ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

CUDDALORE-1

DEPARTMENT OF ZOOLOGY

SYLLABUS 2020-2023

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DETAILS OF THE BOARD OF STUDIES (2020-2023)

NAME OF THE BOARD : UG Board

S. No	Category	Name	Affiliation	Term
1.	Chairman	Dr. P. Thenmozhi	Asst. Professor &Head, Department Of Zoology St. Joseph's College of Arts & Science (Autonomous) Cuddalore-1	
2.	University Nominee	Dr.M.Thirumavalavan	Associate Professor Dept of Zoology Bharathidasan College of Arts & Science for Women, Pondicherry E.mail: thiruma21661@gmail.com Mobile: 9489148487	3 Years
3.	Subject Experts	1. Dr. R. Kannan	Prof & Head, Department of Zoology, Periyar Govt. Arts. College, Cuddalore-1 E.mail: kannan@pacc.in Mobile: 9443445806	
		2. Dr. G. Gunasekaran	Professor Department of Zoology Annamalai University, Chidambaram E. mail: govigunasekar@gmail.com Mobile: 9842694220	
4.	Members (Internal)	1. Dr. A. Arulprakash	Asst. Professor Department of Zoology St. Joseph's college of Arts & Science (Autonomous) Cuddalore-1	
		2. Dr. T. Ganeshkumar	Asst. Professor Department of Zoology St. Joseph's college of Arts & Science (Autonomous) Cuddalore-1	
		3.Dr. N. Jayaprabha	Asst. Professor Department of Zoology St. Joseph's college of Arts & Science (Autonomous) Cuddalore-1	

DEPARTMENT OF ZOOLOGY

MINUTES OF THE BOARD OF STUDIES

The board of studies meeting for the Academic year 2020-21 was conducted in the Department of Zoology on **14.03.2020** at **10.30 am.** in the presence of the University Nominee **Dr. M. Thirumavalavan**, Associate Professor, Dept of Zoology, Bharathidasan College of Arts & Science for Women, Pondicherry, The Subject Experts **Dr. R. Kannan,** Professor & Head, Department of Zoology, Periyar Govt. Arts College, Cuddalore, and **Dr. G. Gunasekaran**, Professor**,** Department of Zoology, Annamalai University, Chidambaram, The Chairman, **Dr. P. Thenmozhi**, Asst. Professor & Head, Department of Zoology, St. Joseph's College of Arts & Science (Autonomous) Cuddalore, The Members were **Dr. A. Arulprakash,** Asst. Professor, Department of Zoology, St. Joseph's College of Arts & Science (Autonomous) Cuddalore , **Dr. T. Ganeshkumar**, Asst. Professor, Department of Zoology, St. Joseph's College of Arts & Science (Autonomous) Cuddalore and **Dr. N. Jayaprabha**, Asst. Professor, Department of Zoology, St. Joseph's College of Arts & Science (Autonomous) Cuddalore.

The following changes and resolutions were made to academic council for the approval of syllabus

For I B.Sc., Zoology

1. Rearrangement of units had been done in the paper Invertebrata I and II to facilitate the students to study in examination point of view.
2. Rearrangement of units had been done in the paper Chordata I and II to facilitate the students to study in examination point of view.

For II B.Sc., Zoology

1. A slight internal changes have been made between the papers Cell Biology and Molecular Biology, viz., Cell Organelles unit had been exchanged to Cell Biology Paper in turn Structure and functions of DNA and Types of RNA had been included in Molecular Biology.

The syllabus for Non Major Elective, Ornamental Fish Culture was approved without any corrections.

There is no addition, deletion or revision had been made in other papers.

With the above resolutions the meeting was concluded at about 2.30 p.m

B.Sc. ZOOLOGY DEGREE COURSE

CURRICULUM DESIGN TEMPLATE

B. Sc. Zoology – Course of study and Scheme of Examinations

(With effect from 2020 - 2023)

