VIVEKANANDA COLLEGE

College with Potential for Excellence

Residential & Autonomous – A Gurukula Institute of Life-Training

Re-accredited (3rd Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC

Affiliated to Madurai Kamaraj University

(Managed by Sri Ramakrishna Tapovanam, Tirupparaitturai, Trichy)

TIRUVEDAKAM WEST, MADURAI DISTRICT– 625 234

www.vivekanandacollege.ac.in

Department of Zoology

Programme**: B.Sc Zoology**

Learning Outcomes based Curriculum Framework (LOCF)

(For those students admitted during the Academic Year 2018-19 and after)

POST GRADUATE AND RESEARCH DEPARTMENT OF ZOOLOGY
B.Sc. ZOOOLOGY

Vision

- Unravel hidden research potentials & Entrepreneurial avenues in Zoology
- Bring a behavioural change in Course knowledge, scientific aptitude and instrumental skills to attract students with best caliber
- Raise students to international standards

Mission

- Strategic plans for translating goals and objectives by curriculum design, good teaching methods and evaluation
- Academic and research collaborations
- Bio-track –A forum to update knowledge
- Hands on training at Bio industries

Programme Educational Objectives (PEO)

A graduate of B.Sc. Zoology programme after five years will

PEO 1	Acquire comprehensive knowledge of Zoology and excel in the chosen area
PEO 2	Develope confidence to prepare for competitive examinations
PEO 3	Inculcate students to pursue higher education and lifelong learning
PEO 4	Motivate students to develop an aptitude for animal preservation and research
PEO 5	Train the youth for self-employment generation to become an entreprenuer

Programme Outcomes (PO)

On completion (after three years) of B. Sc Zoology programme, the students are able to

PO 1	Knowledge on animal taxonomy, preservation techniques and physiology will enable to become museum keepers.
PO 2	Understanding organization of cell, cell organelles and its function, genetics, evolutionary relations and significance with physiology in molecular level.
PO 3	Applications of the techniques and biology module in biotechnology, bioinformatics, biostatistics, immunology, lab technology and micro biology.
PO 4	Use the animals in human welfare, societal behaviour, diagnosis of disease, ancestry study, system regulations, source as food and genetics and developmental counseling.
PO 5	Enhance entrepreneurial skills to be self employable.

Graduate Attributes (GA)

	Attributes	Description	Part
GA 1	**Modern Tool Usage**	Application of appropriate techniques, resources and modern tools to complex activities with an Understandinging of the limitations	**Hand**
GA 2	**Environment and Sustainability**	Understandinging the impact of solutions in societal and environmental contexts for sustainable development	**Hand**
GA 3	**Technical and Entrepreneurial Skills**	Creating confidence to become an entrepreneur by providing entrepreneurial and technical skills	**Hand**
GA 4	**Capacity**	Ability to face the realities of life and withstand current challenges	**Hand**
GA 5	**Graduate and Society**	Application of reasoning to assess social health, safety, legal and cultural issues and the consequent responsibilities relevant to the social practice	**Heart**
GA 6	**Ethics and Values**	Application of ethical principles, professional ethics, responsibilities and norms of the life through value oriented life training	**Heart**
GA 7	**Creativity**	Demonstration of knowledge, Understandinging of	**Heart**

		management principles and application of these to one's own work to manage projects and in multidisciplinary environments	
GA 8	**Harmonious Development of Individual**	Making an individual as perfect man through the harmonious development of physical, emotional and intellectual cultures	**Heart**
GA 9	**Adaptability**	Accepting the ground realties and adapt to the situation to overcome frustrations and failures.	**Heart**
GA 10	**Knowledge**	Application of knowledge of the respective discipline to the solution of complex problems in the day-to-day life	**Head**
GA 11	**Critical Thinking**	Analysis of problems to reach substantiated conclusion by using the principles of mathematics, natural and social sciences and byusing research-based knowledge and research methods	**Head**
GA 12	**Problem Solving**	Designing of solution for complex problems that meet the specified needs with appropriate consideration as to public health and safety, cultural and societal environment	**Head**
GA 13	**Leadership Quality**	Functioning effectively as an individual, as a member or a leader in diverse teams and in multidisciplinary settings	**Head**
GA 14	**Communication**	Communication with society at large, such as, effective reporting, documentation designing, effective presentations and clear instructions	**Head**
GA 15	**Life-long learning**	Recognizing the need for independent and life-long learning in the context of technological changes	**Head**

Mapping of PEO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
PEO 1					
PEO 2					
PEO 3					
PEO 4					
PEO 5					

Mapping of PO with GA

	GA 1	**GA 2**	**GA 3**	**GA 4**	**GA 5**	**GA 6**	**GA 7**	**GA 8**	**GA 9**	**GA 10**	**GA 11**	**GA 12**	**GA 13**	**GA 14**	**GA 15**
PO 1															
PO 2															
PO 3															
PO 4															
PO 5															

Assessment

Under Graduate Programmes - Question Paper Pattern for Both CIA & End Semester Examinations

With Effect From: 2018-19 onwards

Part I (Tamil / Sanskrit/Hindi) and Part II

OBE Syllabus UG: Section A – Remembering (K1)
Section B – Remembering (K1)
Section C – Understanding (K2)
Section D – Applying (K3)

CIA Test Question Paper Pattern (UG) – 3 Tests per Semester – 2 Hours

Section - A: MCQs (Compulsory)	10 X 1 =10 Marks
Section - B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (3 out of 5)	3 X 6 = 18 Marks
Section - D: LA (1 out of 2)	1 X 12 =12 Marks

Total	**50 Marks**

End Semester Examinations Question Paper Pattern (UG) – 3 Hours

Section - A: MCQs	10 X 1 =10 Marks **(From Question Bank given by the Course Teacher)**
Section - B: VSA (5 out of 7)	5 X 2 =10 Marks
Section - C: SA (Either-or)	5 X 5 = 25 Marks
Section - D: LA (3 out of 5)	3 X 10 =30 Marks

Total	**75 Marks**

Part III (Core, Allied &Elective)

CIA Test Question Paper Pattern (UG) – 3 Tests per Semester – 2 Hours

Section - A: MCQs (Compulsory)	10 X 1=10 Marks
Section - B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (3 out of 5)	3 X 6 = 18 Marks
Section - D: LA (1 out of 2)	1 X 12=12 Marks

Total	**50 Marks**

End Semester Examinations Question Paper Pattern (UG) – 3 Hours

Section - A: MCQs	10 X 1 =10 Marks **(From Question Bank given by the Course Teacher)**
Section - B: VSA (5 out of 7)	5 X 2 =10 Marks
Section - C: SA (Either-or)	5 X 5= 25 Marks
Section - D: LA (3 out of 5)	3 X 10 =30 Marks

Total	**75 Marks**

Part IV (SBS-Skills Based Course)

CIA Test Question Paper Pattern (UG) – 3 Tests per Semester at Department Level– 1 Hour

Section - A: MCQs	5 X 1 = 5Marks
Section - B: VSA (2 out of 4)	2 X 2 = 4 Marks
Section - C: SA (1 out of 2)	1 X 6 = 6 Marks
Section - D: LA (1 out of 2)	1 X 10=10 Marks

Total	**25 Marks**

For competitive exam questions Pattern (OMR with 4 options will be used) 50X1=50 (**1 hour**)

End Semester Examinations Question Paper Pattern (UG) – 2 Hours

Section - A: MCQs	10 X 1 = 10 Marks **(From Question Bank given by the Course Teacher)**
Section - B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (Either-or)	3 X 9 = 27 Marks
Section - D: LA (2 out of 4)	2 X 14= 28 Marks

Total	**75 Marks**

For competitive exam questions Pattern (OMR with 4 options will be used) 75X1=75 (**2 hours**)

Part IV (Non Major Elective, Value Education and Environmental Studies)

CIA Test Question Paper Pattern (UG) – 1 Test per Semester – 2 Hours

Section - A: MCQs	10 X 1 = 10 Marks
Section -B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (3 out of 5)	3 X 6 = 18 Marks
Section - D: LA (1 out of 2)	1 X 12= 12 Marks

Total	**50 Marks**

End Semester Examinations Question Paper Pattern (UG) – 2 Hours

Section - A: MCQs	10 X 1 = 10 Marks **(From Question Bank given by the Course Teacher)**
Section - B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (Either-or)	3 X 9 = 27 Marks
Section - D: LA (2 out of 4)	2 X 14= 28 Marks

Total	**75 Marks**

Part V (End Semester Examinations only)

EXTENSION ACTIVITIES

End Semester Examinations Question Paper Pattern (UG) – 2 Hours

Section - A: MCQs	10 X 1 = 10 Marks
Section - B: VSA (5 out of 7)	5 X 2 = 10 Marks
Section - C: SA (Either-or)	3 X 9 = 27 Marks
Section - D: LA (2 out of 4)	2 X 14= 28 Marks

Total	**75 Marks**

Part VI (End Semester Examinations only) UG & PG

1. General Knowledge **– (One Examination per Semester– UG & PG) – 1 Hour**

Section – A: MCQs 50 X 1 =50 Marks (**OMR Sheet**)

Total **50** Marks

2. Wit for Wisdom and Humour for Health – (One Examination per Year – UG & PG) – 1 Hour

Section – A: LA (5 out of 7) 5 X 20= 100 Marks

Total **100** Marks

3. Spiritual Education– (One Examination per Year – UG & PG) – 1 Hour

Section – A: VSA 20 X 2= 40 Marks
Section – B: SA (3 out of 5) 3 X 5 = 15 Marks
Section –C: LA (2 out of 4) 2 X 10 =20 Marks

Total **75** Marks

4. Physical Training– (One Examination for III Year UG & II Year PG Students) – 1 Hour

Section - A: MCQs 10 X 1 = 10 Marks
Section – B: SA ((Either-or)) 4 X 5 = 20 Marks
Section – C: LA (2 out of 4) 2 X 10 =20 Marks

Total **50** Marks

Continuous Internal Assessment (CIA) - Distribution of Marks

	UG		**PG**	
Part - I, II Part - III	Test (Best Two)	15 Marks	Test (Best Two)	15 Marks
	Cycle Test (5 × 1 = 5)	5 Marks	Quiz / Seminar	5 Marks
	Assignment (5 × 1 = 5)	5 Marks	Assignment	5 Marks
	Total	**25 Marks**	**Total**	**25 Marks**
Part- IV	Test (Best Two for SBS)	20 Marks		
	Assignment	5 Marks		
	Total	**25 Marks**		

Abbreviations:

MCQs: Multiple Choice Questions
SA : Short Answer
VSA: Very Short Answer
LA : Long Answer

Core Practical

Bloom's Taxonomy	Continuous Internal Assessment (CIA)					End Semester Examinations (ESE)					
	Major	**Minor**	**Spotters**	**Record**	**Total**	**Major 1**	**Major 2**	**Minor**	**Spotters**	**Record**	**Total**
Remembering **(K1)**	5	2	4	5	**Total 40 marks**)	3.5	3.5	2	5	5	(**Total 60 marks**)
Understanding**ing (K2)**		3	4					4	5		
Applying**ing (K3)**	10	3	4			11.5	11.5	4	5		

Allied Practical

Bloom's Taxonomy	Continuous Internal Assessment (CIA)					End Semester Examinations (ESE)				
	Major	**Minor**	**Spotters**	**Record**	**Total**	**Major**	**Minor**	**Spotters**	**Record**	**Total**
Remembering **(K1)**	5	2	4	5	**Total 40 marks**)	5	5	10	5	(**Total 60 marks**)
Understanding**ing (K2)**		3	4				5	10		
Applying**ing (K3)**	10	3	4			15	5			

PG AND RESEARCH DEPARTMENT OF ZOOLOGY

Programme: B.Sc. Zoology (Under CBCS and OBE)

SCHEME OF EXAMINATIONS

FIRST SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
I	Tamil	P1LT11	Ikkalak Kavithaiyum Nadagamum	6	3	25	75	100
	Sanskrit	P1LS11	Fundamental Grammer & History of Sanskrit Literature-I					
II	English	P2LE11	General English-I	6	3	25	75	100
III	Core	09CT11	Invertebrates – I	4	4	25	75	100
	Core	09CT12	Invertebrates – II	4	4	25	75	100
	Core		Practical –I	2	-	-	-	-
	Allied	07AT01	Chemistry for Biologist-I	4	4	25	75	100
	Allied		Volumetric Estimation	2	-	-	-	-
IV	Non Major	09NE11	Non Major Elective paper I: Human Anatomy	2	2	25	75	100
			TOTAL	**30**	**20**			

SECOND SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
I	Tamil	P1LT21	Ikkalak Kadhai Ilakkiyamum Makkal Thagavaliyalum	6	3	25	75	100
	Sanskrit	P1LS21	Poetry, Grammar & History of Sanskrit Literature – II					
II	English	P2LE21	General English - II	6	3	25	75	100
III	Core	09CT21	Chordates-I	4	4	25	75	100
	Core	09CT22	Chordates-II	4	4	25	75	100
	Core	09CP23	Practical-I	2	4	40	60	100
	Allied	07ATZ2	Chemistry for Biologist - II	4	4	25	75	100
	Allied	07APZ3	Volumetric Analysis	2	2	40	60	100
IV	Non Major	09NE21	Non Major Elective paper II: Food and Nutrition	2	2	25	75	100
			TOTAL	**30**	**26**			

THIRD SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
I	Tamil	P1LT31	Tamil: Idaikkala Ilakkiyamum Urainadaiyum	6	3	25	75	100
	Sanskrit	P1LS31	Prose, Poetics and History of Sanskrit Literature – III					
II	English	P2LE31	English for Academic and Professional Excellence-I	6	3	25	75	100
III	Core	09CT31	Cell Biology	4	4	25	75	100
	Core	09CT32	Genetics	4	4	25	75	100
	Core		Practical-II	2	-	-	-	-
	Allied	08AT01	Allied paper-I : Biodiversity	4	4	25	75	100
	Allied		Allied: Botany Practical-I	2	-	-	-	-
IV	Skill Based	09SB31	Skill Based Paper-I: Public Health and Hygiene	2	2	25	75	100
			TOTAL	**30**	**20**			

FOURTH SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
I	Tamil	P1LT41	Sanga Ilakkiamum Neethi Ilakkiamum	6	3	25	75	100
	Sanskrit	P1LS41	Drama, History of Sanskrit Literature-IV					
II	English	P2LE41	English for Academic and Professional Excellence-II	6	3	25	75	100
III	Core	09CT41	Developmental Biology	4	4	25	75	100
	Core	09CT42	Physiology	4	4	25	75	100
	Core	09CP43	Practical II	2	4	40	60	100
	Allied	08AT02	Taxonomy of Angiosperms and Plant Physiology	4	4	25	75	100
	Allied	08AP03	Allied : Practical-I	2	2	40	60	100
IV	Skill Based	09SB41	Skill Based Paper-II: Clinical Lab Technology	2	2	25	75	100
			TOTAL	**30**	**26**			

FIFTH SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
III	Core	09CT51	Biochemistry and Biophysics	5	4	25	75	100
	Core	09CT52	Biotechnology	5	4	25	75	100
	Core	09CT53	Microbiology & immunology	5	4	25	75	100
	Core		Practical III	3+3	-	-	-	-
	Elective	09EP51	Biostatistics, Computer Applications & Bioinformatics	5	5	25	75	100
IV	Skill Based	09SB51	Sericulture	2	2	25	75	100
	ES	ESUG51	Environmental Studies	2	2	25	75	100
			TOTAL	**30**	**21**			

SIXTH SEMESTER

Part	Study Component	Course Code	Course Title	Hours	Credits	CIA	ESE	Total
III	Core	09CT61	Evolution	6	4	25	75	100
	Core	09CP62	Practical III	3+3	4	40	60	100
	Elective	09EP61	Dairy Farming	5	5	25	75	100
	Elective	09EP62	Environmental Biology	5	5	25	75	100
IV	Skill Based	09SB61	Fish Culture	2	2	25	75	100
	Skill Based	09SB62	Vermitechnology	2	2	25	75	100
	Skill Based	09SB63	Zoology for Competitive Examination	2	2	25	75	100
	VE	VEUG61	Value Education	2	2	25	75	100
V	EA	EAUG61	Extension Activities	-	1	--	100	100
			TOTAL	**30**	**27**			
			Total Hours and Credits :	**180**	**140**			

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- I**
Course Title **: INVERTEBRATES - I**		
Course Code: **09CT11**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students acquire knowledge on general characteristics, classification of Invertebrates and study the organization of various organs and organ systems.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on general characteristic features, morphology and classification of Invertebrates (Protozoa – Helminthes)	K1
CO 2	Understanding the diversity and distribution of invertebrate fauna at different habitats	K2
CO 3	Study the lifecycle and adaptation of Protozoan and helminthes parasites of human, mode of transmission and treatment	K2
CO 4	Trace the origin, evolutionary relationships, phylogeny and affinities of minor phyla.	K2
CO 5	Applying studied information to have knowledge on cattle and human diseases, observe marine animals at their natural habitats and Understanding their biodiversity through field visit	K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	Phylum Protozoa General Characters of the phylum and classification upto class level Type study : Paramecium General topics : a) Locomotion in protozoa b) Nutrition in protozoa c) Etiology and life cycle of protozoan parasites of man (Entamoeba, Plasmodium and Trypanosoma)	**(12 Hrs)**
UNIT-II:	Phylum Porifera General characters of the phylum and classification upto class level Type study : Ascon sponge General topics : a) Canal system in sponges b) Spicules of sponges. c) Reproduction in sponges	**(12 Hrs)**
UNIT- III:	Phylum -Coelenterata General characters of the phylum and classification up to class level Type study : Obelia General topics : a) Polymorphism in hydrozoa	**(12 Hrs)**

	b) Coral reefs c) Ctenophora Structure and affinities	
UNIT- IV:	Phylum Platyhelminthes General characters of the phylum and classification upto class level. Type study : *Fasciola hepatica* General topics : a) Origin of metazoa b) Origin of bilateria	**(12 Hrs)**
UNIT- V:	Phylum Aschelminthes General characters of the phylum and classification upto class level Type study : Ascaris General Topics : a) Helminth parasites - Enterobius and Wuchereria - Disease and control b) Parasitic adaptations in Helminthes.	**(12 Hrs)**

Text Books

Jordan, E.I. and Verma, P.S. 2014 – Invertebrate Zoology, Chand& Co Limited, New Delhi.

