relaxation-Sliding Filament The- ory, cross bridge cycle, biochemical changes and ATP production in muscle.	3	1
4.4	Cori cycle. Kymograph, Simple muscle twitch, muscle fatigue, tetanus, rigor mortis.	2	1
5.1	<b>Carbohydrates</b> : Basic structure, biological importance and classification of monosaccharides, oligosaccharides, polysaccharides with examples.	1	4
5.2	<b>Proteins</b> : Basic structure and classification of amino acids; structure, biological importance and classification of proteins with examples.	1	4
5.3	<b>Lipids</b> : Structure of fatty acid, saturated and unsaturated fatty acid, biological importance and classification of lipids with examples.	1	4
5.4	Vitamins and minerals: Major fat soluble and water soluble vitamins. Important minerals and trace elements required for living organisms. Biological importance of vitamins and minerals.	1	4
5.5	<b>Enzymes</b> : Chemical nature of enzymes, enzyme ac- tivation, enzyme inhibition, allosteric enzymes, iso- enzymes, co-enzymes. Michaelis–Menten enzyme kinetics.	1	5
6.1	<b>Carbohydrate metabolism</b> : Glycogenesis, Glycogenoly- sis, Gluconeogenesis, Hexose monophosphateShunt.	3	4
6.2	Glycolysis, Citric Acid Cycle, Electron Transport Chain and ATP synthesis. Ethanol metabolism.	3	4

6.3	<b>Protein metabolism</b> : Deamination, Transamination, Transmethylation, Decarboxylation, Ornithine cycle.	2	4
6.4	<b>Lipid metabolism</b> : Biosynthesis of fatty acids, Beta oxidation, physiologically important compounds synthesized from cholesterol.	2	4
7.1	<b>Endocrine physiology:</b> Hormones – classification and mechanism of hormone action.	2	7
7.2	Major endocrine glands, their hormones, functions and disorders (hypothalamus, pituitary gland, pineal gland, thyroid gland, parathyroid gland, islets of Langerhans, adrenal gland).	5	6
7.3	Homeostasis and feedback mechanism.	1	7

### References

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Course title	Human Physiology, Biochemistry, And
	Endocrinology - Practicals
Course code	ZY5CRP08
Programme	BSc. ZOOLOGY
Semester	V
Course type	Core
Credits	1
Name of Teacher	Ms. Emi Mathew

СО	Expected Course Outcome	CognitiveLevel						
No.	Upon completion of this course, the students will be able to:							
1	Develop skills in performing and interpreting various laboratory procedures to investigate	An						
	blood parameters of diagnostic significance.							
2	Identify the instruments used in Physiological analysis.	An						
3	Acquire skills in qualitative analysis of nutrients and obtaining results through observation of appropriate reactions and documentation.	An						
4	Develop skills in identification of amino acids and their Rf values by using chromatography.	Ар						
5	Visualise the endocrine glands in brain and analyse the effect of hormones on heartbeat of cockroach.	An						
*PSC	-Program Specific outcome: CO-Course Outcome	:						
Corr	itive I evel: D. Demember: II Understanding: A	, n Annly: An Anglyzo: E Evolució:						
Cogn C-Cr	Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create							

	Human Physiology, Biochemistry & Endocrinology															
ZY5CRP08																
CO	PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	2	2	0	1	0	3	1	0	0	1	3	3	0	0	0	1
2	3	1	0	0	0	3	1	0	2	1	2	1	0	0	1	1
3	3	1	0	0	0	3	1	0	2	1	2	1	0	0	1	1
4	3	1	0	0	0	3	1	0	2	1	2	1	0	0	1	1
5	3	1	0	0	0	3	1	0	2	1	2	1	0	0	1	1

Course	Details
Code	ZY5OPT02
Title	Public Health And Nutrition
Semester	V
Туре	Open Course
Credits	3
Name of Teacher	Mr. Varun Jolly, Ms. Ann Susan Mathew

CO NO.	EXPECTED COURSE OUTCOME-	COGNITIVELEVEL
	Upon completion of this course the students will be ableto ;	
1	Understand the role of physical activity and bal- anceddiet in maintaining health.	U
2	Use Body Mass Index to determine the current stateof health.	Ap
3	Understand the importance of yoga and meditation indaily life.	U
4	Describe public health, diseases and its prevention.	U
5	Use safety measures in daily life to promote healthand well-being	Ар

	Public Health and Nutrition															
ZY50PT02																
СО					PS	50					PO					
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	0	2	0	2	0	1	0	2	2	3	3	0	2	2	2	2
2	0	0	0	0	0	0	0	1	0	3	3	0	0	0	0	1
3	0	2	0	0	0	0	0	1	0	3	3	2	2	2	2	1
4	0	0	0	0	0	2	0	3	2	3	3	2	2	2	2	1
5	0	0	0	0	0	2	0	3	2	3	3	2	2	2	2	1

MODULE	COURSE DESCRIPTION	Hrs.	CO.						
			No.						
PART I HEALTH, EXERCISE & NUTRITION									
1.0	Definition and Meaning of Health	10	1						
1.1	Dimensions and Determination of Health	1	1						
1.2	Physical Activity and Health benefits	1	1						
1.3	Effect of exercise on body systems – Circulatory, Respirato- ry,Endocrine, Skeletal and Muscular	4	1						
1.4	Programmes on Community health promotion (Individual, Family andSociety) Dangers of alcoholic and drug abuse, medico-legal im- plications	4	1						