SEMESTER	COURSE	COURSE CODE	COURSE TITLE	HOURS	CREDITS	EXAM HOURS	MARKS
I	Language – I	LT101T/LF101/ LH101S	Tamil/French/Hindi-I	4	3	3	100
	English – I	20LE101	Communicative English-I	4	3	3	100
	Core – I	19ZO101	Invertebrata –I	4	3	3	100
	Core –II	19ZO102	Invertebrata –II	3	3	3	100
	Core Practical-I	18ZOP21	Practical - I Invertebrata and Chordata	3	-	-	
	Allied - I (Compulsory)	19ABZ101	Allied Botany	4	4	3	100
	Allied Botany	19ABP101	Allied Botany Practical – I	3	2	3	100
	PE – I	20PELS01	Professional English-I	3	3	2	100
	Skill Enhancement Course(SEC)	VE101T	Value Education	2	2	2	100
	Total credits for Semester I			**30**	**23**		**800**
II	Language – II	LT202T/LF202/ LH202S	Tamil/French/Hindi-2	4	3	3	100
	English – II	20LE202	Communicative English-II	4	3	3	100
	Core – III	19ZO203	Chordata-I	4	3	3	100
	Core – IV	19ZO204	Chordata-II	3	3	3	100
	Core Practical-I	18ZOP21	Practical – I Invertebrata and Chordata (Contd.)	3	4	3	100
	Allied – II (Compulsory)	19ACH202	Allied Chemistry	4	4	3	100
	Allied	19ACP202	Allied Chemistry	3	2	3	100

	Chemistry		Practical				
	PE – II	20PELS02	Professional English	3	3	2	100
	Skill Enhancement Course(SEC)	EPD201T	Dynamics of Personality	2	2	2	100
	Total credits for Semester II			**30**	**27**		900
III	**Language – III**	LT303T/LF303/ LH303S	Tamil/French/Hindi-3	4	3	3	100
	English – III	20LE303	Communicative English-III	4	3	3	100
	Core – V	19ZO305	Cell Biology	4	3	3	100
	Core – VI	19ZO306	Molecular Biology	4	3	3	100
	Core Practical-II	**19ZOP42**	**Practical – II Cell and Molecular biology, Genetics and Biotechnology**	3	-		
	Allied - III (Elective)	19ABC303	Allied Biochemistry	5	4	3	100
	Allied Practical	19ABP303	Biochemistry Practical	3	2	3	100
	Ability Enhancement Course(AEC)	EVS301S	Environmental Science	3	2	3	100
	Total credits for Semester III			**30**	**20**		**700**
IV	**Language – IV**	LT404T/LF404/ LH404S	Tamil/French/Hindi-IV	4	3	3	100
	English – IV	20LE404	Communicative English-IV	4	3	3	100
	Core – VII	19ZO407	Genetics	4	3	3	100
	Core – VIII	19ZO408	Biotechnology	4	3	3	100
	Core Practical – II	**19ZOP42**	**Practical – II** Cell and Molecular biology, Genetics and Biotechnology **(Contd.)**	3	4	3	100
	Allied –IV (Elective)	19AMB404	Allied Microbiology	5	4	3	100
	Allied Practical	19AMP404	Allied Microbiology	3	2	3	100

	– IV		Practicals				
	Skill Based Courses (Optional)	19ACS401	**1**	**Basic of Computers and Its Applications**	3	2	3	100
		19EZ402	2	Apiculture				
	Total for Semester IV				**30**	**24**		**800**
V	**Core – IX**	**20ZO509**	Biostatistics and computational Biology		5	4	3	100
	Core – X	**20ZO510**	Developmental Biology and Immunology		5	4	3	100
	Core – XI	**20ZO511**	Animal Physiology		5	4	3	100
	Elective – I [Compulsory]	**20EZ512A**	**Applied Entomology**		5	3	3	100
	Elective – II [Optional] **A**	**20EZ513A**	**Biofertilizer Technology**		4	3	3	100
	B	**20EZ513B**	Public Health and hygiene					
	Core Practical – III	**20ZOP63**	Biostatistics, Animal Physiology, Developmental Biology and Immunology		3	-		100
	Core Practical – IV	**20ZOP64**	Environmental Biology, Economic Zoology and Evolution		3	-		100
			Skill Development Course e course-			**2 (Extra credit)**		
			SSC-Self Study Course			**2(Extra credit)**		
	Total credits for Semester V				**30**	**18**		
VI	**Core – XII**	**20ZO614**	Environmental Biology		5	4	3	100
	Core – XIII	**20ZO615**	Economic Zoology		5	4	3	100
	Core – XIV	**20ZO616**	Evolution		5	4	3	100
	Elective – III [Compulsary]	**20EZ617A**	**Aquaculture**		5	3	3	100

	Skill based subject[optional]	**20EZ618A**	**A**	**Bioinstrumentation**	4	3		
		20EZ618B	B	Sericulture				
	Core Practical – III	**20ZOP63**	Animal Physiology and Developmental Biology and Immunology **(Contd.)**		3	4	3	100
	Core Practical – IV	**20ZOP64**	Environmental Biology, Economic Zoology and Evolution **(Contd.)**		3	4	3	100
	Project work	**XJZO601**	**Project work**			2**(Extra credit)**		
	Extension Activities	**EU601**	**Extension Activities**			**2**		
	Total credits for Semester VI				**30**	**28**		
	Total Credits					**140**		