Reference Books

- Pechenik, Jan A 2014 – Biology of the Invertebrates, Tata Mcgraw – Hill Pub. Company Ltd., New Delhi
- Vasantika Kashyap, 2013, Life of Invertebrates, Second Revised Edition, Vikas Pub. House Pvt. Ltd., New Delhi
- Kotpal, R.L. 2012. Modern Text Book of Zoology, Invertebrates (Animal diversity – I), Rastogi Publications, Meerut
- Barnes, R.D. 2006,Invertebrate Zoology, IV Edition, Holf Saunders International edition
- Ekambaranatha Ayyar and Ananthakrishnan, T.N. 2005, A manual of Zoology, volume I, Invertebrate, Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Lectures**	**Content Delivery Method**	**Teaching Aids**
	Unit -1 Phylum : Protozoa			
1.1	General Characters of the phylum	1	Chalk & Talk	Green Board
1.2	classification upto class level	1	Chalk & Talk	Microscope
1.3	Type study of Paramecium	4	Lecture	PPT & White board
1.4	Locomotion in protozoa	1	Lecture	Green Board
1.5	Nutrition in protozoa	1	Lecture	Green Board
1.6	Entamoeba	1	Discussion	Green Board
1.7	Plasmodium	2	Discussion	Green Board
1.8	Trypanosoma	1	Discussion	Green Board

	Unit -2 Phylum : Porifera			
2.1	General characters of the phylum	1	Lecture	Green Board Charts
2.2	classification upto class level	2	Chalk & Talk	Green Board
2.3	Type study of Ascon sponge	3	Chalk & Talk, ppt	Green Board Smart Board
2.4	Canal system in sponges	2	Chalk & Talk	Green Board
2.5	Spicules of sponges	2	Chalk & Talk Specimen	Green Board Microscope
2.6	Reproduction in sponges	2	Chalk & Talk	Green Board
	Unit -3 Phylum : Coelenterata			
3.1	General characters of the phylum	1	Chalk & Talk	Green Board
3.2	Classification upto class level	2	Lecture PPT	Green Board Smart Board
3.3	Type study of Obelia	3	Discussion Specimen	Green Board Microscope
3.4	Polymorphism in hydrozoa	2	Lecture	Video
3.5	Coral reefs	2	Chalk & Talk ppt	Green Board LCD
3.6	Ctenophora Structure and affinities	2	Chalk & Talk	Green Board
Unit -4	Phylum : Platyhelminthes			
4.1	General characters of the phylum	1	Discussion	Green Board
4.2	Classification upto class level	2	Chalk & Talk	Green Board
4.3	Type study of *Fasciola hepatica*	4	Chalk & Talk Specimen	Green Board Microscope
4.4	Origin of metazoa	2	Chalk & Talk	Green Board
4.5	Origin of bilateria	2	Lecture	Green Board
	Unit -5 Phylum : Aschelminthes			
5.1	General characters of the phylum	1	Lecture	Green Board
5.2	Classification up to class level	2	Chalk & Talk	Green Board
5.3	Type study of Ascaris	3	Chalk & Talk	Green Board
5.4	Enterobius	2	Chalk & Talk	Green Board
5.5	Wuchereria	2	Chalk & Talk	Green Board
5.6	Parasitic adaptations in Helminthes	2	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- I**
Course Title **: INVERTEBRATES - II**		
Course Code: **09CT12**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students Understanding basic aspects of invertebrate biology with their salient features and study of animal organization, comparative anatomy and functional morphology

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Learn the general characteristics and classification of invertebrates (Annelida – Echinodermata)	K1
CO 2	Study the biodiversity of invertebrates in different habitats	K2
CO 3	Can trace the development and affinities of invertebrates	K2
CO 4	Acquire knowledge on social and economical importance of insects	K2, K3
CO 5	Learn the adaptive radiation of marine forms	K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	Phylum Annelida General characters and classification upto class level with examples. Type study : Nereis General topics : a) Origin of coelom and metamerism b) Adaptive radiation in polychaetes	**(12 Hrs)**
UNIT-II:	Phylum Arthropoda General characters and classification up to class level with examples. Type study : Prawn General topics : a) Peripatus - Structure and affinities b) Larval forms of crustacea.	**(12 Hrs)**
UNIT- III:	External characters of Scorpion, Centipedes and Millipedes General topics : a) Social Life of Insects b) Economic Important of Insects	**(12 Hrs)**
UNIT- IV:	Phylum Mollusca General characters and classification upto class level with examples Type study : Pila General topics : a) Torsion in gastropods b) Cephalopods as advanced Molluscs	**(12 Hrs)**

UNIT- V:	Phylum Echinodermata General characters and classification up to class level with examples. Type of study : Star fish General topic : a) Larval forms of echinoderm b) Affinities of echinoderm.	**(12 Hrs)**

Text Books

Jordan, E.I. & Verma, P.S. 2011, Invertebrate Zoology, Chand & Company Ltd, New Delhi.

Reference Books

Kotpal , R.L, 2011. Invertebrates, Rastogi Publications

Kotpal, R.L. 2004. Modern Text Book of Zoology, Invertebrates (Animal diversity – I), Rastogi Publications, Meerut.

Pechenik, Jan. A 2000, Biology of the Invertebrates, Tata Mcgraw – Hill Pub. Co. Ltd., New Delhi.

Meglitsch Paul. A 1972. Invertebrate Zoology, Second Edition, Oxford University Press, London.

Barrington, E.J.W. 1967 – Invertebrate Structure and Function. The English Language Book, Society, London.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	S	L
CO 2	S	M	S	S	M
CO 3	M	S	L	S	L
CO 4	S	S	S	S	S
CO 5	S	M	L	S	L

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk & Talk, Group Discussion, PPT, Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, live animals and cultures

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Lectures**	**Content Delivery Method**	**Teaching Aids**
Unit -1 Phylum Annelida				
1.1	General characters of the phylum	1	Discussion	Green Board
1.2	Classification upto class level with examples	2	Lecture	Green Board
1.3	Type study - Nereis	4	Lecture	Green Board
1.4	Origin of coelom and metamerism	3	Discussion	Green Board
1.5	Adaptive radiation in polychaetes	2	Lecture	Green Board
Unit -2 Arthropoda				
2.1	General characters of the phylum	1	Lecture	Green Board
2.2	Classification upto class level with examples	2	Chalk & Talk	Green Board
2.3	Type study - Prawn	4	Chalk & Talk	Green Board
2.4	Peripatus - structure and affinities	3	Chalk & Talk	Green Board
2.5	Larval forms of crustacea	2	Chalk & Talk	Green Board
Unit -3 Arthropoda				
3.1	External characters of Scorpion, Centipedes and Millipedes	4	Chalk & Talk	Green Board
3.2	Social Life of Insects	4	Lecture	Green Board
3.3	Economic Important of Insects	4	Discussion	Green Board
Unit -4 Mollusca				
4.1	General characters of phylum Mollusca	1	Discussion	Green Board
4.2	Classification upto class level with examples	2	Chalk & Talk	Green Board

4.3	Type study - Pila	4	Chalk & Talk	Green Board
4.4	Torsion in gastropods	3	Chalk & Talk	Green Board
4.5	Cephalopods as advanced Molluscs	2	Lecture	
	Unit -5 Echinodermata			
5.1	General characters of Phylum Echinodermata	1	Lecture	Green Board
5.2	Classification up to class level with examples	2	Chalk & Talk	Green Board
5.3	Type study : Star fish	4	Chalk & Talk	Green Board
5.4	Larval forms of echinoderm	3	Chalk & Talk	Green Board
5.5	Affinities of echinoderm	2	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Non Major Elective**		SEMESTER **- II**
Course Title **: HUMANANTOMY**		
Course Code: **09NE11**	Hours per week: **2**	Credits: **2**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Objectives

- Study of various human tissues and skeletal systems
- Understanding structure and functions of selected organs and organ systems
- Highlights human reproductive system

Syllabus

Unit –I

Types of Tissues, Exoskeleton – Skin and hair
Endoskeleton- Skull, fore limb and hind limb

Unit –II

Structure of Tooth and alimentary canal
Structure of Kidney and Nephron

Unit-III

Structure of lungs
Structure of heart, blood and blood groups

Unit-IV

Structure of brain
Structure of eye and ear

Unit-V

Endocrine glands and their secretions
Male and female reproductive system

Text book

Best and Taylor – 1965.The living body – Chapman & Hall, London

Reference Book

Marieb, M. 2006. Human Anatomy & Physiology, Dorling Kindersley (India) Pvt. Ltd., Delhi.
P.S. Verma and V. K. Agarwal 1985. Animal physiology, S. Chand & Company, New Dlhi.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- II**
Course Title **: CHORDATES - I**		
Course Code: **09CT21**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students acquire knowledge on general features, classification and evolution of chordates and study of organs and organ systems to Understanding their functional aspects

Course Outcomes (COs)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Learn the general characteristics, classification with common examples of chordates, Prochordates specialized characters and peculiar development	K1, K2
CO 2	Understanding the comparative external features of various vertebrates	K2
CO 3	Knowledge on morphological and anatomical features of vertebrates	K2, K3
CO 4	Acquire knowledge on organs of communicative and sensory systems of vertebrates	K1, K3
CO 5	Understanding the structural organization of skeletal system in vertebrates	K1, K2, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	**Protochordata** General characters and classification with examples – Amphioxus - Detailed study, General characters of Balanoglossus and Ascidian. Affinities of Balanoglossus, Retrogressive Metamorphosis in Ascidian	**(12 Hrs)**
UNIT-II:	**Vertebrata** General characters and classification upto classes with examples Agnatha – salient features of Petromyzon External characters of Scoliodon, Frog, Calotes, Pigeon and Rabbit	**(12 Hrs)**
UNIT- III:	Comparative anatomy in Vertebrates - Integumentary system, Digestive system and Respiratory system	**(12 Hrs)**
UNIT- IV:	Comparative anatomy in Vertebrates - Circulatory system, Nervous system and Receptor organs	**(12 Hrs)**
UNIT- V:	Endoskeleton (Frog only) and Endocrine glands Comparative anatomy of Urinogenital system	**(12 Hrs)**

Text Books

Ekambaranatha Ayyar, M. and Ananthakrishnan, T.N. 2013 – A Manual of Zoology Part II (Chordata) S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.

Reference Books

- Gupta R.C and Girish Chopra, 2003 - Comparative Anatomy of Chordates – R.Chand& Co, New Delhi
- Jordan E.L, 2003 – Chordate zoology – S. Chand & Co, Chennai
- Kotpal, R.L. 2004 – Modern Text Book of Zoology Vertebrates, Second Edition, Rastogi Publications, Meerut.
- Harvey Pough F., Heifer, J.B. and McFarland, W.N. 1985 vertebrate life, Macmillan Pub. Co. New York.

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	L	S	L
CO 2	S	M	L	M	L
CO 3	S	M	M	S	L
CO 4	S	S	L	S	L
CO 5	S	L	L	M	M

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk & Talk, Group Discussion, PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
	Unit -1 Protochordata			
1.1	General characters of Protochordata	1	Discussion	Green Board
1.2	Classification with examples	2	Lecture	Green Board
1.3	Amphioxus	2	Lecture	Green Board
1.4	Balanoglossus	1	Discussion	Green Board
1.5	Ascidian	2	Lecture	Green Board
1.6	Affinities of Balanoglossus	2	Chalk & Talk	Green Board
1.7	Retrogressive Metamorphosis in Ascidian	2	Chalk & Talk	Green Board
	Unit -2 Vertebrata			
2.1	General characters of Vertebrata	1	Lecture	
2.2	Classification upto classes with examples	2	Chalk & Talk	Green Board
2.3	Agnatha - Petromyzon	2	Chalk & Talk	Green Board
2.4	Scoliodon	2	Chalk & Talk	Green Board
2.5	Frog	2	Chalk & Talk	Green Board
2.6	Calotes	2	Chalk & Talk	Green Board
2.7	Pigeon	1	Chalk & Talk	Green Board
2.8	Rabbit	1	Chalk & Talk	Green Board
	Unit -3 Comparative anatomy in Vertebrates			
3.1	Integumentary system	4	Chalk & Talk	Green Board
3.2	Digestive system	4	Lecture	Green Board
3.3	Respiratory system	4	Discussion	Green Board
	Unit -4 Comparative anatomy in Vertebrates			

4.1	Circulatory system	4	Discussion	Green Board
4.2	Nervous system	4	Chalk & Talk	Green Board
4.3	Receptor organs	4	Chalk & Talk	Green Board
Unit -5 Comparative anatomy in Vertebrates				
5.1	Endoskeleton (Frog only)	4	Lecture	Green Board
5.2	Endocrine glands	4	Chalk & Talk	Green Board
5.3	Urinogenital system	4	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- II**
Course Title **: CHORDATES - II**		
Course Code: **09CT22**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students basic Understandinging and the study of salient features, Origin, organization, comparative anatomy and trace the evolution

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Study the origin, ancestors and descendents of chordates	K1, K3
CO 2	Understanding the adaptive characters and accessory organs of vertebrates	K1, K2
CO 3	Study the specialized features of Amphibians, identification features of poisonous and non-poisonous snakes	K2
CO 4	Study the structures, its mechanisms and adaptation in Aves	K2, K3
CO 5	Study the mammalia through origin, aquatic adaptations and feeding accessories	K1, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	Origin and Phylogeny of Vertebrates, Amphibia, Reptilia and Birds	**(12 Hrs)**
UNIT-II:	Parental care in fishes, Migration in fishes and Accessory respiratory organs in fishes	**(12 Hrs)**
UNIT- III:	Parental care in Amphibia, Neoteny in Amphibia and Poisonous and non-poisonous snakes of South India	**(12 Hrs)**
UNIT- IV:	Flight adaptation and mechanism of flight in birds, Migration in birds and Flightless birds	**(12 Hrs)**
UNIT- V:	Prototherians, Metatherians and Eutherians, Dentition in mammals, Aquatic mammals and Origin of mammals.	**(12 Hrs)**

Text Books

Jordan, E.L. and Verma, P.S. 2011. Chordate Zoology, S.Chand & Co Ltd

Reference Books

Kotpal, R.L. 2011. Vertebrates, Rastogi Publications

Gupta R.C and Girish Chopra, 2003 - Comparative Anatomy of Chordates – R.Chand & Co, New Delhi

Newmann, 1981, The Phylum chordata, Biology of vertebrates and their kin, Satish Book Enterprises, Agra.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	L	L	S	L
CO 2	S	M	L	M	L
CO 3	S	M	M	S	L

CO 4	S	S	L	S	L
CO 5	S	L	L	M	M

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk & Talk, Group Discussion, PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1 Origin and Phylogeny of Vertebrates				
1.1	Origin and Phylogeny of Amphibia	4	Discussion	Green Board
1.2	Origin and Phylogeny of Reptilia	4	Lecture	Green Board
1.3	Origin and Phylogeny of Birds	4	Lecture	Green Board
Unit -2				
2.1	Parental care in fishes	4	Lecture	
2.2	Migration in fishes	4	Chalk & Talk	Green Board
2.3	Accessory respiratory organs in fishes	4	Chalk & Talk PPT	Green Board LCD
Unit -3				
3.1	Parental care in Amphibia	4	Chalk & Talk PPT	Green Board LCD
3.2	Neoteny in Amphibia	4	Lecture	Green Board
3.3	Poisonous and non-poisonous snakes of South India	4	Discussion	Green Board
Unit - 4				
4.1	Flight adaptation and mechanism of flight in birds	4	Discussion	Green Board
4.2	Migration in birds	4	Chalk & Talk	Green Board
4.3	Flightless birds	4	Chalk & Talk	Green Board
Unit -5				
5.1	Study the mammalia through origin	4	Lecture	Green Board
5.2	aquatic adaptations	4	Chalk & Talk	Green Board
5.3	feeding accessories	4	Chalk & Talk PPT	Green Board LCD
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Lab**		SEMESTER **- II**
Course Title **: PRACTICAL - I**		
Course Code: **09CP23**	Hours per week: **2**	Credits: **4**
CIA : **40 Marks**	ESE: **60 Marks**	Total : **100 Marks**

Preamble

Visualize and assimilate morphological and anatomical features by dissection demonstration, preserved specimens, charts and models and observe animals at their habitat & Understanding their biodiversity.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Student will Understanding the dissection and mounting of organism, organs through demonstration	K1
CO 2	Perform mounting of body parts, locomotory parts and also perform simulated models of dissection through computers.	K2
CO 3	Identify the anatomical and special features from the prepared models and charts.	K2
CO 4	Identify morphological and special characteristics of animals through various phylum and classes	K2
CO 5	Locate, mark and collect the diversity species in agriculture, apiary and marine habitats.	K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

A. Demonstration Cockroach- Dissection - Digestive system, Nervous systems & Reproductive system Mounting - Mouth parts and Salivary glands Earthworm – Dissection - Digestive and Nervous systems Mounting - Body setae and Penial setae House fly - Mounting -Mouthparts Virtual Dissection – Earthworm, Cockroach, Honey bee, Housefly, Mosquito using softwares **B. Chart/Models** Pila - Digestive system and Nervous system Freshwater mussel - Digestive system **C. Spotters** Protozoa *Amoeba, Plasmodium, Paramecium* Entire and conjugation. Porifera Gemmules and Spicules. Coelenterata *Obelia* Colony, Medusa, *Physalia*, Any One Coral, Sea Anemone. Helminthes Liverfluke-Entire, *Taenia*(Entire and Scolex). Nematoda *Ascaris* Male and Female. Annelida *Nereis*, Leech . Arthropoda *Zoea, Nauplius*, Millipede and Centipede Mollusca *Chiton,* Sepia, *Nautilus,* Octopus. Echinodermata Starfish, Sea urchin , Sea cucumber.	**(12 Hrs)**

D. Field Visit Observation and identification of insect pests of agricultural crops. Vist to Vermifarm and observación of Earthworm species Visit to Apiary **Chordates** **A. Dissection and mounting** Fish – Dissection and observation of visceral organs Shark- Mounting of Placoid Scales B. Virtual Dissection - Frog, Calotes and Chick using softwares. **C. Chart/Models** Frog - Arterial system and Venous system, brain and spinal nerves **D. Spotters** *Amphioxus,Balanoglossus, Ascidian, Petromyzon* *Narcine, Anabas, Echines, Hippocampus*, Eel *Rhacophorus* and *Alytes* Krait, Cobra, Viper, *Typhlops, Enhydrina, Draco* and Chaemeleon Beaks and feet in birds, Ant eater and Bat Osteology of Rabbit – Skull, Typical Vertebra, Pectoral and pelvic girdle – Fore limb and Hind limb **E. Field visit** Rameshwaram, Kurusadai Island & Mandapam - Biodiversity study of marine animals.	