2.0	Nutrition and Health	10	1,2
2.1	Concept of Food and Nutrition, Balanced diet	2	1
2.2	Vitamins, Malnutrition, Deficiency Disease	2	1
2.3	Determining Caloric intake and expenditure	2	1
2.4	Obesity, causes and preventing measures	2	1
2.5	Role of Diet and Exercise, BMI	2	2
3.0	Safety Education in Health promotion	8	5
3.1	Principles of Accident prevention	1	5
3.2	Health and Safety in daily life. Health and Safety at work.	2	5
3.3	First aid and emergency care. Common injuries and their management.	2	5
3.4	Modern life style and hypokinetic diseases. Diabetese, Cardiovasculard disorders-Prevention and Management.	3	5
4.0	Life Skill Education	8	3
4.1	Life skills, emotional adjustment and well being.	4	3
4.2	Yoga, Meditation and Relaxation, Psychoneuroimmunology	4	3
PART II PU	JBLIC HEALTH AND SANITATION		
5.0	Public health and water quality	11	4
5.1	Potable water, Health and Water quality	3	4
5.2	Faecal bacteriae and pathogenic microorganisms transmitted by water.	4	4
5.3	Determination of sanitary quality of drinking water, water purifica- tiontechniques	4	4
6.0	Public health and diseases	15	4
6.1	Water borne dseases-Cholera and Typhoid.Prevention of Water bornediseases.	2	4
6.2	Food borne diseases and Prevention Botulinum, Salmenellosis, Hepatitis A	3	4
6.3	Vector borne diseases & Control measuresChikungunya, Filariasis and Dengu fever	3	4
6.4	Zoonotic disease-Leptospirosis & its control	3	4
6.5	Emerging diseases - Swine flue (H1N1), bird flue (H5N1), SARS, Anthrax	2	4
6.6	Re-emerging diseases –TB, Malaria	2	4
7.0	Health Centre visit & Report Presentation	10	1,4,5

#### **References:**

- •Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, ZoologicalSociety of Kerala, Kottayam.
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Course title	Developmental Biology
Course code	ZY6CRT09
Programme	BSc. Zoology
Semester	VI
<b>Course type</b>	Core
Credits	3
Name of Teacher	Ms. Emi Mathew

CO No.	Expected Course Outcomes	CognitiveLevel
	Upon completion of this course, the students will beable to:	
1	Understand historical perspectives, basic concepts and theories of developmental biology.	U
2	Describe fertilization, its significance, polyspermy, parthenogenesis and regeneration	U
3	Compare and contrast different developmental processes like cleavage, blastulation, gastrulation, and cell differentiation in various organisms and draw diagrams of each.	U
4	Differentiate between embryological development of frog and Chick.	An
5	Illustrate Experimental embryology and teratology	U
6	Understand and explain human Reproductive Physiology and various processes involved in human development.	U
7	Discuss reproductive health and importance of sex education and critically analyse Physiological and ethological aspects of human intervention in reproduction.	U
8	Analyse Embryo transfer technology, cloning, stem cell research, Prenatal diagnostic techniques and related Ethical issues.	An
9	Classify placenta in mammals and discuss its functions.	U
*PSO-Program	Specific outcome; CO-Course Outcome;	
Cognitive Lev Create	el: R-Remember; U-Understanding; Ap-Apply; An-A	Analyze; E-Evaluate; C-

	DEVEOPMENTAL BIOLOGY															
ZY6CRT09																
со					PS	60							Ρ	0		
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	2	2	2	3	0	1	2	0	0	0	3	0	2	2	2	2
2	3	3	2	3	0	1	2	0	0	0	3	0	2	2	2	2
3	2	2	2	3	0	1	2	0	0	0	3	0	2	2	2	2
4	2	2	2	3	0	1	2	0	0	0	3	0	2	2	2	2
5	0	1	2	3	0	1	2	0	0	0	3	0	2	2	2	2
6	1	1	1	3	0	1	1	0	0	0	3	0	2	2	2	2
7	1	1	1	3	0	1	1	0	0	0	3	3	2	2	2	2
8	1	1	1	3	0	1	3	0	0	0	3	0	2	2	2	2
9	2	1	1	3	0	1	2	0	0	0	3	0	2	2	2	2

MODULE	COURSE DESCRIPTION	HOURS	CO.NO
1.1	<b>Introduction:</b> Definition, Scope of developmental biology, sub-divisions (descriptive, comparative, experimental and chemical), historical perspectives, basic concepts and theories.	2	1
1.2	<b>Reproductive Physiology:</b> 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).	2	6
1.3	Structure of mammalian sperm and egg, Pregnancy, parturition and lactation. Reproductive health and importance of sex education.	2	7
1.4	<b>Egg types:</b> Classification of eggs based on the amount, distribution and position of yolk. Mosaic and regulative, cleidoic and noncleidoic eggs. Polarity and symmetry of egg.	2	2
1.5	<b>Fertilization:</b> Mechanism of fertilization, Significance of fertilization, Polyspermy.	1	2
1.6	Parthenogenesis- Different types and significance.	1	2