I B.Sc (Zoo)	INVERTEBRATA-I	19ZO101
SEMESTER - I		HRS/WK - 4
CORE – I		CREDIT - 3

Objective:

- Enlightening the knowledge classification of animals by understanding the basic concepts of biosystematics
- To identify invertebrates and classify them up to the classes with the basis of systematic

Course Outcome

On completion of the course students will be able

CO1: To describes the principles of taxonomy and classification of animal kingdom

CO2: To identify the phylum Protozoa and parasitic protozoans

CO3: To classify the phylum Porifera upto classes with examples

CO4: To understand the classification and polymorphism in Coelenterata and coral reefs

CO5: To describe the general characters and classification of phylum Platyhelminthes

SEMESTER I	COURSE CODE: 19ZO101					COURSE TITLE: INVERTEBRATA-I										HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	5	5	4	5	5	5	4	4	5	4	5	4	5	4.7	
CO2	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6	
CO3	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6	
CO4	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6	
CO5	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6	
Mean Overall Score																4.6	

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12Hours**

Principles of Taxonomy – Binomial nomenclature-rules of nomenclature – classification of the animal kingdom.

UNIT – II **12Hours**

PHYLUM PROTOZOA: General characters **Type study- paramecium,** parasitic protozoans [Entamoeba, Trypanosoma and plasmodium]

UNIT – III **12Hours**

PORIFERA: General characters and classification upto classes with examples. **Type study - sycon,** spicules and canal system in sponges.

UNIT – IV **12Hours**

COELENTERATA: General characters and classification upto classes with examples. **Type study** – **Obelia,** polymorphism in coelenterates – corals and coral reefs.

UNIT – V **12Hours**

PLATYHELMINTHES: General characters and classification upto classes with examples. Type study- *Taenia solium*.

Text Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Jordan, E.L. and P.S.Verma, 1993. Inverteb=ate Zoology, 12th Edition. S.Chand and Co.Ltd., NewDelhi.

Reference Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda,Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. Parker and Haswell, 1964 Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishers and distributors, New Delhi.
4. L.A Borradile and F.A.Pott, 1972 The Invertebrates. Cambridge University Press. UK.
5. Adam Sedgwick. A student text book of Zoology. Vol.I and II. Central book Depot. Allahabad.
6. P.S.Dhami and J.K.Dhami. 1969 Invertebrate Zoology, S.Chand and Co. New Delhi.
7. Hyman L.H. The Invertebrate Vol.I-IV. 1955, McGraw Hill Co. New York.
8. Barrington, E.J.W.. Invertebrate structure and function. ELBS Publication.
9. Barnes. Invertebrate Zoology. Toppan International Co.

I B.Sc (Zoo)	INVERTEBRATA-II	19ZO102
SEMESTER – I		HRS/WK – 3
CORE – II		CREDIT – 3

Objective:

- To study the diverse form of invertebrates
- To acquire knowledge about causes and symptoms of some protozoan diseases
- To study parasitic adaptations of annelids and significance of Crustacean and Echinoderm larvae

Course Outcome

On completion of the course students will be able

CO1: To understand the general characters and classification of phylum Aschelminthes

CO2: To know the classification of phylum Annelida and their parasitic adaptation

CO3: To understand the phylum Arthropoda, affinities of peripatus and importance of Crustacean larvae

CO4: To understand the general characters, classification and torsion of phylum Mollusca

CO5: To classify Echinodermata upto classes and to describe the significance of their larvae

SEMESTER I	COURSE CODE: 19ZO102					COURSE TITLE: INVERTEBRATA-II									HOURS: 3	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO2	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO3	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO4	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO5	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
Mean Overall Score																4.4

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **9 Hours**

ASCHELMINTHES – General characters and classification upto classes with examples. **Type study**: *Ascaris*

UNIT – II **9 Hours**

ANNELIDA: General characters and classification upto classes with examples. **Type study**: **Earthworm,** metamerism in Annelids, parasitic adaptations of Leech.

UNIT – III **9 Hours**

ARTHROPODA: General characters and classification upto classes with examples. **Type study** – **Prawn.** Peripatus and its affinities, Mouth parts of insects. Crustacean larvae and their importance.

UNIT – IV **9 Hours**

MOLLUSCA: General characters and classification upto classes with examples. **Type study** – **Fresh water Mussel,** Economic importance of Mollusca, torsion in mollusca

UNIT – V **9 Hours**

ECHINODERMATA: General characters and classification upto classes with examples. **Type Study- Star fish,** Echinoderm larvae and their significance.