Text Books

Kapoor, 2014 Practical Zoology, Silver Line Publications, Allahabad, Uttrapradesh

Reference Books

- Pechenik, Jan A 2014 – Biology of the Invertebrates, Tata Mcgraw – Hill Pub. Company Ltd., New Delhi
- Vasantika Kashyap, 2013, Life of Invertebrates, Second Revised Edition, Vikas Pub. House Pvt. Ltd., New Delhi
- Kotpal, R.L. 2012. Modern Text Book of Zoology, Invertebrates (Animal diversity – I), Rastogi Publications, Meerut
- Barnes, R.D. 2006,Invertebrate Zoology, IV Edition, Holf Saunders International edition
- Ekambaranatha Ayyar and Ananthakrishnan, T.N. 2005, A manual of Zoology, volume I, Invertebrate, Viswanathan (Printers and Publishers) Pvt. Ltd., ChennaiKotpal, R.L. 2011. Vertebrates, Rastogi Publications
- Gupta R.C and Girish Chopra, 2003 - Comparative Anatomy of Chordates – R.Chand & Co, New Delhi
- Newmann, 1981, The Phylum chordata, Biology of vertebrates and their kin, Satish Book Enterprises, Agra.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	S	S	M	S
CO 3	S	S	M	M	S
CO 4	S	M	S	S	S
CO 5	S	S	S	M	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Charts and models, smart board, Group Discussion, PPT, Preserved animals, slides and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, Microscope – Dissection, Compound, Deep vision and Phase Contrast Microspcose.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Practicals	Content Delivery Method	Teaching Aids
	Invertebrates			
1	**A. Demonstration** i) Cockroach- Dissection - Digestive system, Nervous systems & Reproductive system	6	Chalk & Talk Dissection Tools	Green Board Charts
2	ii) Cockroach - Mounting - Mouth parts and Salivary glands	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
3	iii) Earthworm-Dissection - Digestive and Nervous systems	4	Chalk & Talk Dissection Tools	Green Board Microscope Charts
4	iv) Mounting - Body setae and Penial setae	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
5	v) House fly- Mounting -Mouthparts	1	Chalk & Talk Dissection Tools	Green Board Microscope Charts
6	vi) Virtual Dissection – Earthworm, Cockroach, Honey bee, Housefly, Mosquito using softwares	4	Software Internet with Wifi	Smart Board Charts Models Laptops
7	**B. Chart/Models** i) Pila - Digestive system and Nervous system	1	Discussion	Green Board
8	ii) Freshwater mussel - Digestive system	1	Discussion	Green Board
9	**C. Spotters** Protozoa *Amoeba, Plasmodium, Paramecium* Entire and conjugation.	1	Chalk & Talk Discussion	Preserved animalcules and slides
10	Porifera Gemmules and Spicules. Coelenterata *Obelia* Colony, Medusa, *Physalia*, Any One Coral, Sea Anemone.	1	Chalk & Talk Discussion	Preserved animalcules and slides
11	Helminthes Liverfluke-Entire, *Taenia*(Entire and Scolex). Nematoda *Ascaris* Male and Female.	1	Chalk & Talk Discussion	Preserved animals and slides
12	Annelida *Nereis*, Leech . Arthropoda *Zoea, Nauplius,* Millipede and Centipede	1	Chalk & Talk Discussion	Preserved animals and slides
13	Mollusca *Chiton*, Sepia, *Nautilus*, Octopus. Echinodermata Starfish, Sea urchin , Sea cucumber.	1	Chalk & Talk Discussion	Preserved animals and slides
14	**D. Field Visit** Observation and identification of insect	4	Discussion PPt	Live farms and demonstration

	pests of agricultural crops. Vist to Vermifarm and observación of Earthworm species Visit to Apiary		Photographs	
	Chordates			
15	**A. Dissection and mounting** Fish – Dissection and observation of visceral organs	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
16	Shark- Mounting of Placoid Scales	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
17	B. Virtual Dissection - Frog, Calotes and Chick using softwares	5	Software Internet with Wifi	Smart Board Charts Models Laptops
18	**C. Chart/Models** Frog - Arterial system and Venous system, brain and spinal nerves	4	Discussion	Green Board
19	**D. Spotters** *Amphioxus,Balanoglossus, Ascidian, Petromyzon*	1	Chalk & Talk Discussion	Preserved animals and slides
20	*Narcine, Anabas, Echines, Hippocampus*, Eel	1	Chalk & Talk Discussion	Preserved animals and slides
21	*Rhacophorus* and *Alytes* Krait, Cobra, Viper, *Typhlops, Enhydrina, Draco* and Chaemeleon	1	Chalk & Talk Discussion	Preserved animals and slides
22	Beaks and feet in birds, Ant eater and Bat	1	Chalk & Talk Discussion	Preserved animals and slides
23	Osteology of Rabbit – Skull, Typical Vertebra, Pectoral and pelvic girdle – Fore limb and Hind limb	3	Chalk & Talk Discussion	Preserved animals and slides
24	**E. Field visit** Rameshwaram, Kurusadai Island & Mandapam - Biodiversity of marine animals	10	Discussion PPt Photographs	Live farms and demonstration
	Total	**60**		

DEPARTMENT OF ZOOLOGY
Programme: B.Sc., Zoology, (Under CBCS and OBE)
(For those students admitted during the Academic Year 2018-19 and after)

Part – IV **: Non-Major Elective**		
Course Title : **FOOD AND NUTRITION**		
Course Code: **09NE21**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Reveal the types, sources and importances of nutrients
- Expose disorders of malnutrition and food born diseases
- Inculcate importance of sanitation and hygiene for societal welfare

Syllabus

Unit-I

Food as a source of nutrients – Definition- functions of food- recommended daily alLowances for nutrients- nutritive value of foods- Balanced diet.

Unit-II

Nutrients – Carbohydrates, Proteins Fats, Minerals and Vitamins.

Unit-III

Disorders of Malnutrition – Kwashiorkor – Marasmus – Obesity – Anaemia -Epidemic dropsy and Deficiency diseases.

Unit-IV

Food sanitation and Hygiene – Water- Food- food spoilage- Preservation- Control of Insects and Rodents

Unit-V

Food Borne Diseases – Food poisoning-Poisoning organisms – Bacteria, Mold and Yeast.

Text book

Fundamentals of Foods and Nutrition – R. Mudambi and V.Rajagopal – Wiley Eastern Limited – New Delhi.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- III**
Course Title **: CELL BIOLOGY**		
Course Code: **09CT31**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to acquire knowledge on organisational arrangements of cellular organelles of prokaryotes and eukaryotes, their structural setup and their biological functions.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Inculcate knowledge on working principles of microscopes, cell fractionation, staining and identification of cell types	K1,K2,K3
CO 2	Get deeper Understandinging on organisation and functional aspects of cellular organelles, plasma membrane, endoplamic reticulum, golgi body and lysosomes.	K1,K2,K3
CO 3	Comprehends on morphological, chemical composition, structure and functions of synthesising organelles of mitochondria and ribosomes.	K1,K2,K3
CO 4	Develop analyse on structure of oncogenes and nucleus, differentiation of chromosomes, different types of cell division	K1,K2,K3
CO 5	Appreciate through principles of microscopes the organisation of DNA, RNA types, its role in gene regulation and protein synthesis.	K1,K2,K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	Microscopy: Principles of light and electron microscope. Cell as the basic unit of living organism – Cell theory – isolation of cellular components – Homogenisation – fractionation – Centrifugation – Fundamentals of fixation – Staining methods	**(12 Hrs)**
UNIT-II:	Plasma Membrane: Ultra structure – Chemical composition and functions, Endoplasmic reticulum: Structure, types and functions Golgi complex: Structure, Composition and functions Lysosome: Structure, forms, functions and origin	**(12 Hrs)**
UNIT- III:	Mitochondria: Structure, Chemical composition – Functions – Kreb's cycle – Oxidative phosphorylation, Ribosome: Structure – Chemical composition – Functions and origin	**(12 Hrs)**
UNIT- IV:	Nucleus & Nucleolus: Structure and functions, Chromosome: Structure Giant Chromosomes - Cell Cycle: Cell division – Mitosis & Meiosis - Cancer Cells – types and properties - Cell aging - events	**(12 Hrs)**
UNIT- V:	Nucleic Acids: Molecular Structure of DNA & RNA – Types of RNA & DNA replication, Role of RNA and ribosome in protein synthesis, Regulation of protein synthesis (Lac Operon).	**(12 Hrs)**

Text Books

Cytology,Verma P.S. & Agarwal V.K. (2008) .S.Chand & Co. New Delhi.

Reference Books

- De Robertis E.D.P. & De Robertis (2001). Cell and Molecular Biology, E.M.F.
- David M.Prescott (1988).CELLS- Principles of Molecular Structure and Functions, Jones and Bartlett Publications
- Gerald Karp (1985). Cell Biology, McGraw Hill Book Co..

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Microscopy: Principles of light and electron microscope.	3	Chalk & Talk	Green Board
1.2	Cell as the basic unit of living organism	2	Chalk & Talk	Microscope
1.3	Cell theory – isolation of cellular components Homogenisation – fractionation – Centrifugation	4	Lecture	PPT & White board
1.4	Fundamentals of fixation – Staining methods	3	Lecture	Green Board
Unit -2				
2.1	Plasma Membrane: Ultra structure – Chemical composition and functions	3	Lecture	Green Board Charts
2.2	Endoplasmic reticulum: Structure, types and functions	3	Chalk & Talk	Green Board
2.3	Golgi complex: Structure, Composition and functions	3	Chalk & Talk, ppt	Green Board Smart Board
2.4	Lysosome: Structure, forms, functions and origin	3	Chalk & Talk	Green Board
Unit -3				
3.1	Mitochondria: Structure, Chemical composition	3	Chalk & Talk	Green Board
3.2	Functions – Kreb's cycle – Oxidative phosphorylation	5	Lecture PPT	Green Board Smart Board
3.3	Ribosome: Structure – Chemical composition – Functions and origin	4	Discussion Specimen	Green Board Microscope
Unit -4				
4.1	Nucleus & Nucleolus: Structure and functions	3	Discussion	Green Board
4.2	Chromosome: Structure Giant Chromosomes	3	Chalk & Talk	Green Board
4.3	Cell Cycle: Cell division – Mitosis &	3	Chalk & Talk	Green Board

	Meiosis		Specimen	Microscope
4.4	Cancer Cells – types and properties Cell aging - events	3	Chalk & Talk	Green Board
Unit -5				
5.1	Nucleic Acids: Molecular Structure of DNA	2	Lecture	Green Board
5.2	RNA – Types of RNA	2	Chalk & Talk	Green Board
5.3	DNA replication	3	Chalk & Talk	Green Board
5.4	Role of RNA and ribosome in protein synthesis	3	Chalk & Talk	Green Board
5.5	Regulation of protein synthesis (Lac Operon	2	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- III**
Course Title **: GENETICS**		
Course Code: **09CT32**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to acquire knowledge on principles of genetic mechanism, determination of sex and diseases related to genetics.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Get overall idea of Mendelian works on inheritance and the deviation from Mendelian concepts.	K1,K2,K3
CO 2	Understanding the architect of differential inheritance due to multiple allelism, polygene and their associated problems.	K1,K2,K3
CO 3	Impart knowledge on the deviation of Mendelian concepts through the linkage and crossing over and also mapping of chromosome.	K1,K2,K3
CO 4	Find out the methods of sex determinations, factors, and also acquire how sex related diseases and their transmission.	K1,K2,K3
CO 5	Trace and identify the mechanism of non-genetic inheritance, genetic diseases and pedigree. Promotional methods of genetic mechanism through qualitative traits.	K1,K2,K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	Principles of Inheritance- Interaction of genes (Factor hypothesis) a) Historical ideas- Mendel's work- Mendel's laws of inheritance- Mendelian ratio- Test cross- Back cross- Pleiotropism- Penetrance and expressivity. b) Non-allelic interactions- Complementary genes, Epistasis, Supplementary genes, duplicate genes, Collaborator genes and Lethal genes.	**(12 Hrs)**
UNIT-II:	Polygenic inheritance and Multiple allelism a) Definition- Mode of inheritance of Kernel colour in Wheat and Skin colour in Man- Difference between Polygenic and Mendelian inheritance; Multple allele b) Definition- Mode of inheritance of Coat colour in Rabbit and ABO- blood groups in Man- Problems relating to inheritance of ABO- blood groups - Genetics of MN blood group and Problems. c) Genetic basis of Rh- Blood groups and their significance	**(12 Hrs)**
UNIT-III:	Linkage and Crossing-over a) Definition- Linkage- Linkage groups- Kinds of Linkage- Detection of linkage- Significance. b) Crossing over- Significance and evidences of Crossing over. c) Chromosomal Mapping- types	**(12 Hrs)**
UNIT-IV:	Sex determination and sex linkage a) Mechanism of Sex determination- various theories- Role of hormone and environment in sex determination.	**(12 Hrs)**

	b) Sex linked inheritance in Man- Colour blindness, Haemophilia and Eye colour in *Drosophila*- inheritance of sex limited and sex influenced genes- holandric genes.	
UNIT-V:	a) Extra- chromosomal inheritance- inheritance of Shell coiling in Snail, Kappa particles in *Paramecium* and Sigma particles in Drosophila. b) Inborn errors of Metabolism - Phenylketonuria, Alkaptonuria, Albinism, Muscular dystrophy c) Human genetics- Role of Pedigree analysis- Twin study- Syndromes- Turner syndrome, Down syndrome, Klinefelter syndrome, Cri du Chat Syndrome and Wolf syndrome Genetic counselling- Eugenics, Euthenics and Euphenics.	**(12 Hrs)**

Text Books

Genetics – Verma P.S. & VK Agarwal (2008) S. Chand & Co.

Reference Books

- Principles of Genetics- Sinnott, Dunn and Dobzhansky,Mc.GrawHill Pub. Co.
- Principles of Genetics- E.J. Gardner etal (1991),Wiley Eastern & Co
- Human Genetics- E.A. Carlson ,(1985) Mc.Graw Hill Pub. Co.
- Genetics – S. Sambamurthy (2005) Narosa Publication.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Lectures**	**Content Delivery Method**	**Teaching Aids**
Unit -1				
1.1	Principles of Inheritance- Interaction of genes (Factor hypothesis)	2	Chalk & Talk	Green Board
1.2	Historical ideas- Mendel's work- Mendel's laws of inheritance- Mendelian ratio	3	Chalk & Talk	Microscope
1.3	Test cross- Back cross- Pleiotropism- Penetrance and expressivity	3	Lecture	PPT & White board
1.4	Non-allelic interactions- Complementary genes, Epistasis	2	Lecture	Green Board
1.5	Supplementary genes, duplicate genes, collaborator genes and Lethal genes	2	Lecture	Green Board
Unit -2				
2.1	Polygenic inheritance and Multiple allelism Definition- Mode of inheritance of Kernel colour in Wheat and Skin colour in Man- Difference between Polygenic and Mendelian inheritance; Multiple allele	5	Lecture	Green Board Charts
2.2	Definition- Mode of inheritance of Coat colour in Rabbit and ABO- blood groups in Man- Problems relating to inheritance of ABO- blood groups - Genetics of M-N	5	Chalk & Talk	Green Board

	blood group and Problems.			
2.3	Genetic basis of Rh- Blood groups and their significance	2	Chalk & Talk, ppt	Green Board Smart Board
Unit -3				
3.1	Linkage and Crossing-over a) Definition- Linkage- Linkage groups- Kinds of Linkage- Detection of linkage- Significance.	5	Chalk & Talk	Green Board
3.2	Crossing- over- Significance and evidences of Crossing-over.	3	Lecture PPT	Green Board Smart Board
3.3	Chromosomal Mapping- Problems in Chromosomal Mapping	4	Discussion Specimen	Green Board Microscope
Unit -4				
4.1	Sex determination and sex linkage a) Mechanism of Sex determination- various theories	3	Discussion	Green Board
4.2	Role of hormone and environment in sex determination	3	Chalk & Talk	Green Board
4.3	Sex linked inheritance in Man- Colour blindness, Haemophilia and Eye colour in Drosophila	3	Chalk & Talk Specimen	Green Board Microscope
4.4	Inheritance of sex limited and sex influenced genes- holandric genes	3	Chalk & Talk	Green Board
Unit -5				
5.1	Extra- chromosomal inheritance- inheritance of Shell coiling in snail, Kappa particles in Paramecium and Sigma particles in Drosophila.	3	Lecture	Green Board
5.2	Inborn errors of metabolism- Phenylketonuria, Alkaptonuria, Albinism, Muscular dystrophy	3	Chalk & Talk	Green Board
5.3	Human genetics- Role of Pedigree analysis- Twin study- Syndromes- Turner syndrome, Down syndrome, Klinefelter syndrome, Cri du Chat Syndrome and Wolf syndrome - Genetic counselling	3	Chalk & Talk	Green Board
5.4	Eugenics, Euthenics and Euphenics.	3	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skill Based Course		Semester-**III**
Course Title : **PUBLIC HEALTH AND HYGIENE**		
Course Code: **09SB31**	Hours per week: **2**	Credits: **2**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Objectives:

- Inculcate the importance of public health and hygiene
- Consciousness on importance, source and quality of water
- Awareness on certain important human diseases and their preventive measures
- Focus on health planning and health programme

Syllabus

UNIT I: Scope of Public Health and Hygiene – Concepts of Health and Disease –. Nutrition and Health: Classification of foods – Nutritional deficiencies – Vitamin deficiencies – Balanced diet – Nutritional requirements of special groups.

UNIT II: Environment and Health: Water-sources,– Water quality standards.– Solid waste and excreta disposal – Sewage treatment.

UNIT III: Communicable diseases: 1. Respiratory infections: Measles, Rubela, Mumps, Diptheria 2. Intestinal infections: Poliomyletis, Cholera, Typhoid, Amoebiasis 3. Arthropod infections: Malaria, Filariasis, Dengue 4. Zoonosis: Rabies, Plague, Japanese encephalitis 5. Surface infections: Tetanus, Leprosy, STD and AIDS.

UNIT IV: Non-Communicable Diseases: Coronary Heart Disease – Hypertension – Diabetes – Obesity – Blindness – Stroke. Occupational Health Hazards: Physical, Chemical, Mechanical, Biological and Psychological. Mental health: Causes of mental ill-health-alcoholism and Drug dependence.

UNIT V: Health Education: Health planning in India – Health programmes in India – WHO – Non-governmental Voluntary Health Organizations. First aid and Nursing: Methods – Dressing – care — Preparations.

Text books:

- Park and Park, 1995. Text Book of Preventive and Social Medicine. M/s. Banarsidas Bhanot Publishers, Jabalpur.
- Verma S. 1998. Medical Zoology, Rastogi Publications, New Delhi.

Reference Book:

- C. Gopalan, 1985, Nutritive values of Indian foods, ICMR, New Delhi
- Rajvir Bhawar, 2008. Text Book of Public Health and Community Medicines, Published by Armed Forces Medical College, Pune.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- IV**
Course Title **: DEVELOPMENTAL BIOLOGY**		
Course Code: **09CT41**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to acquire knowledge on right from the genesis of the embryo organisation of cells and tissues leading to structure, developmental complexity with in organisations and their interactions.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Understanding the historical theories of development and Understanding the origin shapes and types of gametes.	K1, K2, K3
CO 2	Acquire knowledge on events of the fertilization, cleavage pattern and causes for the cellular differentiation of blastomeres.	K1, K2, K3
CO 3	Understanding the differential modifications and functions of developmental and embryonic cells and the process of development of brain, heart, eye and kidney.	K1, K2, K3
CO 4	Analyse the reproductive cycles and events of human reproduction, mechanism of various metamorphosis and regeneration.	K1, K2, K3
CO 5	Trace the applications and methods of human welfare in embryology.	K1, K2, K3

K1-Remembering **K2-**Understanding **K3-**Applying

Syllabus

UNIT-I:	a) Historical reviews-Theory of Preformation, Theory of Epigenesis, Baer's law and Biogenetic law b) Gametogenesis- Spermatogenesis, Oogenesis c) Types of eggs -structure of spermatozoa and ovum in mammals.	**(12 Hrs)**
UNIT-II:	a) Fertilization: Acrosomal reaction, Cortical reaction, Physiological and biochemical changes, significance-Parthenogenesis. b) Planes and types of cleavage patterns. c) Fate maps in Amphioxus, Frog and Chick	**(12 Hrs)**
UNIT- III:	a) Blastulation and Gastrulation in Amphioxus, Frog and Chick. b) Organogenesis: Derivatives of Ectoderm, Mesoderm and Endoderm-Development of Brain, Eye, Heart and Kidney. c) Foetal membranes in Chick	**(12 Hrs)**
UNIT- IV:	a) Human reproduction; Menstrual cycle-Menopause, pregnancy-Parturition – lactation - hormonal control -Types and Functions of Placenta. b). Amphibian metamorphosis: Anatomical and Biochemical changes, role of hormones in metamorphosis, role of hormones in Insect metamorphosis. c) Regeneration: Definition –mechanism and types- factors controlling regeneration	**(12 Hrs)**

UNIT- V:	a) Gradient theory- Organizer- Concept, Spemann's experiment, Mechanism of Induction- Nuclear transplantation experiments in *Acetabularia.* b) Differentiation- Types, processes, competence- Nucleo cytoplasmic interaction c) Human welfare and Embryology- Birth control, Infertility, Test tube Baby - Intra cytoplasmic Sperm injection (ICSI) and Intra Uterine Insemination (IUI) and Teratogenesis	**(12 Hrs)**

Text Books

Verma, S and Agarwal, V.K, 2005, Chordate Embryology, S.Chand & Co, New Delhi.