2.1	<b>Cleavage:</b> Types, planes and patterns of cleavage, Cell lineage of Planaria. Influence of yolk on cleavage.	3	3
2.2	<b>Blastulation:</b> Morula, blastula formation, types of blastula with examples.	2	3
2.3	<b>Fate maps:</b> Concept of fate maps, construction of fate maps (artificial and natural), structure of a typical chordate fate map. Significance of fate map.	2	3
2.4	<b>Gastrulation:</b> Major events in gastrulation. Morphogenetic cell movements. Influence of yolk on gastrulation. Exogastrulation. Concept of germ layers and derivatives.	3	3
2.5	<b>Cell differentiation and gene action:</b> Potency of embry- onic cells (Totipotency, Pleuripotency, Unipotency ofem- bryonic cells). Determination and differentiation in embry- onic development, Gene action during development with reference to Drosophila -maternal effect genes, zygotic genes.	4	3
3.1	<b>Embryology of Frog:</b> Gametes, fertilization, cleavage, blastulation, fate map, gastrulation, neurulation, notogenesis. Differentiation of Mesoderm and Endoderm, Development of eye. Metamorphosis of frog, Hormonal and environmental onrol.	7	4
3.2	<b>Embryology of chick:</b> Structure of egg, fertilization, cleavage, blastulation, fate map, gastrulation. Development and role of Primitive streak, Salient features of 18hour, 24 hour, 33 hour & 48 hour chick embryo.Extra embryonic membranes in chick.	7	4
3.3	<b>Human development</b> : Fertilisation, cleavage, blastocyst, implantation, placenta. Gestation, parturition and lactation. Human intervention in reproduction, contraception and birth control. Infertility, Invitro fertilization (test tube baby)	6	6
4.1	<b>Experimental embryology:</b> Spemann's constriction experiments, Organizers and embryonic induction. Embryo transfer technology, cloning, stem cell research. Ethical issues.	2	5

4.2	<b>Teratology</b> / Dysmorphology, Developmental defects: Ter- atogenesis, important teratogenic agents.(Radiations, chem- icals and drugs, infectious diseases) genetic teratogenesis in human beings.	2	5
4.3	<b>Developmental defects</b> : Prenatal death (miscarriage and still birth). Intrauterine Growth Retardation (IUGR).	1	5
5.1	General topics: Classification and functions of placenta in mammals. Regeneration in animals.	3	9
5.2	<b>Prenatal diagnosis</b> (Amniocentesis, Chorionic villi sam- pling, Ultra sound scanning, Foetoscopy, Maternal serum alpha-fetoprotein, Maternal serum beta-HCG).	2	8

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Course title	Developmental Biology – Practicals
Course code	ZY6CRP09
Semester	VI
Course type	Core
Credits	1
Name of Teacher	Ms. Emi Mathew

CO No.	Expected Course Outcomes	Cognitive Level
	Upon completion of this course, the students will beable to:	
1	Compare blastula and gastrula of chick and frog, and identify various stages of embryonic development in chick	An
2	Understand various prenatal diagnostic procedures and technological application in human development	U
3	Carry out candling and vital staining of chick embryo and identify various developmental stages.	Ар
4	Carry out dissection of reproductive organs of cockroach	Ар
5	Identify placenta found in animals	An
6	Examine the reproductive capacity of fish	Ар

Developmental Biology (Practical)																
ZY6CRP09																
СО	PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	2	1	0	0	0	3	1	0	0	0	2	1	0	1	0	1
2	2	1	0	0	0	3	1	0	0	0	3	2	0	1	0	1
3	2	1	0	0	0	3	1	0	0	0	3	0	0	1	0	1
4	2	1	0	0	0	3	1	0	0	0	2	0	0	1	0	1
5	2	1	0	0	0	3	1	0	0	0	2	0	0	1	0	1
6	2	1	0	0	0	3	1	0	0	0	3	0	0	1	0	1

Module	Course Description	Hours	CO.No.
1	Embryological studies- Blastula (frog, chick)	5	1,5
	gastrula (frog, chick), Study of placenta- pig and man		
2	Experimental embryology - Amniocentesis, Embryo transfer technology, cloning	3	2
4	Chick developmental studies - Candling method, 18 hour, 24 hour, 33 hour and 48 hour chick embryo, Vital staining- demonstration.	12	3
5	Study of reproductive organs in cockroach	6	4
6	Study of reproduction in Fish (Calculation of fecundity of fish, Calculation of gonado-somatic index)	10	6

Course	Microbiology And Immunology
Code	ZY6CRT10
Semester	VI
Туре	Core Course
Credits	3
Name of Teacher	Ms. Ann Susan Mathew