Text Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Jordan, E.L. and P.S.Verma, 1993. Invertebrate Zoology, 12th Edition. S.Chand and Co.Ltd., NewDelhi.
3. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda,Mollusca, Echinodermata. Rastogi Publications, Meerut.

Reference Books:

1. Parker and Haswell, 1964 Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishers and distributors, New Delhi.
2. L.A Borradile and F.A.Pott, 1972 The Invertebrates. Cambridge University Press. UK.
3. Adam Sedgwick. A student text book of Zoology. Vol.I and II. Central book Depot. Allahabad.
4. P.S.Dhami and J.K.Dhami. 1969 Invertebrate Zoology, S.Chand and Co. New Delhi.
5. Hyman L.H. The Invertebrate Vol.I-IV. 1955, McGraw Hill Co. New York.
6. Barrington, E.J.W.. Invertebrate structure and function. ELBS Publication.
7. Barnes. Invertebrate Zoology. Toppan International Co.

II B.Sc (Zoo)	BOTANY	19ABZ101
SEMESTER – I		HRS/WK – 4
ALLIED BOTANY		CREDIT – 3

Objective:

- To teach of basic idea of plant science through traditional disciplines such as plant taxonomy, anatomy, morphology, physiology, embryology, genetics, evolution and ecology.

Course Outcome

On completion of the course students will be able

CO1: To understand the taxonomy of plants

CO2: To describe anatomy of prokaryotic and eukaryotic plant cells.

CO3: To understand plant physiology and embryology

CO4: To describe Structure and life history of some plant species

CO5: To acquire knowledge on plant genetics, evolution and ecology

SEMESTER I & IV	COURSE CODE: 19ABZ101					COURSE TITLE: BOTANY									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	4	4	2	3	5	1	5	1	5	4.0
CO2	5	5	5	5	4	5	4	3	4	4	5	1	5	1	5	4.1
CO3	5	5	4	5	4	5	4	3	3	4	5	1	5	2	5	4.0
CO4	5	5	4	5	4	5	4	3	3	3	5	1	5	3	5	4.0
CO5	5	5	4	5	4	5	4	3	2	4	5	2	5	3	5	4.1
Mean Overall Score																4.0

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT –I: Taxonomy

General outline of Bentham and Hooker's system of classification. Bacteria-general characters-shape-flagellation-structure of E.coli –reproduction and economic importance. Structure of TMV and Bacteriophage. Study of the characters and the economic important of the following families Cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

UNIT –II: Cell biology and Anatomy

Prokaryotic and eukaryotic cell- ultrastructure of plant cells-cell organelles –Chloroplast, Mitochondria and Nucleus, Cell divisions- Mitosis. Tissues- meristematic and permanent tissues, primary and normal secondary thickening of the dicot stem.

UNIT –III: Plant physiology and Embryology

Photosynthesis –light reaction- calvin cycle, respiration- glycolysis and kreb's cycle-electron transport system- Growth hormones-Auxins-tissue culture – principles. Structure of mature anther-structure of mature ovule-and its types and fertilization.

UNIT – IV: Structure and life history

Fungi- Penicillium, Agaricus; Algae-Chlorella; Bryophytes- Funaria; Pteridophytes-Lycopodium (excluding developmental studies) and Gymnosperms-Cycas. Economic importance of chlorella, penicillium and Agaricus.

UNIT- V: Genetics, Evolution and Ecology

Mendelism-monohybrid and dihybrid crosses; Theories of evolution-Lamarckism and Darwinism; Ecosystem- fresh water ecosystem, environmental pollution-types and control measures.

Text Books

1. Ashok Bendre, A.K. and Pandey P.C. (1975) Introductory Botany. Rastogi Publication Meerut.

2. Ganguly, A.K. and Kumar. N.C. (1971) General Botany Vol. I & Vol. II, Emkay Publication, Delhi.

Reference Books

1. Rev. Fr. Ignacimuthu, S.J. (1975) Basic Biotechnology – Tata Mcraw till publication co., New Delhi.

2. Rao,K.N.Krishnamoorthy,K.V. and Rao. G.(1975) Ancillary Botany. S. Viswanathan Private.Ltd.,Chennai

II B.Sc (Zoo)	**ALLIED PRACTICAL BOTANY**	**19ABP101**
SEMESTER –I		**HRS/WK – 3**
ALLIED PRACTICAL –I		**CREDIT – 2**

Description of plants in technical terms belonging to the families mentioned in the theory part.

To study the internal structure of Anatomy material, Pteridophytes and Gymnosperms.

Identification and Description of Micro Preparation materials mentioned in the theory part.

Description of experimental setup of plant physiology.