Reference Books

- Balinsky, B.I, 1981, An Introduction to Embryology, Holt Saunders, New York.
- 2. Berrill, N.J, 1986, Developmental Biology, McGraw Hill, New Delhi.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Lectures**	**Content Delivery Method**	**Teaching Aids**
Unit -1				
1.1	Historical reviews-Theory of pre formation, Theory of Epigenesis	2	Chalk & Talk	Green Board
1.2	Baer's law and Biogenetic law	2	Chalk & Talk	Microscope
1.3	Gametogenesis- spermatogenesis, Oogenesis	4	Lecture	PPT & White board
1.4	Types of eggs -structure of spermatozoa and ovum in mammals	4	Lecture	Green Board
Unit -2				
2.1	Fertilization: Acrosomal reaction, Cortical reaction	2	Lecture	Green Board Charts
2.2	Physiological and biochemical changes	2	Chalk & Talk	Green Board
2.3	significance-parthenogenesis	3	Chalk & Talk, ppt	Green Board Smart Board
2.4	Planes and types of cleavage patterns	2	Chalk & Talk	Green Board
2.5	Fate maps in Amphioxus, Frog and Chick	3	Chalk & Talk Specimen	Green Board Microscope
Unit -3				
3.1	Blastulation and Gastrulation in Amphioxus, Frog and Chick	3	Chalk & Talk	Green Board
3.2	Organogenesis: Derivatives of Ecto, Meso and Endoderm	3	Lecture PPT	Green Board Smart Board
3.3	Development of Brain, Eye, Heart and Kidney	3	Discussion Specimen	Green Board Microscope

3.4	Foetal membranes in Chick	3	Lecture	Video
Unit -4				
4.1	Human reproduction; Menstrual cycle- Menopause	2	Discussion	Green Board
4.2	pregnancy-Parturition – lactation - hormonal control	2	Chalk & Talk	Green Board
4.3	Types and Functions of Placenta	2	Chalk & Talk Specimen	Green Board Microscope
4.4	Amphibian metamorphosis: Anatomical and Biochemical changes	2	Chalk & Talk	Green Board
4.5	role of hormones in metamorphosis and Insect metamorphosis	2	Lecture	Green Board
4.6	Regeneration: Definition –mechanism and types- factors controlling regeneration	2	Dairy farm	Live animals
Unit -5				
5.1	Gradient theory- Organizer- Concept, Spemann's experiment	2	Lecture	Green Board
5.2	Mechanism of Induction- Nuclear transplantation experiments in *Acetabularia*	2	Chalk & Talk	Green Board
5.3	Differentiation- Types, processes, competence- Nucleo cytoplasmic interaction	2	Chalk & Talk	Green Board
5.4	Human welfare and Embryology- Birth control, Infertility	3	Chalk & Talk	Green Board
5.5	Test tube Baby - Intra cytoplasmic Sperm injection (ICSI) and Intra Uterine Insemination (IUI) and Teratogenesis	3	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- IV**
Course Title **: PHYSIOLOGY**		
Course Code: **09CT42**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to Understanding the knowledge on structure and functions physiology of various organ systems. And to create awareness on nutritional deficiencies.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on physiological role of major and minor nutrient.	K1, K2, K3
CO 2	Impart knowledge on structure and physiology of circulatory and respiratory systems in animals.	K1, K2, K3
CO 3	Analyse the physiology of excretion, ionic balance and chemical coordination in animals.	K1, K2, K3
CO 4	Obtain knowledge on types and constructions, physiological and chemical coordination of neuromuscular system.	K1, K2, K3
CO 5	Gain the knowledge on structure and physiology of receptors (ear and eye) and endocrine glands and circadian rhythm	K1, K2, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

UNIT-I:	a) Definition and brief history of Physiology - the fields and branches of physiology. Nutrition and types - Food- composition, classification - the physiological role of major nutrient and minerals; Vitamins- chemical nature of vitamins, classification and their role in animal life. b) Digestion and absorption of carbohydrate, protein and lipids in man.	**(12 Hrs)**
UNIT-II:	a) Circulation- types of circulatory system, circulatory media found in animals, types of heart, origin and conduction of heart beat, composition of blood, general functions of blood, blood clotting mechanisms, blood transfusion, blood volume and blood pressure. b) Respiration –- Respiratory pigments, transport of respiratory gases-Oxygen dissociation curve, respiratory quotient.	**(12 Hrs)**
UNIT- III:	a) Excretion- major excretory substances- classification of animals based on excretory producs, structure of human kidney, nephron and its ultra-structure, mechanism of urine formation and excretion – hormonal control. b) Osmoregulation – definition, Osmoregulators, osmoconformers, stenohaline and euryhaline organisms, Osmoregulation in fishes Thermoregulation – Suspended animation – Hibernation, Aestivation, Diapause.	**(12 Hrs)**
UNIT- IV:	a) Nervous system- Central Nervous system and Autonomous Nervous system- physiological role of sympathetic and parasympathetic Nervous system- Ultra structure of a typical neuron, concept of synapse- nerve impulse conduction- neuro muscular junction- reflex action- reflex arc. b) Muscular system- ultra structure of skeletal fibres- general properties of muscle fibre contractile proteins- mechanism of muscle contraction, biochemical changes during muscle contraction.	**(12 Hrs)**

UNIT- V:	a) Receptors- types - structure and functioning of phonoreceptor (Human ear) and photoreceptor (Human eye) b) Endocrine system- structure, hormones and role of pituitary gland, thyroid gland, Para-thyroid gland, adrenal gland and Islets of Langerhans. Chronobiology- biological rhythms, and biological clock – definitions only	**(12 Hrs)**

Text Books

- Essentials of Animal Physiology – S.C Rastogi ,2002, Wiley Easernt Ltd. New Delhi.
- General physiology- A.Mariakuttikan & N. Arumugam 2006,Saras Pub,Nagercoil.

Reference Books

- General & comparative Animal physiology – William S. Hoar 2004.,Prentice-Hall
- Animal physiology - Kunt Schmidt ,2000-Eastern Economy Ed.
- Comparative Animal physiology - C.L Prosser and F.A.Brown 1965,W.B.Saunder's Co
- Animal physiology and related Biochemistry – R.C. Dalela Verma,1995. Jai Prakash Nath and Co.

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	**Topic**	**No. of Lectures**	**Content Delivery Method**	**Teaching Aids**
	Unit -1 12 Hours			
1.1	Definition and brief history of Physiology - the fields and branches of physiology	3	Chalk & Talk	Green Board
1.2	Nutrition and types - Food- composition, classification - the physiological role of major nutrient and minerals	3	Chalk & Talk	Microscope
1.3	Vitamins- chemical nature of vitamins, classification and their role in animal life	3	Lecture	PPT & White board
1.4	Digestion and absorption of carbohydrate, protein and lipids in man	3	Lecture	Green Board
	Unit -2 12 Hours			
2.1	Circulation- types of circulatory system, circulatory media found in animals, types of heart, origin and conduction of heart beat	3	Lecture	Green Board Charts
2.2	composition of blood, general functions of blood, blood clotting mechanisms	3	Chalk & Talk	Green Board
2.3	blood transfusion, blood volume and blood pressure	3	Chalk & Talk, ppt	Green Board Smart Board
2.4	Respiration –- Respiratory pigments, transport of respiratory gases-Oxygen dissociation curve, respiratory quotient	3	Chalk & Talk	Green Board
	Unit -3 12 Hours			
3.1	Excretion- major excretory substances- classification of animals based on excretory product	3	Chalk & Talk	Green Board
3.2	structure of human kidney, nephron and its ultra	3	Lecture	Green Board

	structure, mechanism of urine formation and excretion – hormonal control		PPT	Smart Board
3.3	Osmoregulation – definition, Osmoregulators, osmoconformers, stenohaline and euryhaline organisms	3	Discussion Specimen	Green Board Microscope
3.4	Osmoregulation in fishes -Thermoregulation – Suspended animation – Hibernation, Aestivation, Diapause.	3	Lecture	Video
Unit -4 12 Hours				
4.1	Nervous system- Central Nervous system and Autonomous Nervous system- physiological role of sympathetic and para-sympathetic Nervous system	3	Discussion	Green Board
4.2	Ultra structure of a typical neuron, concept of synapse- nerve impulse conduction- Neuro muscular junction- reflex action- reflex arc	3	Chalk & Talk	Green Board
4.3	Muscular system- ultra structure of skeletal fibres- general properties of muscle fibre contractile proteins	3	Chalk & Talk Specimen	Green Board Microscope
4.4	mechanism of muscle contraction biochemical changes during muscle contraction	3	Chalk & Talk	Green Board
Unit -5 12 Hours				
5.1	Receptors- different types of receptors- structure and functioning of phonoreceptor (Human ear) and photoreceptor (Human eye)	4	Lecture	Green Board
5.2	Endocrine system- structure, hormones and role of pituitary gland, thyroid gland, Para-thyroid gland,	4	Chalk & Talk	Green Board
5.3	Adrenal gland, Islets of Langerhans. Chronobiology- biological rhythms, and biological clock – definitions only	4	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Lab**		SEMESTER **- II**
Course Title **: PRACTICAL - II**		
Course Code: **09CP43**	Hours per week: **2**	Credits: **4**
CIA : **40 Marks**	ESE: **60 Marks**	Total : **100 Marks**

Preamble

Visualize and analyse the morphology and anatomy of cell types, cell division, its methods of genetic inheritance and diseases, developmental stages of embryo and its associated structural and physiological activities and excretory products of animals.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on cell types, cell division, identification of genetic materials and perform micro technique.	K1, K2, K3
CO 2	Demonstrate the principles of Mendelian and non-Mendelian inheritance.	K1, K2, K3
CO 3	Observe genetic modification, differential inheritance due to multiple allelism, polygene and their associated problems.	K1, K2, K3
CO 4	Identify, analyse and prepare various developmental stages of embryo and its associated structures.	K1, K2, K3
CO 5	Trace the excretory products of physiological activities and their testing techniques in animals.	K1, K2, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Syllabus

CELL BIOLOGY

1. Study of Cell types – Observation of prepared slides
2. Study of buccal epithelium in human and Onion peeling
3. Mitosis – Study of stages in Onion root tip meristem
4. Meiosis – Study of stages of grass hopper testis –squash
5. Micro technique- Preparation of permanent slides (Demonstration only).
6. Identification of the genetic material(chromosome)by simple staining – Giant chromosome in *Chironomus* larva
7. Spotters
   I. Watson and Crick model of DNA
   II. DNA Replication
   III. Lac Operon
   IV. Clover leaf model of tRNA
   V. Coding dictionary

GENETICS

1. Survey of simple Mendelian traits in man in small population.
2. Use of beads to study Monohybrid, Dihybrid and Test crosses.
3. Distribution of tasters and non-tasters in the class population (PTC tasting).
4. Polygenic inheritance of quantitative traits – observations and graphical representations may be made using height and weight of the students.
5. Genetic basis and significance of a) Gynandromorphism
   b) Shell coiling in *Limnaea.*
   c) Klinefelters, Down and Turner's Syndromes
   d) Colour blindness and Hypertrichosis.

6. Fraternal, identical and Siamese twins
7. Drosophila culture and identification of various stages.

DEVELOPMENTAL BIOLOGY

1. Study of structure of egg of an insect, frog and Chick.
2. Temporary mounting of Chick blastoderm.
3. Effect of Thyroxine in tadpoles of Frog (Demonstration only)

Spotters

a) Observation of cleavage, Blastula and Gastrula of Frog (Slides).
b) Whole mount of 24 Hours and 48 Hours chick embryo (Slides)
c) Placental types – Observation

PHYSIOLOGY

1. Effect of temperature on the opercular movement of fish.
2. Study of oxygen consumption by a fish
3. Test for the detection of excretory products (Ammonia, Urea and Uric acid).
4. Study of blood corpuscles- Preparation of blood smear and counting of blood corpuscles using haemocytometer.
5. A study on ECG strip and report
6. Effect of activities on blood pressure in Man.

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	L	M	S
CO 2	S	S	S	M	S
CO 3	S	S	M	M	S
CO 4	S	M	S	S	S
CO 5	S	S	S	M	S

S-Strong **M-**Medium **L-**Low

Pedagogy

Chalk and talk, Charts and models, Smart board, Group Discussion, PPT, Preserved animals, slides and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, Microscope – Dissection, Compound, and Phase Contrast Microscopes.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Practicals	Content Delivery Method	Teaching Aids
	Invertebrates			
1	**CELL BIOLOGY** Study of Cell types – Observation of prepared slides	2	Chalk & Talk Dissection Tools	Green Board Charts
2	Study of oral epithelium in human and Onion peeling	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
3	Mitosis – Study of stages in Onion root tip meristem	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
4	Meiosis – Study of stages of spermatogenesis in grass hopper testis –squash	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
5	Micro technique- Preparation of permanent slides (Demonstration only).	2	Chalk & Talk Dissection	Green Board Microscope

			Tools	Charts
6	Identification of the genetic material(chromosome)by simple staining – Giant chromosome in Chironomous larva	4	Software Internet with Wifi	Smart Board Charts Models Laptops
7	Spotters I. Watson and Crick model of DNA II. DNA Replication III. Lac Operon IV. Clover leaf model of tRNA V. Coding dictionary	1	Discussion	Green Board
8	**GENETICS** A survey of simple Mendelian traits in man (Class population).	1	Discussion	Green Board
9	Use of beads and models to illustrate Monohybrid , Dihybrid and Test cross	1	Chalk & Talk Discussion	Preserved animalcules and slides
10	Distribution of tasters and non tasters in the class population (PTC tasting)	1	Chalk & Talk Discussion	Preserved animalcules and slides
11	Polygenic inheritance of quantitative traits – observations and graphical representations may be made using height and weight of the students	1	Chalk & Talk Discussion	Preserved animals and slides
12	Genetic basis and significance of a)Gynandromorphism b) Shell coiling in Limnaea. c) Klinefelters, Down and Turner's Syndromes d) Colour blindness and Hypertrichosis	1	Chalk & Talk Discussion	Preserved animals and slides
13	Fraternal, identical and Siamese twins	1	Chalk & Talk Discussion	Preserved animals and slides
14	Drosophila culture and identification of various stages	4	Discussion PPT Photographs	Live farms and demonstration
15	**Developmental Biology** Study of structure of egg of an insect, frog and Chick.	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
16	Temporary mounting of Chick blastoderm	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
17	Effect of Thyroxin in tadpoles of Frog (Group study)	5	Software Internet with Wifi	Smart Board Charts Models Laptops
18	**Spotters** a) Observation of cleavage, Blastula and Gastrula of Frog (Slides). b) Whole mount of 24 Hours and 48 Hours chick embryo (Slides) c) Placental types – Observation	4	Discussion	Green Board

19	**Physiology** Effect of temperature on the opercular movement of fish.	1	Chalk & Talk Discussion	Preserved animals and slides
20	Study of oxygen consumption by a fish Test for the detection of excretory products (Ammonia, Urea and Uric acid)	1	Chalk & Talk Discussion	Preserved animals and slides
21	Study of blood corpuscles- Preparation of blood smear and counting of blood corpuscles using haemocytometer	1	Chalk & Talk Discussion	Preserved animals and slides
22	A study on ECG strip and report Effect of activities on blood pressure in Man	1	Chalk & Talk Discussion	Preserved animals and slides
23	Circadian rhythm of body temperature in man	3	Chalk & Talk Discussion	Preserved animals and slides
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skill Based Course		
Course Title : **Clinical Lab Technology**		
Course Code: **09SB41**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Principles, applications and working mechanisms of biomedical instruments
- Importance of blood grouping
- Functions of ECG and EEG
- Examination of semen and stools

Syllabus

UNIT I

BIOMEDICAL DIAGNOSTIC LABORATORY-1:

Laboratory bio safety – general plan and organization –biomedical waste management, Applications of autoclave, centrifuge, microscope,

UNIT II

BIOMEDICAL DIAGNOSTIC LABORATORY -2

Electrophoresis, Chromatography, Colorimeter, Ultra Sound scan, X-ray, Doppler scan, CT scan, MRI scan.

UNIT III

HEMATOLOGICAL TECHNIQUES 1:

Blood – composition - counting of blood cells – blood smear – staining- ABO and Rh Blood grouping – Transfusion strategies.

UNIT IV

HEMATOLOGICAL TECHNIQUES 2

Haemoglobin estimation - Haemoglobinometer, Haemocytometer, ECG, EEG – ESR — Blood bank.

UNIT V

BIOMEDICAL STANDARDS AND DISORDERS:

Lipid profile, enzyme profile, urine profile, semen analysis, stool examination; anemia, diabetes, jaundice, bleeding disorders, CHD, Arthritis.

Text Book

- Medical Laboratory Technology - Volume I, II & III – L. Mukherjee,1989 – McGraw Hill Publ. Co.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- V**
Course Title **: BIOCHEMISTRY AND BIOPHYSICS**		
Course Code: **09CT51**	Hours per week: **5**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to Understanding the broad spectrum of bio- molecules in their structure, metabolism and functions. They are also made awareness of biophysical properties among the living systems

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge in biomolecule structure, classification and biophysical principles.	K1,K2 & K3
CO 2	Understanding the properties of biomolecules and various law's bio-physical principles.	K1,K2 & K3
CO 3	Explore the metabolic pathways and their products in the living system.	K1,K2 & K3
CO 4	Applying the biophysical principles in the living systems.	K1,K2 & K3
CO 5	Analyse the products of biomolecules and biophysical principles in living system.	K1,K2 & K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M**-Medium **L**-Low

Syllabus

UNIT-I **12 Hours**

a. Acids, Bases, Dissociation constant, indicators, p^H, Buffers, Electrolytes, isotopes, isomerism.

b. Biologically important chemical bonds and their importance.

c. Classification, structure and properties of Carbohydrates, Lipids, Protein and Amino acids.