СО	Expected Course Outcomes	Cognitive
No.	Upon completion of this course, the students will be able to:	level
1	Understand the role of microbes in environment ,human health, infections and diseases and pathogenesis, transmission, preven- tion and control, epidemiology, symptomology, food and safety management, therapeutics, industrial application of microbes, role of microbes as decomposers, role in energy transfer and ecosystem functioning, different means of transport microbes, bioremediation etc.	U
2	Understands the history classification of microbes, our im- munesystem, methods in microbiology, sterilization and disin- fection, culture media, plating techniques and culture preserva- tion techniques and vaccines and vaccination.	U
3	Applies their knowledge in operating instruments like Auto- clave, Hot air oven, Bacteriological incubator, laminar flow, water bath etc., able to do culture of bacteria and fungus, mi- crobes in living condition, plating techniques, Gram staining, Antibiotic sensitivity test and drug resistance in bacteria, de- termination of ABO blood groups and Rh factor.	Ар
4	Develop proficiency in the quantitative and qualitative estima- tion of microbes, microbiology laboratory techniques andsafety procedures, aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use Appropriate methods to identify microorganisms.	Ар
5	Design and construct novel plans for dealing emerging microbial diseases, multiple drug resistant bacteria wa- ter purification techniques and waste management using microbes,	Ар
6	Analyse the transfer of STD, manifestation of allergic reactions, auto immune disorders, blood transfusion reactions etc.	An

	VI SEM MICROBIOLOGY & IMMUNOLOGY														
							Z	Y6CRT1	.0						
	PO1	PO2	PO3	PO4	PO5	P06	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	2	1	3	1	1	1	3	1	2	0	0	2	2	2	1
CO2	2	1	3	2	1	1	2	1	2	0	0	2	1	2	1
CO3	1	1	2	1	1	1	2	0	0	0	0	3	2	1	0
CO4	1	1	2	1	0	0	2	1	2	0	0	2	2	2	1
CO5	2	1	3	1	1	2	1	1	1	0	0	2	2	2	2
CO6	2	1	2	2	1	1	0	0	1	0	0	2	2	2	0

MODULE	COURSE DESCRIPTION	Hrs.	CO.No
1 1.1	Introduction: History and scope of microbiology. Outline classification of Microbes.	5	1
	(bacteria, fungus & virus )		
	Methods in Microbiology: Sterilization and disinfection - physical and chemical methods.		
1.2	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.	5	1
2 2.1	Morphology and fine structure of bacteria: Size, shape, cilia, pi- li, flagella, capsule, cell wall and its composition. Cytoplasmic membrane, protoplast, spheroblast, intracellular membrane sys- tems, cytoplasm, vacuoles, genetic material, cell inclusions, bacterial spores.	10	2
2.2	Bacterial growth Curve, Staining techniques – gram staining. Bacterial Reproduction Sexual – (conjugation, transduction)and Asexual (budding,,	5	2
	fragmentation). Virology: Structure of virus; Human, animal, and bacterial virus. Viral		
	replication, cultivation of animal viruses.		
3	Infections & Diseases: Types of infections – primary, second- aryand nosocomial infections.	4	3
5.1	(Brief Account only)Contagious diseases – epidemic, endemic and pandemic, mode of		
	Transmission – food, water, air, vectors and carriers.		
		4	3
3.2	Diseases: Epidemiology, symptomology, diagnosis and treatment. Bacterial - Clostridium		
	tetany (tetanus), Viral – HIV virus (AIDS), fungal –Candida albicans (candidiasis).		
3 3.1	Introduction to Immunology: Innate and acquired immunity, passive (natural and artificial)	5	2
	and active immunity (Natural and Artificial).Mechanisms of in- nate immunity - barriers,		
	inflammation, phagocytosis.		
3.2	Lymphoid organs: Primary (Thymus, Bone marrow) and secondary lymphoid organs (lymph	4	2
	nodes, spleen).		
	Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.		
4	Antigens, Types of antigens, haptens, adjuvants, immunoglobu-	3	2,3
4.1	mistructure, classes and functions of mininune globulins.		&4

4.2	Types of Immunity- , humoral & cell mediated immunity Monoclonal & polyclonal antibodies. Antigen – antibody reactions, Precipitation test, Agglutination test, VDRL WIDAL, ELISA.	3	2,3 &4
4.3	Auto immune diseases: Pernicious Anemia, Rheumatoid Arthritis. Immunodeficiency -AIDS. Hyper sensitivity- Type I, (E.g. Anaphylaxis) II (Transfusion reaction), III (Arthus reaction) and IV (Mantaux Test) (in brief).	3	1,2
4.4	Introduction Types of vaccines, Current Vaccines, Re- cent trends in vaccine preparation.	3	1,2

#### References

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- •Gladys Francis & Mini K.D., (Editors) (2012), Microbiology, Zoological Society of Kerala, Kottayam.
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Course	Microbiology And Immunology (P)
Code	ZY6CRP10
Programme	B.Sc Zoology,
Semester	VI
Туре	Core Practical
Credits	2
Name of Teacher	Ms. Ann Susan Mathew

CO No	<b>Expected Course Outcomes</b> Upon completion of this course, the students will be able to:	Cognitive Level
1	Develop skills and knowledge on instrumentation and preparation of culture medias and culture techniques used in microbiological studies.	Ap
2	Staining and identification of microbes	An
3	Observe motility of bacteria and understand antibiotic sensitivity	U
4	Analyse blood group of sample provided	An
5	Understand the primary and secondary lymphoid organs	U

PSO- Program Specific Outcome; CO- Course Outcome;

Cognitive Level: R- Remember; U- Understanding: Ap- Apply; An- Analyse; E-Evaluate; C- Create.

Microbiology & Immunology (Practical - VI SEM)																
ZY6CRP10																
CO		PSO PO														
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	2	0	0	3	0	0	0	0	3	2	0	0	0	1
2	3	1	0	0	0	3	1	0	0	0	2	0	0	0	0	1
3	3	1	0	0	0	3	1	0	0	0	2	0	0	0	0	1
4	1	2	0	0	0	3	1	0	0	0	2	0	0	0	1	1
5	2	3	0	0	0	3	1	0	0	0	2	0	0	0	0	1

Module	Course Description	Hrs	СО
1	Instruments –Autoclave, Hot air oven, Bacteriological incubator – Laminar air flow.	2	1
2	Preparation of solid and liquid media for microbial cul- tures. (Ingradients, pH and method of preparation) (Demonstration) (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar (b) Liquid Media(1) Nutrient broth (2) Peptone water.	4	1
3	Culture methods (Demonstration) a) Streak plate tech- nique and isolation of pure colonies. (b) Lawn culture (c) Pour plate culture (d) Liquid culture	5	1
4	Examination of microbes in living condition Hanging drop method for demonstrating motility of bacteria.	4	3
5	Gram staining – preparation, procedure, identification of Gram + ve and Gram –ve bacteria.	4	2
6	Antibiotic sensitivity test (demonstration only)	4	1,3
7	Streak plating (individual performance)	4	1
8	Preparation of a fungal smear – Lactophenol cotton blue staining and mounting	3	2
9	Determination of ABO blood groups and Rh factor (Antigen – antibody Reaction)	2	4
10	Study through photographs/ illustration, the primary immune (Bone marrow and thymus) and secondary immune (spleen and lymph nodes) organs in Rat/Man	4	5

Course	Biotechnology, Bioinformatics & Molecular Biology
Code	ZY6CRT11
Programme	B.Sc Zoology
Year/Semester	VI
Туре	Core Course
Credits	3
Name of Teacher	Ms. Priya Thomas

CO No.	Expected Course Outcomes	Cognitive
		Level
1.	Interpret the importance, tools, techniques, potential	U
	applications and hazards of biotechnology.	
2.	Understand animal cell culture methods.	U
3.	Analyse the role and action of bio fertilizers.	An
4.	Understand the principles and application of	U
	Bio informatics.	
5.	Explain the genetic concept and nature of genetic	U
	material.	
6.	Interpret gene expression and gene regulation	U
	PSO-Program Specific Outcome; CO-Course Outcome;	
	Cognitive Level: R-Remember; U-Understanding; Ap-	
	Apply; An-Analyze; E-Evaluate; C-Create	

Modul	Course Description	Hours	CO No.
e			
	BIOTECHNOLOGY	20	
1.		11	
1.1	Introduction: Scope, Brief History and Importance	1	1
1.2	Enzymes (restriction endonucleases, ligases, linkers &	3	1
	adapters), Vectors-[ Plasmids, Phage vectors, Cosmids, Artificial		
	Chromosomes] Host cells. Basic steps & techniques in rDNA		
	technology		
1.3	Gene Libraries, Construction of genomic library and cDNA	1	1
	Library.		
1.4	PCR technique and DNA amplification	1	1
1.5	Brief description of screening methods – Probes, Nucleic Acid	1	1
	hybridization		

1.6	In-situ Hybridization, Fluorescence in situ Hybridization	1	1
	(FISH), Colony hybridization.		
1.7	Methods of transfer of desired gene into target cell.	1	1
1.8	Blotting Techniques- Southern, Northern, Western	1	1
	blotting.		
1.9	DNA Finger printing (DNA Profiling) and its application.	1	1
	Molecular markers - RFLP		
2		9	
2.1	Animal Cell Culture: Brief account on methods, substrates,	3	2
	media and procedure of animal cell culture. Stem Cells, types		

	and potential use,		
2.2	Organismal Cloning- reproductive & therapeutic- brief account only.	1	2
2.3	Applications in Medicine (insulin, growth hormone, genetherapy) Agriculture (GM plants and biopesticides)	1	1, 3
2.4	Applications in Environment (bioremediation), Industry (Sin-	1	1
2.5	lactic acid, vitamins, food and beverages.	1	1
2.6	andbiologically active products.	1	1
0.7	Biological warfare & Biopiracy. Protection of biotechnologi- calinventions.	1	1
2.7	Intellectual Property Rights, Patenting and patent protection.	1	1
	BIOINFORMATICS		
3		8	
3.1	Introduction: Definition, importance and role of bioinformatics in life sciences. Computational Biology.	2	4
3.2	Biological databases: Nucleotide sequence databases (NCBI- GENBANK, DDBJ and EMBL).	1	4
3.3	Protein databases - structure and sequence databases (PDB, SWISSPROT and UNIPROT).	1	4
3.4	Introduction to Sequences alignments: Local alignment and Global alignment, Pair wise alignment (BLAST and FAS- TA land multiple sequence alignment	2	4
3.5	Phylogenetic Tree construction and Analysis	2	4
4		6	
4.1	Molecular visualization software - RASMOL.	2	4
4.2	Basic concepts of Drug discovery pipe line.	2	4
4.3	Computer aided drug discovery and its applica-	1	4
4.4	tions.Human Genome Project.	1	4
5	MOLECULAR BIOLOGY	8	