UNIT-II **12 Hours**

a. Structure and function of cholesterol, biosynthesis of cholesterol.

b. Enzymes and Co enzymes: Classification and properties of enzymes-factors affecting enzyme action.

c. Theories of enzyme action-Mechanism of enzyme action- Role of Coenzymes and isoenzymes.

UNIT-III **12 Hours**

a. Metabolism of carbohydrates (Glycolysis, Glycogenesis, Glyconeogenesis and Glycogenolysis)

b. Metabolism of Protein (deamination, transamination, transdeamination and urea synthesis)

c. Metabolism of Lipid (β-oxidation, biosynthesis of glycerol)

UNIT-IV **12 Hours**

a. Biological oxidation: Definition- The respiratory chain-Oxidative phosphorylation

b. Production of ATP and energy budget in the metabolism of major nutrients.

c. High energy compounds-definition-biologically important high energy compounds.

UNIT-V **12 Hours**

a. Colloids –introduction. Types of colloidal solution-general properties of colloidal solution, Brownian movement, Osmotic pressure, dialysis, Donnan membrane equilibrium. Surface tension
b. Adsorption, hydrotrophy, diffusion (passive and active), transport across the cell membrane- pinocytosis, transport of ions.
c. Thermodynamics-definitions of different terms, Free energy, heat energy, enthalpy, entropy, exothermic and endothermic reactions. Bioelectricity - definition and measurement-action potential-membrane potential, Redox potential.

Text Books

- Deb A.C. 2003. Fundamentals of Biochemistry, New central book agency, Kolkatta
- Subramanian, M.A. 2005. Biophysics- Principles and Techniques, M.J.P. Publication, Chennai.

Reference Books

- Ambika Shanmugam 2003. Fundamentals of Biochemistry, Madras Medical College, Chennai
- Lehninger 2008. Biochemistry, Kalyani Publications, New Delhi
- R.N. Roy 2006. Biophysics, Kolkatta
- Salil Bose 1982. Elementary Biophysics, Jyothi books, Madurai.

Pedagogy

Chalk and talk, Group Discussion and PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Acids, Bases, Dissociation constant, indicators, p^H, Buffers, Electrolytes, isotopes, isomerism.	4	Chalk & Talk	Green Board
1.2	Biologically important chemical bonds and their importance.	4	Chalk & Talk	PPT
1.3	Classification, structure and properties of Carbohydrates, Lipids, Protein and Amino acids.	4	Lecture	PPT & Green Board
Unit -2				
2.1	Structure and function of cholesterol, biosynthesis of cholesterol.	3	Lecture	Green Board Charts
2.2	Enzymes and Co enzymes: Classification and properties of enzymes-factors affecting enzyme action	4	Chalk & Talk	Green Board
2.3	Theories of enzyme action-Mechanism of enzyme action	3	Chalk & Talk, ppt	Green Board Smart Board
2.4	Role of Coenzymes and isoenzymes.	2	Chalk & Talk	Green Board
Unit -3				
3.1	Metabolism of carbohydrates (Glycolysis, Glycogenesis, Glyconeogenesis and Glycogenolysis)	4	Lecture PPT	Green Board
3.2	Metabolism of Protein (deamination, transamination, transdeamination and urea synthesis)	4	Lecture PPT	Green Board Smart Board
3.3	Metabolism of Lipid (β-oxidation, biosynthesis of glycerol)	4	Lecture PPT	Green Board
Unit -4				
4.1	Biological oxidation: Definition- The	4	Lecture	Green Board

	respiratory chain-Oxidative phosphorylation		PPT	
4.2	Production of ATP and energy budget in the metabolism of major nutrients.	4	Chalk & Talk	Green Board
4.3	High energy compounds-definition-biologically important high energy compounds	4	Chalk & Talk	Green Board
Unit -5				
5.1	Colloids –introduction. Types of colloidal solution-general properties of colloidal solution, Brownian movement, Osmotic pressure, dialysis, Donnan membrane equilibrium. Surface tension	3	Lecture PPT	Green Board
5.2	Adsorption, hydrotrophy, diffusion (passive and active), transport across the cell membrane- pinocytosis, transport of ions.	3	Lecture PPT	Green Board
5.3	Thermodynamics-definitions of different terms, Free energy, heat energy, enthalpy, entropy, exothermic and endothermic reactions.	3	Lecture PPT	Green Board
5.4	Bioelectricity - definition and measurement-action potential-membrane potential, Redox potential	3	Lecture PPT	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER - **V**
Course Title **: BIOTECHNOLOGY**		
Course Code: **09CT52**	Hours per week: **5**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

Enable the students to Understanding the basic knowledge on concepts, tools, techniques and applications of biotechnology.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on concepts and various tools and techniques in biotechnology	K1,K2
CO 2	Understanding the functions of the tools under various disciplines of biotechnology	K2,K3
CO 3	Explore the culture techniques, gene modification, gene amplification and environmental bioremedies using in biotechnology	K2,K3
CO 4	Gain knowledge on the principles and applications of various molecular techniques	K2, K3
CO 5	Inculcate the entrepreneurial skills using the tools and techniques in biotechnology	K1, K2, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M**-Medium **L**-Low

Syllabus

Unit: I Introduction and Molecular Tools

a. Definition – Scope and importance- Biotechnology as an interdisciplinary pursuit - Intellectual Property Right (IPR) and Ethics in biotechnology

b. Enzymes – Restriction endonucleases (Type I, II & III), DNA-ligase, Reverse transcriptase, DNA polymerase, Terminal transferase - Linkers and Adaptors

c. Vectors – pBR322, Ti plasmid, SV40 - Basic ideas about Phagemid, Cosmid, Bacterial Artificial Chromosome (BAC), Yeast Artificial Chromosome (YAC), Transposons as vectors, Shuttle and Expression vectors.

Unit-II Recombinant DNA Technology

a. Gene cloning in Prokaryotes - DNA-gene library, genomic library - cDNA library
b. Integration of DNA fragments into vector - Transfer of rDNA into bacterial cell
c. Screening of recombinants - Selection of recombinants - DNA- sequencing

Unit: III Techniques

a. **Molecular techniques**- Agarose Gel Electrophoresis – RFLP, RAPD, Polymerase Chain Reaction (PCR) – Blotting Techniques- Molecular probes and Hybridization- DNA finger Printing- Microarray

b. **Animal Cell culture techniques**: Basic aspects of Animal cell, tissue and organ culture - Immobilized cell culture - Insect cell culture-Whole embryo culture

c. **Plant cell culture techniques:** *In vitro* culture technique – Introduction for plant cell, tissue and organ culture

Unit-IV Applied Biotechnology

a. **Animal-**Transgenic animals-Sheep& Fish- Animal bioreactor and molecular farming - Products from animal cell culture - Tissue plasminogen activator (tPA), blood factor VIII, Erythropoietin (EPO)

b. **Plant-**Disease resistant plant production-Production of stress resistant plants – Insect resistant transgenic plants

c. **Microbes-**Biofertilizers, Biopesticides, Primary and secondary metabolites-Ethanol production-Single cell protein (SCP) - Biogas production- Biohydrogen- Mushroom culture

Unit - V Biotechnology in Medicine and Environment

a. **Medicine:** Recombinant vaccines - Improved contraceptives & Vaccines to control fertility-Antibiotic production- Penicillin., Monoclonal antibody production and its applications

b. DNA probes in diagnosis of diseases- Production of Human peptide hormones and insulin- Gene therapy

c. Environment: Genetically Modified Organisms (GMOs) for the management of environmental wastes - Bioremediation – i*n situ* and *ex situ* process- Microbial degradation of Xenobiotics – Biomining and Ore leaching.

Text Books

- Dubey R.C. 2012. A text book of Biotechnology, S .Chand and Company Ltd., New Delhi

Reference Books

- Das H.K. 2007. Text Books of Biotechnology, Wiley Precise text books.
- Channarayappa, 2006. Molecular BiotechnologyPrinciples and practices, University Press.
- Satyanarayana U. 2008. Biotechnology, Books and Allied, Kolkatta
- Lohar S. 2005. Biotechnology Praksh MJP publications Chennai.

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, Smart Board & Electrophoresis apparatus

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	**Definition** – Scope and importance- Biotechnology as an interdisciplinary pursuit - Intellectual Property Right (IPR) and Ethics in biotechnology	3	Chalk & Talk	Green Board
1.2	**Enzymes –** Restriction endonucleases (Type I, II & III), DNA-ligase	2	Chalk & Talk	PPT & Smart board
1.3	Reverse transcriptase, DNA polymerase, Terminal transferase - Linkers and Adaptors **Vectors** – pBR322, Ti plasmid, SV40 - Basic ideas about Phagemid, Cosmid	4	Lecture	PPT & White board
1.4	Bacterial Artificial Chromosome (BAC), Yeast Artificial Chromosome (YAC), Transposons as vectors, Shuttle and Expression vectors.	3	Lecture	Green Board
Unit -2				
2.1	Gene cloning in Prokaryotes - DNA-gene library, genomic library , cDNA library	4	Lecture	Green Board Charts
2.2	Integration of DNA fragments into vector - Transfer of rDNA into bacterial cell	4	Chalk & Talk	Green Board
2.3	Screening of recombinants - Selection of recombinants - DNA- sequencing	4	Chalk & Talk, ppt	Green Board Smart Board

Unit -3				
3.1	**Molecular techniques**- Agarose Gel Electrophoresis – RFLP, RAPD, Polymerase Chain Reaction (PCR) – Blotting Techniques- Molecular probes and Hybridization- DNA finger Printing- Microarray	5	Chalk & Talk	Green Board & Electrophoresis apparatus
3.2	**Animal Cell culture technique**s: Basic aspects of Animal cell, tissue and organ culture - Immobilized cell culture - Insect cell culture-Whole embryo culture	3	Lecture PPT	Green Board Smart Board
3.3	**Plant cell culture techniques:** *In vitro* culture technique – Introduction for plant cell, tissue and organ culture	4	PPT and Chalk & Talk	Green Board Microscope
Unit -4				
4.1	**Animal-**Transgenic animals-Sheep& Fish- Animal bioreactor and molecular farming - Products from animal cell culture - Tissue plasminogen activator (tPA), blood factor VIII, Erythropoietin (EPO)	4	PPT & Discussion	Smart Board
4.2	**Plant-**Disease resistant plant production-Production of stress resistant plants – Insect resistant transgenic plants	4	Chalk & Talk	Green Board
4.3	**Microbes-**Biofertilizers, Biopesticides, Primary and secondary metabolites-Ethanol production- Single cell protein (SCP) - Biogas production- Biohydrogen- Mushroom culture	4	Chalk & Talk PPT	White Board Microscope
Unit -5				
5.1	**Medicine:** Recombinant vaccines - Improved contraceptives & Vaccines to control fertility-Antibiotic production- Penicillin., Monoclonal antibody production and its applications	5	Lecture	Green Board
5.2	DNA probes in diagnosis of diseases- Production of Human peptide hormones and insulin- Gene therapy	3	Chalk & Talk	Smart Board
5.3	**Environment:** Genetically Modified Organisms (GMOs) for the management of environmental wastes - Bioremediation – i*n situ* and *ex situ* process- Microbial degradation of Xenobiotics – Biomining and Ore leaching.	4	Chalk & Talk PPT	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- V**
Course Title **: MICROBIOLOGY AND IMMUNOLOGY**		
Course Code: **09CT53**	Hours per week: **5**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

Enable the students to Understanding the basic knowledge on microbes, their structures and behaviour. To study the immune system and basic immunotechniques

Course outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on basic concepts of microbiology and immunology	K1&K2
CO 2	Understanding the classification , structure and behaviour of microbes and immune system	K1&K2
CO 3	Analyze the microbial physiology in various media and the cellular morphology of immune system	K1&K2&K3
CO 4	Explore the impact of microbes in different media and to gain the knowledge on types and response of different immune system	K1&K2&K3
CO 5	Impart the knowledge on microbes in daily life and to empower to develop the skills in immunotechniques	K1&K2&K3

K1-Remembering **K2-**Understanding **K3-**Applying

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M-**Medium **L-**Low

Syllabus

UNIT-I **12 Hours**

a. History and scope of Microbiology: Classification of microorganisms- Structural features of Bacteria, Virus, Actinomycetes and Fungi: Reproduction of Viruses (T4 Phage and HIV)
b. Bacterial growth and nutritional requirements: Culture of Microorganisms – Types of culture media, Cultural characteristics of bacteria
c. Isolation and enumeration, methods and maintenance of culture; preservation of microbes, reproduction in Bacteria – Conjugation, Transformation and Transduction

Unit II **12 Hours**

a. Food Microbiology: Fermented food, Food spoilage, Food poisoning, physical and chemical methods in food preservation.
b. Soil Microbiology: Common soil microbes; symbiotic and asymbiotic organisms; physiology of nitrogen fixation.
c. Water Microbiology: Coliform bacteria and MPN, Estimation of Total Plate Count, Index, Faecal Streptococci.

Unit III **12 Hours**

a. Study of common bacterial and viral diseases of man – Causative organisms, mode of transmission, pathogenicity, symptoms and their preventive measures

b. Diseases of Gastro – enteric System – Cholera, Typhoid. Respiratory System – Diphtheria, Tuberculosis
c. Nervous System – Leprosy, Polio and Rabies – Genital System – AIDS, Fungal Diseases

Unit IV **12 Hours**

a. Immune system – Types of Immunity – Innate and acquired immunity: Passive and active
b. Lymphoid organs – Primary and secondary organs, GALT & BALT. Lymphocytes – Sub-Population of T&B Cells
c. Immunoglobulin – Types, structure and functions-Antigen-Antibody reactions – Vaccination principles – Vaccines – Preparations and immunization

Unit V **12 Hours**

a. Immune Response – Acquired immune response – Humoral immunity and Cell Mediated Immunity – Complements – classical and alternate pathway – MHC and HLA – Structure and function.
b. Immune techniques – principles of precipitation – VDRL slide test, Double immuno diffusion and Immuno-electrophoresis – ELISA and Radio Immuno Assay.
c. Hypersensitivity, transplantation – grafting – immune deficiency-Types and diseases.

Text Books

- Michael J.Pelczar, J.R. Ecschan, Noel R Krieg 2010. Microbiology an Application Based Approach, Tata McGraw Hill Education Private Ltd, NewDelhi
- Ananthnarayanan,& Jayaram Panicker, 2010. Text Book of Microbiology, Universities Press

Reference Books

- Gangal S. and Sontakke, S. 2013 Text Book of Basic and Clinical Immunology, University Press (India) Pvt, Ltd, Hyderabad
- Hannigan B.M., Moore, C.B.T. and Quinn, D.G. (2010). Immunology, Viva books, New Delhi
- Sharma, P.D. 1998. Microbiology, Rastogi Publications
- Meena Kumari S. 2005 Microbial Physiology, M.J.P. Publishers , Chennai
- Vijaya Ramesh, K. 2005, Environmental Microbiology, M.J.P. Publishers Chennai
- Kuby, T. 1994. Immunology, P.G. Publishing Pvt., Ltd., New Delhi
- Tizard I.R. 1995. Immunology – An Introduction IV ED. Saunders College Publications, Philadelphia

Pedagogy

Chalk and talk, Group Discussion and PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	History and scope of Microbiology: Classification of microorganisms- Structural features of Bacteria, Virus, Actinomycetes and Fungi: Reproduction of Viruses (T4 Phage and HIV)	4	Chalk & Talk	Green Board
1.2	Bacterial growth and nutritional requirements: Culture of Microorganisms – Types of culture media, Cultural characteristics of bacteria	4	Chalk & Talk	PPT
1.3	Isolation and enumeration, methods and maintenance of culture; preservation of microbes, reproduction in Bacteria – Conjugation, Transformation and Transduction	4	Lecture	PPT & Green Board
Unit -2				
2.1	Food Microbiology: Fermented food, Food spoilage, Food poisoning, physical and chemical methods in food preservation.	4	Lecture	Green Board Charts
2.2	Soil Microbiology: Common soil microbes; symbiotic	4	Chalk & Talk	Green Board

	and asymbiotic organisms; physiology of nitrogen fixation.			
2.3	Water Microbiology: Coliform bacteria and MPN, Estimation of Total Plate Count, Index, Faecal Streptococci.	4	Chalk & Talk, ppt	Green Board Smart Board
Unit -3				
3.1	Study of common bacterial and viral diseases of man – Causative organisms, mode of transmission, pathogenicity, symptoms and their preventive measures	4	Lecture PPT	Green Board
3.2	Diseases of Gastro – enteric System – Cholera, Typhoid. Respiratory System – Diphtheria, Tuberculosis	4	Lecture PPT	Green Board Smart Board
3.3	Nervous System – Leprosy, Polio and Rabies – Genital System – AIDS, Fungal Diseases	4	Lecture PPT	Green Board
Unit -4				
4.1	Immune system – Types of Immunity – Innate and acquired immunity: Passive and active	4	Lecture PPT	Green Board
4.2	Lymphoid organs – Primary and secondary organs, GALT & BALT. Lymphocytes – Sub-Population of T&B Cells	4	Chalk & Talk	Green Board
4.3	Immunoglobulin – Types, structure and functions-Antigen-Antibody reactions – Vaccination principles – Vaccines – Preparations and immunization	4	Chalk & Talk	Green Board
Unit -5				
5.1	Immune Response – Acquired immune response – Humoral immunity and Cell Mediated Immunity – Complements – classical and alternate pathway – MHC and HLA – Structure and function.	4	Lecture PPT	Green Board
5.2	Immune techniques – principles of precipitation – VDRL slide test, Double immuno diffusion and Immuno-electrophoresis – ELISA and Radio Immuno Assay.	4	Lecture PPT	Green Board
5.3	Hypersensitivity, transplantation – grafting – immune deficiency-Types and diseases.	4	Lecture PPT	Green Board
	Total	**60**		

Course Designer (Name of the Course Teacher)

Dr.K.Kamatchi
Dr.S.Selvaraj

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Elective Theory**		SEMESTER **- V**
Course Title **: BIOSTATISTICS, COMPUTER APPLICATION & BIOINFORMATICS**		
Course Code: **09EP51**	Hours per week: **5**	Credits: **5**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

Enable the students to acquire knowledge on principle, methods, analysis and interpretation of biology data through statistical and computational techniques.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	To acquire knowledge on history, data and instruments of statistics and bioinformatics	K1,K2 &K3
CO 2	To retrieve, present and evaluate the data using statistics and computational tools	K1,K2 &K3
CO 3	Interpertate retried, analyzed data using methods, techniques through soft packages and statistical tools	K1,K2 &K3
CO 4	Explore, predict and to study the applications of statistical and computational biology	K1,K2 &K3
CO 5	To develop the skills in computational biology and computer data based works by using concepts, tools and techniques	K1,K2 &K3

K1-Remembering **K2-**Understanding **K3-**Applying

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M-**Medium **L-**Low

Syllabus

UNIT- I **12 Hours**

a. Scope of Biostatistics- Types of Data- Importance of data collection
b. Classification, tabulation and frequency distribution.
c. Representation of data- Diagrammatic and graphical methods – Bar (Simple, Composite and Percentage) Pie, Histogram and Frequency curve.