5.1	Nature of Genetic Materials: Discovery of DNA as genet-	1	5
5.2	Avery Macarty and Macleod, Hershey Chase Experiment	1	5
5.3	Prokaryotic genome, Eukaryotic ge-	1	5
5.4	nome.Structure and types of DNA &	2	5
5.5	RNA. DNA replication.	1	5
5.6	Modern concept of gene (Cistron,	1	5
5.7	muton, recon, viral genes).	1	5
6		12	
6.1	Brief account of the following Split genes (introns and ex- ons),Junk genes, Pseudogenes, Overlapping genes, Transpos-	2	6
6.2	Central dogma reverse, one gene- one enzyme hypothesis, One	2	6
6.3	gene-one polypeptide hypothesis.	2	6
	Characteristics of genetic code, Contributions of Hargo- bindKhorana		
6.4	Protein synthesis [prokaryotic]: Transcription of	2	6
6.5	mRNA,Reverse transcription, post transcriptional modi- fications.	3	6
6.6	Translation, Post translational modifications.	1	6
	Gene regulations: Prokaryotic( inducible & repressible sys- tems)Operon concept -Lac operon and Tryptophan operon.		
	Brief account of Eukaryotic gene regulation.		

- References
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Course	Biotechnology, Bioinformatics & Molecular Biology (P)
Code	ZY6CRP11
Programme	B.Sc Zoology
Year/Semester	VI
Туре	Core Course
Credits	2
Name of	Ms. Priya Thomas
Teacher	

CO No.	Expected Course Outcomes	Cognitive				
		Level				
1	Recognize and categorise the blotting techniques and DNA	R, U				
	isolation procedure used in biotechnological applications.					
2	Identify and summarise the characteristic features of ge- nome	U				
	sequences of organisms					
3	Identify and comment on protein sequences	U				
4	Use bioinformatic tools for macromolecule visualization.	Ap				
5	Differentiate the molecular composition, structural	An				
	orientaton and functional significance of macromolecules.					
PSO-Program Specific Outcome; CO-Course Outcome; Cognitive Level: R-Remember; U- Understanding; Ap- Apply; An-Analyze; E-Evaluate; C-Create						

Mapping of CO to PO and PSO																
Biotechnology, Bioinformatics and Molecular Biology (Practical)																
ZY6CRP11																
СО	PSO										PO	)				
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	3	0	1	0	0	3	1	0	0	0	3	0	0	0	0	1
2	3	1	2	0	0	3	3	0	0	0	3	1	0	0	0	1
3	3	0	2	0	0	3	3	0	0	0	3	0	0	0	0	1
4	3	0	2	0	0	3	3	0	0	0	3	0	0	0	0	1
5	3	1	2	0	0	3	3	0	0	0	3	1	0	0	0	1

Module	Course Description	Hours	CO No.
1	BIOTECHNOLOGY		
1.1	Identify and comment on the item provided: (Westernblotting / Southern blotting / Northern blotting / PCR)	6	1
1.2	Write down the procedure involved in DNA isolation	6	1
2	BIOINFORMATICS		
2.1	Download/use print out/pictures of genome sequences of any2 organisms. Identify and mention the characteristic fea- tures of both.	6	2
2.2	Download/ use print out/pictures of a protein sequence , identify it & comment on its amino acid composition.	6	3
2.3	Download / use print out/pictures of a macromolecule. Write a brief note on the bioinformatics tool used to visualize its structure.	6	4
3	MOLECULAR BIOLOGY		
3.1	Identify and comment on its molecular composition / structural orientation / functional significance (Any tissue /Cell organelles/ DNA, DNA replication, RNA different types using models or diagrams)	6	5

Course	Occupational Zoology.				
	(Apiculture, Vermiculture, Quail Farming &Aquaculture) (T)				
Code	ZY6CRT12				
Semester	VI				
Туре	Core Course				
Credits	3				
Name of Teacher	Mr. Varun Jolly				

CO No.	Expected Course outcomes:	Cognitivelevel				
	OCCUPATIONAL ZOOLOGY					
	(APICULTURE, VERMICULTURE, QUAIL FARMING & AQUACULTURE) (T)					
1.	Understand the common cultivable fishes, types of aq- uaculture, its management and fish processing and preservation.	U				
2.	Construct ornamental fish culture units for for self employment.	С				
3.	Design and management of aquariums.	С				
4.	Use vermiculture technique for better waste management.	Ар				
5.	Carry out apiculture and quail farming for self employment or as a hobby.	Ар				
6.	Understand the various species of earthworms, honey bees and be products.	U				
7.	Identify diseases of fishes, earthworms and honeybees.	U				
*PSO-Program Specific Outcome; CO-Course Outcome;						
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C- Create						

Occupational Zoology																
ZY6CRT12																
СО		PSO														
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	2	0	1	0	3	3	1	0	0	0	2	1	0	0	0	1
2	2	0	1	0	3	3	0	0	0	0	2	1	0	0	2	1
3	2	0	1	0	3	3	0	0	0	0	2	1	0	0	1	1
4	2	0	1	0	3	3	0	0	0	0	2	1	0	0	1	1
5	2	0	1	0	3	3	0	0	0	0	2	0	0	0	1	1
6	2	0	1	0	3	3	0	0	0	0	2	0	0	0	1	1
7	2	0	1	0	3	3	0	0	0	0	2	0	0	0	1	1

MODULE	COURSE DESCRIPTION	Hrs.	Co No.
1.0	APICULTURE	18	5,6,7
1.1	Definition, Different species of honey bees, Organization of honey bee colony, Social life and adaptation of honey bees. Communication among honey bees.	2	6
1.2	Bee keeping methods and equipments, Management and maintenance of an apiary, Growth period, honey flow period and	2	6,5
	dearth period Division of the colony, uniting two colonies, , re- placing old queen with new queen, swarming management, monsoon management.		
1.3	Enemies of bees. Diseases of bees.	2	7
1.4	Bee pasturage. Uses of honey bees, By-products of honey bees, Honey and wax composition. Testing the quality of honey. Ex- traction of wax, Uses of honey and wax. Royal jelly, Propolis. Apitherapy, Agencies supporting apiculture.	2	6,5
1.5	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.	10	6,5
2.0	VERMICULTURE	8	6,7,4
2.1	Introduction, Ecological classification of earth worms. Species of earth worms used for vermicultre, Reproduction & life cycle, Role of earth worm in solid waste management, in agriculture, in medicine etc.	2	6,7

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2.2	Preparation of vermibed, Maintenance & monitoring, Prepara- tion of vermicompost, Preparation of vermiwash	2	6,7,4
2.3	Activity: Submission of a report after preparing a vermiculture unit or visiting a vermicomposting unit.	4	6,7,4
3.0	QUAIL FARMING (Coturnix coturnix)	4	5
3.1	Introduction, care of quail chicks, care of adult quails, care of breeding quails, ration for quail, care of hatching eggs, health care.	2	5
3.2	Use of quail egg and meat. Sources of quality chicks.	2	5
4.0	AQUACULTURE	24	1,2,3
4.1	Advantages and salient features of aquaculture, Types of Aqua- culture, Biotic and abiotic features of water, Importance of algae in aquaculture.	2	1
4.2	Common cultivable fishes of Kerala, Fish diseases, Composite fish culture, Integrated fish culture, Carp culture, Prawn culture, Mussel culture Pearl culture. Processing & Preservation.	3	1
4.3	Aquarium management - Setting up of an aquarium, Biological filter & Aeration, Breeding of gold fish, gourami (Osphronemus), fighter and Guppy (live bearer). Nutrition and types of feed for aquarium fishes, Establishment of commercial ornamental fish culture unit.	2	3,2
4.4	Transportation - Live fish packing and transport Common dis- eases of aquarium fishes and their management. Aquaponics (a brief introduction only).	2	1
4.5	Activity – Setting up of an Aquarium	5	3
4.6	Field visit – Visiting an Aquaculture farm	10	3

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George cust& Peter Bird, Tropical Fresh water Aquaria, Hamlyn London.
Course	Occupational Zoology .
	(Apiculture, Vermiculture, Quail Farming &Aquaculture) (P)
Code	ZY6CRP12
Programme	B.Sc Zoology
Semester	VI
Туре	Core Course
Credits	1
Name of Teacher	Mr. Varun Jolly

CO No.	Expected Course outcomes:	Cognitivelevel				
	OCCUPATIONAL ZOOLOGY (P)					
1	Identify the types of culturable fishes, earthworms and honey bees.	U				
2	Determine the castes of honey bees.	Ар				
3	Determine various bee keeping equipments and Components of aquarium.	Ар				
4	Identify bee products, silk, chandrika, natrika andver- micompost	U				
5	Identify fish diseases and parasites	U				
6	Determine adulteration in honey	Ар				
7	Carry out temporary mounting and separation of co- coon.	Ар				
*PSO-Program Specific Outcome; CO-Course Outcome;						
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-						

Create

	Occupational Zoology (Practical - VI SEM)															
	ZY6CRP12															
CO	PSO PO															
	<b>1 2 3 4 5 6 7 8 9 10 1 2 3 4</b>								5	6						
1	2	0	1	0	3	3	1	0	0	0	2	1	0	0	0	1
2	2	1	1	0	3	3	0	0	0	0	2	1	0	0	0	1
3	1	0	1	0	3	3	0	0	0	0	2	1	0	0	0	1
4	1	0	1	0	3	3	0	0	0	0	2	1	0	0	0	1
5	2	0	1	0	3	3	0	0	0	0	2	0	0	0	0	1
6	2	0	1	0	3	3	0	0	0	0	2	0	0	0	0	1
7	2	0	1	0	3	3	0	0	0	0	2	0	0	0	0	1