UNIT – II **12 Hours**

a. Measures of Central tendency- calculation of Mean, (Arithmatic, Geomatric, Harmonic) Median and Mode- Their merits and demerits.
b. Measures of Dispersion – Calculation of range, Quartile deviation, mean deviation, standard deviation
c. Variance and co-efficient of variation

UNIT-III **12 Hours**

a. Chi- square analysis- Calculation of gene frequency in a Mendelian population
b. Probability- Theorem and calculation
c. Students t- test and its significance

UNIT IV **12 Hours**

a. History, Classifications of computer-main frame, mini, micro and super computer

b. Number systems -Decimal to binary. Popular software packages- MS word, power point, MS Excel
c. Web and multimedia-Web browsers, E-mail-creating ID, management of mail.

UNIT V **12 Hours**

a. History and concepts of Bioinformatics, Biological databases; Types of databases.
b. Basic and functional genomics - gene alignment, BLAST, Tools in BLAST. Multiple sequence alignment, CLUSTAL W
c. Phylogenetic analysis, SwissProt- Expasy- Proteomic tools.

Text Books

- Palanichamy S.and Manoharan. S. 2003. Statistical methods for Biologists, Paramount Pub, Palani
- Ignacimuthu, 2006. Basic Bioinformatics, Narosa Publishers, New Delhi

Reference Books

- An Introduction to Biostatistics, 2004, S.Sundar Rao and J.Richard, Prentice Hall of India Private Ltd, New Delhi
- Introductory Practical Biostatistics, B.N.Misra *et al.*,1983,Naya Prakash, Kolkatta
- Bioinformatics- D.R Westhead, J.H. Parish and R.M. Twyman 2003.Viva Books, Pvt.Ltd, New Delhi.
- Bioinformatics, Lohar,P.S 2009, MJP Publishers, Chennai
- Fundamental concept of Bioinformatics- Dan E. Krane & Michael L. Raymer, 2003. Pearson.Edu. New Delhi.
- Recent advances in Bioinformatics-IrfarA.Khan. Atiya Khanum,2002, Ukaz. Pub. Hyderabad.

Pedagogy

Chalk and talk, Group Discussion and PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Scope of Biostatistics- Types of Data- Importance of data collection	4	Chalk & Talk	Green Board
1.2	Classification, tabulation and frequency distribution.	4	Chalk & Talk	Green Board
1.3	Representation of data- Diagrammatic and graphical methods – Bar (Simple, Composite and Percentage) Pie, Histogram and Frequency curve.	4	Chalk & Talk	Green Board
Unit -2				
2.1	Measures of Central tendency- calculation of Mean, (Arithmatic, Geomatric, Harmonic) Median and Mode- Their merits and demerits.	5	Chalk & Talk	Green Board
2.2	Measures of Dispersion – Calculation of range, Quartile deviation, mean deviation, standard deviation	6	Chalk & Talk	Green Board
2.3	Variance and co-efficient of variation	1	Chalk & Talk,	Green Board
Unit -3				
3.1	Chi- square analysis- Calculation of gene frequency in a Mendelian population	4	Chalk & Talk,	Green Board
3.2	Probability- Theorem and calculation	4	Chalk & Talk,	Green Board

3.3	Students t- test and its significance	4	Chalk & Talk,	Green Board
Unit -4				
4.1	History, Classifications of computer-main frame, mini, micro and super computer	4	Lecture	Smart Board
4.2	Number systems -Decimal to binary. Popular software packages- MS word, power point, MS Excel	4	Lecture	Smart Board
4.3	Web and multimedia-Web browsers, E-mail-creating ID, management of mail.	4	Lecture	Smart Board
Unit -5				
5.1	History and concepts of Bioinformatics, Biological databases; Types of databases.	4	Lecture PPT	Green Board Smart Board
5.2	Basic and functional genomics - gene alignment, BLAST, Tools in BLAST. Multiple sequence alignment, CLUSTAL W	4	Lecture PPT	Green Board Smart Board
5.3	Phylogenetic analysis, SwissProt- Expasy- Proteomic tools.	4	Lecture PPT	Green Board Smart Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skilled Based Course		
Course Title : **Sericulture**		
Course Code: **09SB51**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Understanding sericulture as a cottage industry and exposure to silkworm rearing
- Mulberry cultivation and pathology
- Awareness creation to make them an entrepreneur

Syllabus

UNIT I: History of Sericulture – Sericulture as cottage industry - Types of Silk worms – Mulberry and Non-mulberry– Economic importance of silk and its by products (4 Hours)

UNIT II: Mulberry cultivation – Methods of propagation – Irrigation – Manuring - Diseases and Pests of Mulberry – Control measures. (6 Hours)

UNIT III: Life cycle of *Bombyx mori* – Voltinism - Silk gland – Rearing House and appliances – Rearing methods- Pathology of silk worm and control. (6 Hours)

UNIT IV:Characteristics of Cocoons – Stiffling – Process of Silk reeling (4 Hours)

UNIT V:Identification of silk worm larvae, pupa and Imago,

Morphology of silk gland, DFL, Rearing appliances and Chandrika (4 Hours)

Text Books

- An Introduction to Sericulture, 2006,G. Ganga of J. Sulochana Chetty, Oxford & IBH, Publishing Company, NewDelhi

Reference books

- Principles of Sericulture, 1996, H.Aruga, Oxford & IBH, Publishing Company, New Delhi

SEMESTER – V

(For those who joined in June 2014 and after)

Part – IV **: Common Course Theory**		
Course Title : **ENVIRONMENTAL STUDIES**		
Course Code: **ESUG51**	Hours per week: **2**	Credits: 2
CIA Marks**: 25 Marks**	ESE Marks**: 75 Marks**	Total Marks: **100**

Objectives

- *Disseminate information of Environment of national and international issues*
- *Environmental consciousness creation among the students*
- *Facilitation of environmental leadership among students*

Syllabus

Unit-I	Introduction – Nature, scope and importance of Environmental studies – Natural Resources and conservation – forest, water and energy.	**6** hrs
Unit-II	Ecosystem – concept – structure and function, energy fLow, food chain, food web and ecological pyramids	**6** hrs
Unit-III	Biodiversity – definition, types – values – India, a mega diversity zone – Hotspots – Endangered and endemic species – threat to biodiversity and conservation	**6** hrs
Unit-IV	Environmental pollution – Air pollution- causes and effect – Ozone depletion – Global warming – acid rain – Water pollution – Noise pollution – Solid waste management – Nuclear hazard	**6** hrs
Unit-V	Human population and the environment – Population growth – variation among nations – effects of population explosion – family welfare programme – environment and human health.	**6** hrs

Text books

1. Environment studies – R.Murugesan (2009), Milleneum Publication. Madurai-16
2. T.Ramesh and P.Rajendran (2017) Environmental studies, Dart Publication, Madurai, Tamil Nadu, India
3. Murugeshan, R (2013) Environmental studies. Millennium publication and Distributions, Madurai, Tamil Nadu, India.
4. Bharucha.E (2019) Textbook of environmental studies for undergraduate courses, universities Press (India) Private Limited, Hyderabad, India.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Theory**		SEMESTER **- VI**
Course Title **: EVOLUTION**		
Course Code: **09CT61**	Hours per week: **6**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To acquire knowledge in theories of origin of life and evolution. To study various evolutionary forces, radiation and phylogeny in species.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on process of evolution through principles, theories and evidences	K1,K2, & K3
CO 2	Understanding the basic concept of evolution through various evolutionary processes.	K1,K2, & K3
CO 3	Ensure the progress, barriers and attainments in the events of evolutionary processes.	K1,K2, & K3
CO 4	Analyse the structure and outcomes of the evolutionary processes of speciation	K1,K2, & K3
CO 5	Impart the knowledge on fossil and fossilization and also in evolutionary sequences / ancestral behaviours of mammals.	K1,K2, & K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M**-Medium **L**-Low

Syllabus

Unit – I **12 Hours**

a. Origin of Life: Oparin-Haldane Theory,
b. Evidences for Evolution from Morphology and comparative anatomy, Embryology, Physiology and Biochemistry.
c. Lamarckism and Neo-Lamarckism

Unit – II **12 Hours**

a) Darwinism: Natural selection, Neo-Darwinism – Types of selection- Experimental evidences.

b) Modern synthetic theory- Hardy-Weinberg's Law – Behaviour of genes in natural population
c) Genetic Drift – Evolutionary Significance.

Unit - III **12 Hours**

a) Species Concept – Sub Species and Sibling Species, Allopatric and Sympatric Speciation, Isolating Mechanism – Types and Examples
b) Distribution of Animals – Barriers – Continental Drift Hypothesis Extinction – Types and causes
c) Mimicry and colouration.

Unit – IV **12 Hours**

a) The Geological Records – Geological time scale– Survey of Geological periods

b) Fossils: methods of fossilisation –types

c) Methods of detection - Lead and Carbon Method.

Unit –V **12 Hours**

a) Adaptive Radiation in Mammals.

b) Evolution of Man- Biological and cultural.

c) Evolution of horse- Orthogenesis.

Text Book

- VeeraBala Rastogi, 2005. Organic Evolution, Kedarnath Ramnath Pub.

Reference Books

- Strickberger, 1994. Evolution, ELBS Publishers.
- Moody P.A.1995. Introduction to evolution, Kalyani Pub, New Delhi.
- Dobzhansky, Th., Ayala, F. J., Stebbins, G. Ledyard & Valentine, J. W., 1977. Evolution W. H. Freeman and Company, San Francisco
- Chattopadhay, 2002. Life – origin, Evolution and adaptation, Books and Allied P Ltd, Kolkata.

Pedagogy

Chalk and talk, Group Discussion and PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Origin of Life: Oparin-Haldane Theory	2	Chalk & Talk	Green Board
1.2	Evidences for Evolution from Morphology and comparative anatomy, Embryology, Physiology and Biochemistry.	6	Chalk & Talk	Green Board
1.3	Lamarckism and Neo-Lamarckism	4	Lecture	PPT & Green Board
Unit -2				
2.1	Darwinism: Natural selection, Neo-Darwinism – Types of selection- Experimental evidences.	4	Lecture	Green Board Charts
2.2	Modern synthetic theory- Hardy-Weinberg's Law – Behaviour of genes in natural population	4	Chalk & Talk	Green Board
2.3	Genetic Drift – Evolutionary Significance.	4	Chalk & Talk, ppt	Green Board Smart Board
Unit -3				
3.1	Species Concept – Sub Species and Sibling Species, Allopatric and Sympatric Speciation, Isolating Mechanism – Types and Examples.	5	Lecture PPT	Green Board
3.2	Distribution of Animals – Barriers – Continental Drift Hypothesis Extinction – Types and causes	5	Lecture PPT	Green Board Smart Board
3.3	Mimicry and colouration	2	Lecture PPT	Green Board

Unit -4				
4.1	The Geological Records – Geological time scale– Survey of Geological periods	4	Lecture PPT	Green Board
4.2	Fossils: methods of fossilisation –types	4	Chalk & Talk	Green Board
4.3	Methods of detection - Lead and Carbon Method	4	Chalk & Talk	Green Board
Unit -5				
5.1	Adaptive Radiation in Mammals.	4	Lecture PPT	Green Board
5.2	Evolution of Man- Biological and cultural.	4	Lecture PPT	Green Board
5.3	Evolution of horse- Orthogenesis	4	Lecture PPT	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Core Lab**		SEMESTER **- II**
Course Title **: PRACTICAL - III**		
Course Code: **09CP62**	Hours per week: **6 (3+3)**	Credits: **4**
CIA : **40 Marks**	ESE: **60 Marks**	Total : **100 Marks**

Preamble

To enable the students to have hands on experiments in the field of biochemical, Microbiological, Biotechnological tools and Biophysical process. They are further made to analyse the environmental parameters and process also analyse these with appropriate statistical tools. They are also exposed to the different packages in genome analysis and protein designing further they are exposed to the various aspects of Microbiology, Immunology and Dairy science in the evolutionary prospects.

Course Outcomes (CO)

On the successful completion the students are enable

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on the principles of biophysical, biochemical, biotechnological tools and also to certain the analytical methods of environments, statistics using computer system	K1, K2, K3
CO 2	Understanding the basis of biological experiment using different principles and methodology	K1, K2, K3
CO 3	Analyse the results of various biological, ecological and parameter measurements through the statistical tools	K1, K2, K3
CO 4	Ensure the applications of the biological experiment in the prospects of evolutionary aspects	K1, K2, K3
CO 5	Trace the employing, marketing and development strategies in the Microbiological and Dairying	K1, K2, K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Biochemistry & Biophysics, Biotechnology, Environmental biology, Biostatistics, Computer Applications and Bioinformatics

Biochemistry &Biophysics

Objectives

To enable the students to

- Experiments to observe certain physiological aspects
- Analysis of blood and water samples

1. Study of salivary amylase enzyme activity. Effect of temperature and p^H
2. Tests for albumen, Sugar and Urea in Urine.
3. Qualitative tests for carbohydrate, protein and lipid.
4. Study of p^H meter and measurement of p^H of various water samples.
5. Estimation of Ascorbic acid (Vitamin-C)
6. Analysis of Slide Preparation: Haemin and Uric acid crystals.

Biotechnology

Objectives

To enable the students to

- Screen industrially important microbes
- Isolation of genomic and plasmid DNA
    1. Primary screening of industrially important microbes
    2. Isolation of Genomic DNA
    3. Isolation of Plasmid DNA
    4. Demonstration of Agarose gel Electrophoresis
    5. Immobilization of yeast cells
    6. PCR demonstration
    7. Spotters - Typical gene cloning experiment, Electrophoretic apparatus, Southern blotting, Northern blotting and DNA sequencing

Microbiology and Immunology

Objectives

To enable the students to

- Introduction of basic techniques in microbiology
- Principles and uses of microbiological instruments
- Dissection & observation of lymphoid organs
- Introduction of basic techniques in Immunology

1. Cleaning of glass wares – Sterilizing media and equipment's
2. Preparation of media for Microbes.

3. Distribution of microbes in Nature- Soil, Water and in Air.
4. Cultural characterization of Bacteria
5. Simple staining of bacteria
6. Differential staining of bacteria – Gram staining.
7. Microscopic examination of live bacterial population.
   Hanging drop technique
8. Spotters: Autoclave/ pressure cooker and Colony counter.
9. Dissection to show lymphoid organs in Chick.
10. Observation of spleen cells-Slide.
11. Bleeding and serum separation.
12. Demonstration of agglutination by blood group antigen.
13. Demonstration of R.B.C. and W.B.C. count.
14. Spotters : Various Lymphoid organs in chick and human

Biostatistics, Computer Applications and Bioinformatics

Objectives

To enable the students to

- Applying statistical Programmes in biological Studies
- Handle the various basic tools of bioinformatics

Biostatistics

2. Collection of Data
3. Frequency Distribution (with number of Seed Pods)
4. Calculation of Mean, Median, Mode and Standard Deviation
5. Chi-Square analysis for Mendelian Cross (Monohybrid & Dihybrid)
6. Probability with tossing of coins.

Computer Applications

1. MS Word and its applications
2. Excel – Bar diagram, Pie diagram and Histogram
3. PowerPoint
4. Data base retrieval from internet
5. Email Creation and sending documents

Bioinformatics

1. Browsing the internet using websites
2. Browsing the internet using search Engines
3. Searching the data bases
   a. in NCBI
   b. in PDB
   c. in Swiss – Prot
4. Getting gene sequences from data bank
   a. Nucleotide sequences

b. Protein sequences

5. Analyzing Protein sequences using ROSMOL and JMOL
   a. Structure
   b. Bond length between molecules
   c. Bond angle between molecules

SEMESTER – VI

Evolution, Dairy Farming, Microbiology & Immunology

Evolution

Objectives

To enable the students to

- Finger print study and experiments with beads to Understanding evolutionary concepts
- Principles of natural selection and genetic drift in large and small population

1. Variation in finger prints in Man.

2. Experiment with beads to illustrate gene pool concept & production of genotypes

3. Experiment to study natural selection in large population

4. Experiment to study principles of genetic drift in small population.

5. Spotters- Homologous and Analogous organs, Evolutionary importance of *Peripatus, Limulus* and *Nautilus,* Study of vestigial organs, Petrified fossils (Stone fossil)

Dairy Farming

Objectives

To enable the students to

- **Observe of Dairy process, testing and identification of breeds**
- **Detect the quality of milk**

1. Identification of breeds of Cow and exotic cows
2. Computation of ration for calf and pregnant cow
3. Experiment to identify the specific gravity of milk using Lactometer
4.dectetion of adulteration using MBR test, alcohol test and H_2SO_4 tests
5. Visit to dairy processing Centre and Veterinary hospital

Environmental biology

Objectives

To enable the students to

- **Observation of eco system**
- **Estimation of ecological parameters**

1. Morphometric study of fresh water pond
2. Food web and Food chain
3. Identification of fresh water and marine plankton
4. Animal association
5. Estimation of dissolved oxygen in water samples

6. Measurement of soil temperature, pH and moisture

Pedagogy

Chalk and talk, Charts and models, Smart board, Group Discussion, PPT, Preserved animals, slides and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, Microscope – Dissection, Compound, and Phase Contrast Microscopes.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Practicals	Content Delivery Method	Teaching Aids
	Invertebrates			
1	**Biochemistry &Biophysics** 1. Study of salivary amylase enzyme activity. Effect of temperature and p^H 2. Tests for albumen, Sugar and Urea in Urine. 3. Qualitative tests for carbohydrate, protein and lipid.	3	Chalk & Talk Dissection Tools	Green Board Charts
2	4. Study of p^H meter and measurement of p^H of various water samples. 5. Estimation of Ascorbic acid (Vitamin-C) 6. Analysis of Slide Preparation: Haemin and Uric acid crystals.	3	Chalk & Talk Dissection Tools	Green Board Microscope Charts
3	***Biotechnology*** 1. Primary screening of industrially important microbes 2. Isolation of Genomic DNA 3. Isolation of Plasmid DNA	3	Chalk & Talk Dissection Tools	Green Board Microscope Charts
4	4. Demonstration of Agarose gel Electrophoresis 5. Immobilization of yeast cells 6. PCR demonstration	3	Chalk & Talk Dissection Tools	Green Board Microscope Charts
5	7. Spotters - Typical gene cloning experiment, Electrophoretic apparatus, Southern blotting, Northern blotting and DNA sequencing	3	Chalk & Talk Dissection Tools	Green Board Microscope Charts
6	**Microbiology and Immunology** 1. Cleaning of glass wares – Sterilizing media and equipment's 2. Preparation of media for Microbes. 3. Distribution of microbes in Nature- Soil, Water and in Air.	3	Software Internet with Wifi	Smart Board Charts Models Laptops
7	4. Cultural characterization of Bacteria 5. Simple staining of bacteria	5	Discussion	Green Board