MODUL E	COURSE DESCRIPTION	Hrs.	Co No.
1.0	1. General Identification, Economic importance, Morpholo- gy,scientific names and common names of the following	4	1
	a) Economic important and morphology of culturable fishes (Catla, Rohu, Grass carp, Common carp, Silver carp, <i>Etroplus suratensis</i> , Oreochromis /Tilapia, <i>Mugil cephalus</i> and <i>Anabas Testudineus</i> )		
	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 - Crasostria and pearl oyster - Pinctada fucata and freshwater mussel - <i>Lamellidens marginalis</i> ).		
2.0	Castes of bees	2	2
3.0	Principle & uses of - Aquarium filters, Aquarium aerator, Aquarium plants, Oven, Pelletiser, Screw Press, die plate	2	3
4.0	Identification and study of fish parasites and diseases (five numbers each) using slides/pictures	3	5
5.0	Bee keeping equipments, Beehive, Smoker, honey extractor, Queen Cage	3	3
6.0	Bees wax, Honey, Vermicompost (Identification-Uses)	3	4
7.0	Formulation of artificial feed for aquarium fishes – demon- stration	3	3
8.0	Tests for determining the adulteration in honey.	6	6
9.0	Mounting of pollen basket	2	7
10.0	Mounting of mouth parts of honey bee	4	7
11.0	Separation of cocoon from worm castings.	4	7

Course	Nutrition, Health and Lifestyle Management
Code	ZY6CBT04
Semester	VI
Credits	3
Name of Teacher	Ms. Priya Thomas, Ms. Emi Mathew

CO No.	Expected Course Outcome	CognitiveLevel
1	Understand the concept of health, balanced nutrition and good lifestyle practices.	U
2	Analyse the normal health standards and the use of devices used to measure different health parameters.	An
3	List the food safety laws and regulations	R
4	Create good life style practices, follow healthy food habitsand maintain physical and mental fitness	С

## Mapping of CO to PO and PSO

Nutrition, Health and Lifestyle Management																
	ZY6CBT04															
СО	CO PSO PO															
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6
1	0	2	0	0	0	1	1	3	1	3	3	0	2	1	1	1
2	0	2	0	0	0	2	1	3	1	3	3	2	0	2	1	1
3	0	0	0	0	0	0	1	3	1	3	3	2	2	2	2	1
4	0	0	0	0	0	0	0	3	0	3	3	2	2	2	2	2

Modu	Course Description	Hours	CO No.
le			
1		15	
1.1	Nutrition and health: Nutritional requirements of man,	3	1
	classification of major nutrients including protein, vitamins and		
	minerals, water.		
1.2	Role of fibre, biological value of food components, food groups	3	1
	and sources, balanced diet.		
1.3	RDA, BMI, BMR, Calorie intake and expenditure.	1	1
1.4	Healthy eating pyramid, Nutrition in infancy, preschool, school,	3	1
	adolescent, pregnancy, lactation and old age.		

1.5	Nutrition in diseases and special conditions.	3	1
1.6	Food safety: Nutrition education, food sanitation and hygiene,	2	3
	food adulteration and consumer protection.		
2		18	
2.1	Understanding of health: Define health, basic concepts,	5	1
	dimensions of health, basic parameters of health care.		
2.2	Health Parameters: Individual normal standards	1	2
2.3	Devices 1. Blood pressure, 2. Brain activities and sleep, 3. Focus	12	2
	or attention, 4.Pulse, 5. Body temperature, 6. Daily physical		
	activities, 7. Electrocardiogram (ECG), 8.Cardiac fitness 9.		
	Stress, 10. Haematological parameters, 11. BMI.		
3		15	
3.1	Introduction to Life style diseases	1	4
3.2	Common life style diseases: Alzheimer's disease and other	2	4
	neural disorders, asthma, cancer.		
3.3	Cardio vascular diseases - including hypertension.	2	4
	Atherosclerosis and stroke, chronic obstructive pulmonary		
	disease.		
3.4	Diabetes Mellitus or Type 2 Diabetes, depression, obesity.	2	4
	osteoporosis.	_	
3.5	Constipation, gastro-intestinal disturbances including	2	4
	diarrhoea and peptic ulcer.		-
3.6	Liver cirrhosis and other liver diseases.	2	4
3.7	Occupational lifestyle diseases.	2	4
3.8	Modern lifestyle disorders: sleeping habits, junk food, poor	2	4
	eating habits, anxiety, food poisoning.		
4		10	
4.1	Causes of lifestyle diseases.	2	4
4.2	Defects of modern food habits and unbalanced diet options.	2	4
4.3	Food adulteration, environmental pollution, poor life style	2	4
	choices.		
4.4	Drug abuse, tobacco smoking, alcohol and drug consumption.	2	4
4.5	Lack of adequate exercise, wrong body posture, disturbed	2	4
	biological clock, stressful environmental conditions.		
5		14	
5.1	Prevention and control of life style diseases.	1	4
5.2	Healthy life style habits and practices, healthy eating habits,	6	4
	exercise and fitness, good sleep patterns, a strict no to alcohol,		
	drugs, and other illegal drugs. Uncontrollable factors like age,		
	gender, heredity and race.		
5.3	Healthy diet: disease prevention through appropriate diet and	4	4

	nutrition, avoiding foods that are high in fats, salt and refined		
	products. Avoid junk food and replace by natural food/organic		
	food.		
5.4	Physical exercise: Moderate exercise for fitness of body,	2	4
	walking, stretching, right postures of sitting & standing,		
	relaxation and cutting down of stress, sports, aerobic exercise		
	and yoga.		
5.5	Health literacy as a public health goal: Awareness programs in	1	4
	schools, colleges and through mass media.		

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