	6. Differential staining of bacteria – Gram staining. 7. Microscopic examination of live bacterial population. Hanging drop technique 8. Spotters: Autoclave/ pressure cooker and Colony counter. 9. Dissection to show lymphoid organs in Chick. 10. Observation of spleen cells-Slide.			
8	11. Bleeding and serum separation. 12. Demonstration of agglutination by blood group antigen. 13. Demonstration of R.B.C. and W.B.C. count. 14.Spotters : Various Lymphoid organs in chick and human	3	Chalk & Talk Discussion	Preserved animals and slides
9	**Biostatistics** 1. Collection of Data 2. Frequency Distribution (with number of Seed Pods) 3. Calculation of Mean, Median, Mode and Standard Deviation	4	Discussion	Green Board
10	4. Chi-Square analysis for Mendelian Cross (Monohybrid & Dihybrid) 5. Probability with tossing of coins.	3	Chalk & Talk Discussion	Preserved animalcules and slides
11	**Computer Applications** 1. MS Word and its applications 2. Excel – Bar diagram, Pie diagram and Histogram and Power point	2	Chalk & Talk Discussion	Preserved animalcules and slides
12	1. Data base retrivel from internet 2. E.Mail Creation and sending documents	2	Chalk & Talk Discussion	Preserved animals and slides
13	**Bioinformatics** 1. Browsing the internet using websites 2. Browsing the internet using search Engines 3. Searching the data bases d. in NCBI e. in PDB **f.** in Swiss – Prot	2	Chalk & Talk Discussion	Preserved animals and slides
14	3. Getting gene sequences from data bank c. Nucleotide sequences d. Protein sequences 4. Analyzing Protein sequences using ROSMOL and JMOL d. Structure e. Bond length between molecules **f.** Bond angle between molecules	4	Chalk & Talk Discussion	Preserved animals and slides
15	**Evolution** 1.Variation in finger prints in Man. 2. Experiment with beads to illustrate gene	2	Discussion PPT Photographs	Live farms and demonstration

	pool concept & production of genotypes 3. Experiment to study natural selection in large population			
16	4. Experiment to study principles of genetic drift in small population. 5. Spotters- Homologous and Analogous organs, Evolutionary importance of *Peripatus, Limulus* and *Nautilus*, Study of vestigial organs, Petrified fossils (Stone fossil)	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
17	**Dairy Farming** 1. Identification of breeds of Cow and exotic cows 2. Computation of ration for calf and pregnant cow 3. Experiment to identify the specific gravity of milk using Lactometer 4.dectetion of adulteration using MBR test, alcohol test and H_2SO_4 tests 5. Visit to dairy processing Centre and Veterinary hospital	6	Chalk & Talk Dissection Tools	Green Board Microscope Charts and Field visit
18	**Environmental biology** 1. Morphometric study of fresh water pond 2. Food web and Food chain 3. Identification of fresh water and marine plankton	4	Software Internet with Wifi	Smart Board Charts Models Laptops
19	4. Animal association 5. Estimation of dissolved oxygen in water samples 6. Measurement of soil temperature, pH and moisture	3	Discussion	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Elective Theory**		SEMESTER **- VI**
Course Title **: DAIRY FARMING**		
Course Code: **09EP61**	Hours per week: **5**	Credits: **5**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To gain knowledge in breeds, physiology and management in dairy and dairy farm.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on the dairy breed animals, their digestive physiology and ingredients.	K1,K2,K3
CO 2	Understanding the modern techniques in breeding and management of dairy animals at various stages.	K1,K2,K3
CO 3	Impart knowledge on management of dairy products, its production and by-products	K1,K2,K3
CO 4	Analyze the quality production of dairy animals and dairy products	K1,K2,K3
CO 5	Trace the employability and marketing methods using dairy techniques and through field visits.	K1,K2,K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M**-Medium **L**-Low

Syllabus

UNIT-I:	a. Scope of Dairy farming, Dairy breeds of India- Cow and Buffalo b. Exotic breeds-Cow c. Systems of breeding – Hybrid vigour – grading up merits and demerits of inbreeding and outbreeding.	**(12 Hrs)**
UNIT-II:	a. Digestive system of Cow and glands related to digestion b. Common cattle feed – their nutritive value – minerals- Feed additives and silage preparation. c. Feeding and management of pregnant cow and calf	**(12 Hrs)**
UNIT- III:	a. Viral diseases – rinderpest, Foot and mouth disease b. Bacterial diseases – Mastitis, Anthrax, Haemorrhagic – septicaemia c. Metabolic diseases – Milk fever and bloot.	**(12 Hrs)**
UNIT- IV:	a. Anatomy of udder and physiology of milk production b. Milk – composition, Pasteurization and Nutritive value, Colostrum and their importance, Techniques to produce quality milk- Techniques to detect milk adulteration, Spoilage of milk c. Preparation of Dahi, Butter,Ghee, Gova, Flavoured milk, butter	**(12 Hrs)**

	milk, ice cream .	
UNIT- V:	a. Housing and equipments for dairy cows- Records to be maintained in a Dairy b. Artificial insemination – Semen collection and storage c. Role of co-operative societies in milk production and Marketing.	**(12 Hrs)**

Text Books

- G.C. Banerjee 2012 - A Text book of Animal Husbandry – Oxford & IBH Publication, New Delhi.

Reference Books

- Sukumar De, 2008. Outline of Dairy technology, Oxford University Press
- Handbook of Animal husbandry, 2000. Publication and information division- ICAR, New Delhi

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Scope of Dairy farming	2	Chalk & Talk	Green Board
1.2	Dairy breeds of India; Cow and Buffalo	3	Chalk & Talk; PPT	PPT & Green board
1.3	Exotic breeds-Cow	2	Lecture	PPT & White board
1.4	Systems of breeding – Hybrid vigour	1	Lecture	Green Board
1.5	Grading up merits and demerits of inbreeding and outbreeding	4	Chalk & Talk; PPT	PPT & Green board
Unit -2				
2.1	Digestive system of Cow and glands related to digestion	3	Lecture	Green Board Charts
2.2	Common cattle feed, their nutritive value and minerals	3	Chalk & Talk	Green Board
2.3	Feed additives and silage preparation	2	Chalk & Talk,	Green Board
2.4	Feeding and management of pregnant cow and calf	4	Chalk & Talk	Green Board
Unit -3				
3.1	Viral diseases – rinderpest, Foot and mouth disease	4	Lecture Chalk & Talk	Green Board
3.2	Bacterial diseases – Mastitis, Anthrax, Haemorrhagic – septicaemia	4	Lecture Chalk & Talk & PPT	Green Board Smart Board
3.3	Metabolic diseases – Milk fever and bloot.	4	Lecture Chalk & Talk	Green Board
Unit -4				
4.1	Anatomy of udder	1	Discussion; Chalk & Talk	Green Board and Model Chart
4.2	Physiology of milk production	2	Chalk & Talk	Green Board
4.3	Milk – composition, Pasteurization and	4	Chalk & Talk	Green Board

	Nutritive value, Colostrum and their importance			
4.4	Techniques to produce quality milk- Techniques to detect milk adulteration, Spoilage of mil**k**	3	Chalk & Talk	Green Board; lab models
4.5	Preparation of Dahi, Butter,Ghee, Gova, Flavoured milk, butter milk, ice cream.	2	Chalk & Talk	Green Board
Unit -5				
5.1	Housing and equipments for dairy cows	3	Lecture	Green Board
5.2	Records to be maintained in a Dairy	3	Chalk & Talk	Green Board
5.3	Artificial insemination – Semen collection and storage	3	Chalk & Talk	Green Board
5.4	Role of co-operative societies in milk production and Marketing.	3	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Elective Theory**		SEMESTER **- VI**
Course Title **: ENVIRONMENTAL BIOLOGY**		
Course Code: **09EP62**	Hours per week: **5**	Credits: **5**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To obtain knowledge an environmental factor, structure, barriers. Its measurement and management

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on fundamental concepts, structure and types of ecosystem	K1,K2,K3
CO 2	Understanding the behavioral patterns found in organisms at different ecological levels.	K1,K2,K3
CO 3	Ensure the reciprocal relationship and impact between organisms and environment.	K1,K2,K3
CO 4	Trace the problems of adverse environment and its management	K1,K2,K3
CO 5	Create awareness on protects patterns, conservation and management of environment	K1,K2,K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**S**	**S**	**L**	**M**	**S**
CO 2	**S**	**L**	**S**	**S**	**L**
CO 3	**S**	**S**	**S**	**S**	**M**
CO 4	**M**	**S**	**L**	**S**	**M**
CO 5	**S**	**L**	**S**	**S**	**S**

S-Strong **M**-Medium **L**-Low

Syllabus

UNIT-I **12 Hours**

a. Introduction and scope - Soil profile and fauna: Water- properties, water problem in terrestrial habitat.
b. Light- light in relation to aquatic habitat, effect on organisms
c. Temperature-range, thermal stratification, tolerance, homeothermic, Poikilothermic animals, adaptations to extremes of temperature and effects on organisms.

UNIT-II **12 Hours**

a. Interspecific relationship- Symbiosis- Mutualism and Commensalism, Antibiosis, Parasitism, Predation and Competition- Intraspecific relationship- Colonisation, aggregation and social organization.
b. Ecosystem- Definition, components, Pond and forest as an ecosystem- trophic levels, Food chain and Food web- Ecological pyramids, energy fLow and productivity
c. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

UNIT-III **12 Hours**

a. Community- Definition, structure and characteristics- Ecotone, edge effect and ecological niche
b. Community dynamics- ecological succession and climax community.
c. Population ecology- characteristics- Natality, Mortality, Dispersal, age pyramid, population estimation- Regulation and dynamics of population.

UNIT-IV **12 Hours**

a. Characteristics, Zonation and fauna and adaptations of fresh water, marine and estuary habitats
b. Terrestrial habitats- forests, deserts, caves, fauna and their adaptations
c. Parasitic adaptations- Ecto and endo

UNIT-V **12 Hours**

a. Environmental pollutants- Types- Air pollution- Sources, Effects and control measure
b. Water pollution- Sources, Effects and control measures- Radioactive and Noise pollution
c. Natural Resources-Wild life - Conservation and management.

Text Books

- Verma, P.S and Agarwal, V.K 2000. Environmental biology, S.Chand & Co, New Delhi.
- Rastogi, V.B and Jayaraj, M.S, 1984. Animal Ecology and distribution of animals, Kedarnath, Ramnath, Meerut.

Reference Books

- Arora, M.P. 2011. Ecology, Himalaya Publishing house, New Delhi
- Rana, S.V.S. 2009. Essentials of Ecology and Environmental science, Prentice- Hall of India, New Delhi.
- Odum, E.P 1983. Basic Ecology, Saunder's College Publishing, New York.

Pedagogy

Chalk and talk, Group Discussion and PPT

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Introduction and scope - Soil profile and fauna: Water- properties, water problem in terrestrial habitat.	4	Chalk & Talk	Green Board
1.2	Light- light in relation to aquatic habitat, effect on organisms	4	Chalk & Talk	PPT
1.3	Temperature-range, thermal stratification, tolerance, homeothermic, Poikilothermic animals, adaptations to extremes of temperature and effects on organisms.	4	Lecture	PPT & Green Board
Unit -2				
2.1	Interspecific relationship- Symbiosis- Mutualism and Commensalism, Antibiosis, Parasitism, Predation and Competition- Intraspecific relationship- Colonisation, aggregation and social organization.	3	Lecture	Green Board Charts
2.2	Ecosystem- Definition, components, Pond and forest as an ecosystem- trophic levels, Food chain and Food web- Ecological pyramids, energy fLow and productivity	4	Chalk & Talk	Green Board
2.3	Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.	3	Chalk & Talk, ppt	Green Board Smart Board
Unit -3				
3.1	Community- Definition, structure and characteristics- Ecotone, edge effect and ecological niche	4	Lecture PPT	Green Board
3.2	Community dynamics- ecological succession and climax community.	4	Lecture PPT	Green Board Smart Board

3.3	Population ecology- characteristics- Natality, Mortality, Dispersal, age pyramid, population estimation- Regulation and dynamics of population.	4	Lecture PPT	Green Board
Unit -4				
4.1	Characteristics, Zonation and fauna and adaptations of fresh water, marine and estuary habitats	4	Lecture PPT	Green Board
4.2	Terrestrial habitats- forests, deserts, caves, fauna and their adaptations	4	Chalk & Talk	Green Board
4.3	Parasitic adaptations- Ecto and endo	4	Chalk & Talk	Green Board
Unit -5				
5.1	Environmental pollutants- Types- Air pollution- Sources, Effects and control measure	3	Lecture PPT	Green Board
5.2	Water pollution- Sources, Effects and control measures- Radioactive and Noise pollution	3	Lecture PPT	Green Board
5.3	Natural Resources-Wild life - Conservation and management.	3	Lecture PPT	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skill Based Course		
Course Title : **Fish culture**		
Course Code: **09SB61**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Impart the knowledge on common food fishes and enhancement of fish productivity
- Management and maintenance of fish pond and various types of fish culture
- Common fish diseases, treatment and control measures

Syllbus

UNIT I: Scope and importance of aquaculture – Physical and Chemical characteristic features of water bodies– Types of culture systems (Traditional, intensive, semi-intensive and extensive) (5 Hours)

UNIT II: Selection of cultivable species – Site selection for fish farming – construction of fish ponds – Types of fish ponds – Maintenance and management of ponds. Fish Feeds (5 Hours)

UNIT III: Types of culture – Monoculture, Monosex-culture and Poly culture – Integrated fish farming (paddy cum fish culture – Induced breeding (5 Hours)

UNIT IV: Common fish diseases - Prevention and treatment (4Hours)

UNIT V: Identification of common edible fishes

Fish food organisms Ornamental fish culture (5 Hours)

Text Books

Fish Culture 1993 G. Santhanakumar, JJ publications

Reference books

- An introduction to fishes 2011 S.Khanna, Silver line publications
- Fish & Fisheries 2010 Pandey & Shukla, Rastogi PulicationsA manual of Fresh water Aqua culture 1997 R. Santhanam, Oxford and IBH Pub.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skill Based Course		
Course Title : **Vermitechnology**		
Course Code: **09SB62**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Role of vermitechnology for sustainable agriculture and environmental management
- Salient features of exotic and indigenous earthworm species
- Products from vermitechnology

Syllabus

Unit I: **(5 Hours)**

Features of Exotic species and indigenous species for vermicomposting

Unit II: **(5 Hours)**

Rearing and culturing – Vermicompost Unit – vermibed preparation Precomposting - composting by earthworms – methods – management – harvesting of vermicast.

Unit III **(5 Hours)**

Vermicast – characteristics – qualitative analysis - Vermiwash – characteristics – vermiwash unit - preparation, collection and analysis

Unit IV **(5 Hours)**

Application of vermicomposting in Agriculture and horticulture – Economics of vermiculture

Unit V: **(5 Hours)**

Earthworms in pollution control and waste land development

Earthworms as food and medicinal importance - Role of KVIC and NABARD

Text book:

- **Vermiculture,** 2012 M.Seetha Lekshmy and R.Santhi, Saras Publication

Reference books

- Vermicomposting for sustainable agriculture (2003): BK Gupta – Agrobios

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

Part – IV : Skill Based Course		
Course Title : **Zoology for Competitive Examination**		
Course Code: **09SB63**	Hours per week: **2**	Credits: **2**
CIA : **25**	ESE: **75**	Total : **100**

Objectives

- Appear for competitive exams
- Have overall Course knowledge essential for employment

Syllabus

UNIT I **(5 Hours)**

a) Non - Chordata:- General organisation - Classification with diagnostic features up to classes. Protozoa:- Structure, reproduction and life history of Amoeba Paramecium, Trypanosoma, Plasmodium, Monocystis, Leishmania - locomotion, nutrition, economic importance. Porifera: Sponges canal system, skeleton, reproduction and economic importance. Coelenterata:- Diploblastic organization - life history of obelia and Aurelia, Metagenesis - Polymorphism in Hydrozoa Corals and Croal formation - relationships of Cnidaria and Acnidaria. Helminthes:- Structure and life history of Planaria, Fasciola, Teania, Ascaris and Wucheraria - parasitic adaptations - Helminthes in relation to man. Annelida:- Neries, earthworm and leech - Coelom and metamerism - modes of life in polychactes. Onychophora:- Structure, affinities and distribution of Peripatus. Arthropoda:- Prawn, Scropion and Cockroach - Larval forms and parasitism in Crustacea - Mouth parts, vision, respiration and excretion Metamosphosis and social life in insects. Mollusca:- Freshwater mussel, pila, sepia - oyster culture and pearl formation. Echinodermata:- General organisation - Water vascular system Larval forms and affinites.

b) Prochordata:- Amphioxus, Balanoglossus - Ascidian retrogressive Metamorphosis, neoteny and affinities. Chordata:- General Organisation - Characters, Outline classification Up to class level. Pisces:- Locomotion, migration, respiration, economic importance structure and affinities of Dipnoi. Amphibia:- Origin of Amphibians - Parental care - South Indian amphibians. Reptiles:- Origin - Conquest of land - adaptations to live on land Adaptive radiation - Temporal Vacuties - identification of poisonous and non-poisonous snakes - poison apparatus - south Indian examples. Birds:- Origin - fight adaptations - mechanism of flight - double respiration - migration - Flightless birds, their structure and distribution. Mammals:- Dentition, skin derivatives - distribution - adaptive radiation - Prototheria and Metatheria, their Phylogenetic relationship - South Indian examples.

UNIT II **(5 Hours)**

a) Cell and Molecular Biology:- Cellular Organeles - Structure and function - Plasma membrane, mitochondria, golgi bodies, endoplasmic reticulum and ribosomes - Nucleolus and nucleus - Chloroplast - Cell division (Mitosis & meiosis) - Chromosomes - DNA structure and function, replication of DNA, Genetic code - RNA and protein synthesis. Gene expression - Recombinant DNA, Genetic cloning - Genetic engineering, its uses in agriculture, biology and medicine - Sex chromosomes and sex determination.

b) Genetics:- Laws of inheritance - Linkage, principle of gene mapping multiple alleles, blood groups - mutation (Natural and induced) Sex Linked and Sex Limited inheritance - Chromosome number and form ploidy - cytoplasmic inheritance - Karyotypes - Normal and abnormal genetic disorder - Bio-chemical genetics - regulation of gene expression in prokaryotes and Eukaryotes - population genetics - Eugenics. Mean, Median and standard deviation.

UNIT III **(5 Hours)**

a) Bio Chemistry:- Structure of carbohydrates, amino acids, proteins lipids - Glycolysis and Kreb's cycle - oxidation, reduction - oxidative phosphorylation - energy conservation and release, cyclic AMP, ATP enzymes – mechanism. Hormones, their classification biosynthesis and function. Physiology:- with reference to mammals, digestion, nutrition, balanced diet in man - assimilation, intermediary/metabolism. Composition of blood - Coagulation, Transport of oxygen, Carbondioxide, Blood pigments, Mechanism of respiration, Muscles, mechanism of muscle contraction, Temperature regulation, Acid base balance and homeostasis, Nerve impluses and conduction, neurotransmitters. Receptors, photo, phono and chemoreception. Nephron and urine formation, Endocrine glands, ovary and pituitary organs and their inter relationship, Physiology of reproduction in humans, Normal Zoology development in insects and pheromones. Bioluminescence, Biological rhythms, Physiology of immune response Antigens - Immunoglobulins, humoral and cell mediated immunity. T & B cells, mechanism of antibody formation - AIDS.

b) Development Biology:- Gametogenesis - fertilization - type of eggs - blastulation and gastrulation in Amphioxus, frog and chick morphogenetic movements - organizer potency, organogenesis with reference to hear, eye kideny brain - Formation and fate of extra embryonic membranes in chick. Placenta, types, functions, Regeneration - Aging and senescence - metamorphosis in Frog - Cancerous growth.

UNIT IV **(5 Hours)**

a) Environmental Biology:- Biotic and abiotic factors, their role, Intra and interspecific association. Biogeochemical cycles. Ecosystem, concept and components - energy fLow, food chain, food web, trophic levels. Ecological succession, Community structure - Stratification. Population and Population dynamic - Habitat, ecology, adaptations in marine fresh water and terrestrial habitats. Wild life, need for conservation management and methods of conservation. Sanctuaries with special reference to Tamil Nadu. Pollution - air, water and land - Perspective policy planning for the environment.

b) Evolution:- Origin of life - Evolutionary thought - Contributions of Lamarck Darwin and De Varies - present status of Darwinism and Lamrkism - modern synthetic concept - Hardy Weinberg Law - Polymorphism and mimicry in evolution. Specification, species concept - Isolation mechanisms and their role, role of hybridization in evolution. Fossils and Fossilization Origin and evolution of man - Cultural evolution and Biochemical evolution.

UNIT V **(5 Hours)**

a) Animal distribution: Zoogeographical distribution - Continental and island fauna - Continental drift - Discontinuous distribution adaptive radiation. Natural resources and their conservation. Alternative sources of energy.

b) Economic Zoology:- Parasitism and Commensalim - Protozoan Parasites and diseases, helminth parasites and diseases of man and domestic animals - Beneficial and destructive insects Insect pests on crops and stored products - Control methods. Sericulture, apiculture, poultry, pisciculture and induced breeding, Shell fisheries, Aquaculture practices in Tamil Nadu and their impact on the environment and on agriculture.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – IV : Common Course Theory		
Course Title **: Value Education**		
Course Code: **VEUG61**	Hours per week: **2**	Credits: **2**
CIA : 25	**ESE: 75**	Total : **100**

Syllabus

UNIT I: The heart of Education:

Introduction – Eternal Value – Integrated approach to value education - one for all and all for one – Responsibilities of a citizen – Habit Vs wisdom – purifying mind pollution – Respect for all Religions – Parents, teachers and felLow students – The need and benefit of exercise and meditation for students.

UNIT II: The Value of Body and Life Energy

Introduction – what are the causes for paid, Disease and death? Three Basic needs for all living Beings – Personal Hygeine Five Factors of Balance in Life – The need and benefits of physical Exercise – The value and Base of Life energy – The value and Base of Bio-magnetism - You are your own best caretaker.

The Marvelous nature of mind

Introduction- Bio-magnetism – The base of the mind – characterisation of the Genetic Centre – metal frequency – practice for a creative mind - benefits of meditation.

UNIT III: Analysis of Thought

Introduction – An Explosition on the nature of thought– six roots for thoughts – Introspection for analysis of thoughts-practical techniques for analysis of thoughts. Benefits of Blessings

Effects of good vibrations – Make Blessing a Daily Habit

UNIT IV: Moralisation of Derive

Introduction – moralization of desire - Analyse your desires – Summary of practice.

Neutralision of Anger:

Introduction – meaning – characteristics of Anger – Anger is a Destructive emotion – Anger spoils our relationship with others – Some common misconception about anger – will power and method success through awareness – method of neutralisation of anger.

UNIT V: Eradication of Worries

Worry is a mental disease – Nature's Law of cause and effect – factors beyond our control – How to deal with problems – analyse your problem and eradicate worry Harmonious Relationships

Introduction – Three angles of life – The value of harmony in personal relations – Love and Compassion – pleasant face and loving words – appreciation and gratitude to parents and teachers – Bringing needed reforms in educational institutions Why should we serve others? Brotherhood – A scientific Basis for Universal Brotherhood protection of the environment – non-violence and the five fold moral culture.

Text Book: Value Education for Health, Happiness and Harmony

Based on the Philosophy and Teachings of Swami Vethanthiri Maharisi) Published By: Brain Trust, Aliyar A Wing of World Community Service Centre

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – V : Common Course Theory		
Course Title **: EXTENSION ACTIVITIES**		
Course Code: **EAUG61**	Hours per week:	Credits: **1**
CIA : 25	**ESE: 75**	Total : **100**

Syllabus

UNIT-I:

Community Development-I: definition – structure and composition – community based issues – need for awareness – Developmental Programmes.

UNIT – II:

Community Development–II: Rural Scenario – need of the Community – need for the community service – role of youth in community building – communal harmony – literacy – Educational Recreation.

UNIT – III:

Volunteer Empowerment: Women's Emancipation – formation of Youth Clubs – Self-Help Groups – Youth and Development.

UNIT – IV:

Social Analysis: Social issues – cultural invasion – media infiltration – human rights Education/Consumer Awareness – Adolescents Reproductive – HIV/AIDS/STD – Social harmony/National integration – Blood Donation.

UNIT – V:

Introduction to NSS: Basic Concepts – profile – aims – objectives – symbol – Motto – structure – Regular activities – Special Camping Programme – Adventure Programme – National Days and Celebrations.(Applicable to NSS Students)

(OR)

NCC- Origin – Organisation – Ministry of Defence – Armed forces – commands – Defence establishments in Tamil Nadu

Civil Defence – Aid to civil authorities – Disaster management – Leadership – Man management – Adventure activities – Social service

Reference:

National Service Scheme Manual (Revised), Ministry of Human Resources Development, government of India.

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Allied Theory**		SEMESTER **- III**
Course Title **: ANIMAL ORGANISATION**		
Course Code: **09AT01**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

Students are enable to gain basic knowledge on taxanomical methods, outline classification of animals, morphological, anatomical and functional features of representative animals.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Inculcate knowledge on animal classification and taxonomical methods with suitable examples.	K1
CO 2	Understanding the structure ingestion and egestion of bioprocesses in feeding and respiration of representative animals.	K2
CO 3	Make awareness on movement of fluids, body and structural in invertebrates and chordates representatives.	K2
CO 4	Observe a structure and functional aspects of nervous system, receptors in earthworm, insects and human.	K2
CO 5	Trace the structure and processes of excretion, reproduction in selected invertebrates and chordates.	K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Syllabus

UNIT-I: 1. Principles of taxonomy – Binomial nomenclature - Animal Organisation – body types – protozoa – metazoa – types of coelom – types of symmetry **(12 Hrs)**

2. Outline classification of Invertebrates and the salient features of the Phyla with examples. Outline classification of Chordates upto classes giving examples

UNIT-II: 1. Feeding and digestion in Amoeba and Frog. **(12 Hrs)**

2. Respiration in Amoeba, Cockroach, Gills in Fish and Lungs in bird.

UNIT- III: 1. Circulatory system in Earthworm and Calotes. **(12 Hrs)**

2. Locomotion in Amoeba and Earthworm: Flight mechanism in Pigeon.

UNIT- IV: 1. Nervous system of Earthworm and Frog. **(12 Hrs)**
2. Receptors – photoreceptors of insects and man. Human ear.

UNIT- V: 1. Excretion in Amoeba, Earthworm and Frog. **(12 Hrs)**
2. Reproductive system of Rabbit.

Text Books

- A Text Book of Invertebrates –2004. Nair *et al.,* Saras Publications.
- A Text Book of Chordates – 2004. Thangamani, *et.a.l.,* Saras Publications

Reference Books

- A Manual of Zoology, Vol. I- Invertebrata, 1982. Ekambaranatha Ayyar and Ananthakrishnan.
- A Manual of Zoology, Vol. II – Chordata – 1982. Ekambaranatha Ayyar and Ananthakrishnan.

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1				
1.1	Principles of taxonomy – Binomial nomenclature - Animal Organisation – body types – protozoa – metazoa –	3	Chalk & Talk	Green Board
1.2	types of coelom – types of symmetry	3	Chalk & Talk	Microscope
1.3	Outline classification of Invertebrates and the salient features of the Phyla with examples	3	Lecture	PPT & White board
1.4	Outline classification of Chordates upto classes giving examples	3	Lecture	Green Board
Unit -2	12 Hours			
2.1	Feeding and digestion in Amoeba, Hydra and Frog	6	Lecture	Green Board Charts
2.2	Respiration in Amoeba, Cockroach, Gills in Fish and Lungs in bird	6	Chalk & Talk	Green Board
Unit -3	12 Hours			
3.1	Circulatory system in Paramoecium, Earthworm and Calotes	5	Chalk & Talk	Green Board
3.2	Locomotion in Amoeba, Paramoecium and Earthworm	5	Lecture PPT	Green Board Smart Board
3.3	Flight mechanism in Pigeon	2	Discussion Specimen	Green Board Microscope
Unit -4	12 Hours			
4.1	Nervous system of Earthworm	1	Discussion	Green Board
4.2	Human brain	2	Chalk & Talk	Green Board
4.3	Receptors – photoreceptors of Euglena, insects and man	4	Chalk & Talk Specimen	Green Board Microscope
4.4	Human ear	2	Chalk & Talk	Green Board
Unit -5	12 Hours			

5.1	Excretion in Amoeba, Earthworm	5	Lecture	Green Board
5.2	Excretion in Man	3	Lecture	Green Board
	Reproductive system of Rabbit	4	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Allied Theory**		SEMESTER **- IV**
Course Title **: BIOLOGY AND HUMAN WELFARE**		
Course Code: **09AT02**	Hours per week: **4**	Credits: **4**
CIA : **25 Marks**	ESE: **75 Marks**	Total : **100 Marks**

Preamble

To enable the students to develop knowledge on various diseases, transmission and remedies. Also develop knowledge on entrepreneurial avenues in biology.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on structure, mode of infection, development and remedies of virus and viral diseases.	K1
CO 2	Understanding the structure, mode of infections, biology and remedies of bacteria and bacterial diseases.	K2
CO 3	Impart knowledge on differential diseases caused by fungal, protozoan and helminthes.	K2
CO 4	Explore the avenues, opportunities and limitations of sericulture, fish culture and vermiculture	K2
CO 5	Trace the organisation, characteristics, candidates, culture and entrepreneurial values of biogas, mushroom culture, apiculture.	K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	S
CO 2	S	L	S	S	L
CO 3	S	S	S	S	M
CO 4	M	S	L	S	M
CO 5	S	L	S	S	S

S-Strong **M**-Medium **L**-Low

Syllabus

UNIT-I: a. Structure of a typical virus **(12 Hrs)**
b. Brief account on Viral diseases
c. Polio, Rabies and AIDS

UNIT-II: a. Structure of typical Bacteria **(12 Hrs)**
b. Brief account on Bacterial diseases
c. Cholera, Tuberculosis and Tetanus

UNIT- III: a. Fungal diseases – Ringworm and Black piedra **(12 Hrs)**
b. Protozoan diseases – Amoebic dysentery and Malaria
c. Helminth parasites – Ancylostoma and Wucheraria

UNIT- IV: a. Sericulture – Scope – Silkworm biology – Life cycle – common diseases and control – silkworm rearing methods. **(12 Hrs)**
b. Fish culture – Scope and Importance – types of culture – diseases and control – maintenance of fish pond.
c. Vermiculture – Features of exotic and indigenous species – rearing and

culturing – Characteristics of Vermicast and Vermiwash – Economics of vermiculture

UNIT- V: a. Biogas production – characteristic features of biogas – production of biogas – uses **(12 Hrs)**

b. Mushroom culture – nutritive and medicinal value – Morphology of Indian oyster mushroom – cultivation of paddy straw mushroom – Advantages.

c. Apiculture – biology of honey bee – bee hive – honey extraction – medicinal value – bee wax and bee venom.

Text Books

- Text Book of Clinical Protozoology – N.S. Ruprah, Oxonian Press.
- Text Book of Microbiology – 2004 Ananthanarayanan, Orient Longman.

Reference Books

- Text Book of Preventive and Social Medicines – Park and Davis.
- Handbook on Mushrooms – 1988. Nita Bahi, Oxford and IBH.
- Biogas Technology- A Practical Handbook – Khandelwal & S.S. Mahdi.
- An Introduction to Sericulture Ganga shetty, Oxford and IBH.
- Vermicomposting for sustainable agriculture 2005 Gupta, Agrobios.

Pedagogy

Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Method	Teaching Aids
Unit -1	12 Hours			
1.1	Structure of a typical virus	3	Chalk & Talk	Green Board
1.2	Viral diseases – Chicken pox	3	Chalk & Talk	Microscope
1.3	Polio, Rabies	2	Lecture	PPT & White board
1.4	Mumps, Influenza	2	Lecture	Green Board
1.5	AIDS	2	Lecture	Green Board
Unit -2	12 Hours			
2.1	Structure of typical Bacteria	4	Lecture	Green Board Charts
2.2	Bacterial diseases – Cholera	4	Chalk & Talk	Green Board
2.3	Tuberculosis and Tetanus	4	Chalk & Talk, ppt	Green Board Smart Board
Unit -3	12 Hours			
3.1	Fungal diseases – Ringworm and Black piedra	2	Chalk & Talk	Green Board
3.2	Protozoan diseases – Amoebic dysentery and Malaria	3	Lecture PPT	Green Board Smart Board
3.3	Helminth parasites – Ancylostoma, Wuchereria	3	Discussion Specimen	Green Board Microscope
Unit -4	12 Hours			
4.1	Sericulture	4	Discussion	Green Board
4.2	Fish culture	4	Chalk & Talk	Green Board
4.3	Vermiculture	4	Chalk & Talk Specimen	Green Board Microscope

Unit -5 12 Hours				
5.1	Biogas production	4	Lecture	Green Board
5.2	Mushroom culture	4	Chalk & Talk	Green Board
5.3	Apiculture	4	Chalk & Talk	Green Board
	Total	**60**		

DEPARTMENT OF ZOOLOGY

Programme: B.Sc., Zoology, (Under CBCS and OBE)

(For those students admitted during the Academic Year 2018-19 and after)

PART – III **: Allied Lab**		SEMESTER **- II**
Course Title **: PRACTICAL - I**		
Course Code: **09AP03**	Hours per week: **2**	Credits: **4**
CIA : **40 Marks**	ESE: **60 Marks**	Total : **100 Marks**

Preamble

Visualize, analyse and observe the various types of organisms in microbes, invertebrata and chordata, their organ systems, adaptations, their diversity and behavioral patterns.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

No.	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO 1	Acquire knowledge on the body systems in the representative animals	K1,K2,K3
CO 2	Notify the specific characters, identifying structures in the preserved, stuffed and dried animals.	K1,K2,K3
CO 3	Observe the microscopic organisms to analyse their survival skills.	K1,K2,K3
CO 4	Demonstrate the staining and mounting techniques in microbes and representative insects.	K1,K2,K3
CO 5	Trace the entrepreneurial skills, biodiversity, habitat, environment through the field visit.	K1,K2,K3

K1-Remembering **K2**-Understanding **K3**-Applying

Mapping of CO with PO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
CO 1	S	S	L	M	M
CO 2	S	M	S	S	S
CO 3	S	S	L	M	S
CO 4	S	M	S	S	S
CO 5	S	S	S	M	M

S-Strong **M**-Medium **L**-Low

Syllabus

1. Observation of the folLowing -Spotters **(12 Hrs)**

- Paramoecium conjugation
- Obelia (entire)
- Hydra (entire)
- Taenia (entire)
- Scolex of Taenia
- Ascaris male and female
- Neries (entire)
- Penaeus
- Pila (entire) and shell of Fresh water mussel)
- Starfish (entire)
- Amphioxus, Balanoglossus, Scoliodon

- Cobra, Viper, Pigeon
- Skull of Pigeon dorsal and ventral view
- Pectoral girdle of pigeon
- Fore and hind limb of Frog
- Synsacrum of bird

2. Simple staining of Bacteria from milk and sewage water.
3. Mounting of mouth parts of Mosquito, Housefly and Honey bee.
4. Identification of Ascaris (male & female) and Tapeworm.
5. Identification of egg, larva, pupa and adult of silk moth.
6. Dissection to show silk glands.
7. Common appliances used in silkworm rearing and apiculture.
8. Visit to Biogas production, Mushroom culture and Fish culture centres.

Text Books

Kapoor, 2014 Practical Zoology, Silver Line Publications, Allahabad, Uttrapradesh

Reference Books

- Pechenik, Jan A 2014 – Biology of the Invertebrates, Tata Mcgraw – Hill Pub. Company Ltd., New Delhi
- Vasantika Kashyap, 2013, Life of Invertebrates, Second Revised Edition, Vikas Pub. House Pvt. Ltd., New Delhi
- Kotpal, R.L. 2012. Modern Text Book of Zoology, Invertebrates (Animal diversity – I), Rastogi Publications, Meerut
- Barnes, R.D. 2006,Invertebrate Zoology, IV Edition, Holf Saunders International edition
- Ekambaranatha Ayyar and Ananthakrishnan, T.N. 2005, A manual of Zoology, volume I, Invertebrate, Viswanathan (Printers and Publishers) Pvt. Ltd., ChennaiKotpal, R.L. 2011. Vertebrates, Rastogi Publications
- Gupta R.C and Girish Chopra, 2003 - Comparative Anatomy of Chordates – R.Chand & Co, New Delhi
- Newmann, 1981, The Phylum chordata, Biology of vertebrates and their kin, Satish Book Enterprises, Agra.

Pedagogy

Chalk and talk, Charts and models, Smart board, Group Discussion, PPT, Preserved animals, slides and Field visit

Teaching Aids

Green Board, LCD Projector, Interactive White Board, Microscope – Dissection, Compound, Deep vision and Phase Contrast Microspcose.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Practicals	Content Delivery Method	Teaching Aids
1	1. Observation of the folLowing -Spotters Paramoecium conjugation Obelia (entire) Hydra (entire) Taenia (entire) Scolex of Taenia Ascaris male and female Neries (entire) Penaeus Pila (entire) and shell of Fresh water mussel) Starfish (entire) Amphioxus, Balanoglossus, Scoliodon Cobra, Viper, Pigeon Skull of Pigeon dorsal and ventral view Pectoral girdle of pigeon Fore and hind limb of Frog Synsacrum of bird	2	Chalk & Talk Dissection Tools	Green Board Charts
2	2. Simple staining of Bacteria from milk and sewage water.	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
3	3. Mounting of mouth parts of Mosquito, Housefly and Honey bee.	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
4	4. Identification of Ascaris (male & female) and Tapeworm.	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
5	5. Identification of egg, larva, pupa and adult of silk moth.	2	Chalk & Talk Dissection Tools	Green Board Microscope Charts
6	6. Dissection to show silk glands.	4	Software Internet with Wifi	Smart Board Charts Models Laptops
7	7. Common appliances used in silkworm rearing and apiculture.	1	Discussion	Green Board
8	8. Visit to Biogas production, Mushroom culture and Fish culture centres	1	Discussion	Green Board
	Total	**60**		