I B.Sc (Zoo)	CHORDATA-I	19ZO203
SEMESTER – II		HRS/WK – 4
CORE – III		CREDIT – 3

Objective:

To acquire knowledge on classification of chordates and their characteristic features

Course Outcome

On completion of the course students will be able

CO1: To describes the general characters and affinities of Cephalochordata

CO2: To know the general characters and affinities of Hemichordata

CO3: To understand the general characters and affinities of Urochordata

CO4: To describes the salient features and classification of Phylum chordata and their origin

CO5: To know classification of phylum Pisces, Accessory respiratory organs and Migration in fishes

SEMESTER II	COURSE CODE: 19ZO203					COURSE TITLE: CHORDATA-I									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	5	3	4	4	4	5	4	4	4.3
CO2	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO3	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO4	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO5	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
Mean Overall Score																4.3

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12Hours**

Sub phylum: Prochordata: **Type study**: **Amphioxus** (Cephalochordata) - General Characters and affinities

UNIT –II **12Hours**

Sub phylum: Prochordata: **Type study**: **Balanoglossus** (Hemichordata) General Characters and affinities

UNIT – III **12Hours**

Sub phylum: Prochordata: **Type study**: **Ascidian** (Urochordata) General Characters and affinities.

UNIT – IV **12Hours**

Salient Features and General classification of Phylum chordata upto orders. Origin of Chordates

UNIT – V **12Hours**

Class PISCES General characters and classification upto orders. **Type study: Shark.** Accessory respiratory organs in fishes, Migration in fishes

Text Books:

1. Ekambaranatha Ayyar, M and T.N Anantha Krishnan 1992, A manual of zoology Vol. II [Chordata]. S. Viswanathan [Printers and publishers] Pvt. Ltd., Madras.
2. Jordan E. L. and P.S. Verma 1995. Chordate Zoology and elements of Animal Physiology. S. Chand and co., New Delhi.
3. Kotpal R.L. 1992. Vertebrata, Rastogi publication, Meerut.

Reference Books:

1. Nigam. H.C 1983 Zoology of chordates, Vishal publications, Jalandhar.
2. Waterman, Allyn J.et al. 1971, Chordate Structure and functions, Mac. Millan and co., New York.
3. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
4. Hyman. L.H. Comparative vertebrate zoology. McGraw Hill co. New York

I B.Sc (Zoo)	CHORDATA-II	19ZO204
SEMESTER – II		HRS/WK – 3
CORE – IV		CREDIT – 3

Objective:

To impart peculiar characteristics of prochordates, amphibians, snakes, birds and mammals.

Course Outcome

On completion of the course students will be able

CO1: To classify phylum Amphibia and explain their adaptive features and parental care

CO2: To classify the phylum Reptilia and biting mechanism of poisonous snakes

CO3: To describe the phylum Aves and migration and flight adaptation in birds

CO4: To understand the Phylum Mammalia and egg laying mammals

CO5: To understand the Origin of Primates and adaptations of aquatic mammals

SEMESTER II	COURSE CODE: 19ZO204					COURSE TITLE: CHORDATA-II									HOURS: 3	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	5	3	4	4	3	5	4	5	4.5
CO2	5	5	4	5	4	5	5	5	3	4	4	3	5	4	5	4.4
CO3	4	5	4	5	4	5	5	5	3	4	4	3	5	5	5	4.4
CO4	4	5	4	5	4	5	3	3	4	4	4	3	5	4	5	4.1
CO5	4	5	4	5	4	5	3	3	4	4	4	3	5	3	5	4.1
Mean Overall Score																4.3

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **9 Hours**

Class AMPHIBIA General characters and classification upto orders. **Type study** : **Frog** - Adaptive features of Anura, Urodela & Apoda. Parental care in Amphibia – Neoteny.

UNIT –II **9 Hours**

Class REPTILIA- General characters and classification upto orders. **Type study** – **Calotes.** Poison apparatus and biting mechanism of poisonous snakes. Conservation of turtles and crocodiles.

UNIT – III **9 Hours**

Class AVES - General characters and classification upto orders. Features of Archaeopteryx **Type study** –**Pigeon.** Migration in birds, Flight adaptation.

UNIT – IV **9 Hours**

Class MAMMALIA - General characters and classification upto orders. Egg laying mammals **Type study** – **Rabbit.** Dentition in mammals.

UNIT – V **9 Hours**

Origin of Primates - Type study – Lemurs **-** adaptations of aquatic mammals

Text Books:

1. Ekambaranatha Ayyar, M and T.N Anantha Krishnan 1992, A manual of zoology Vol. II [Chordata]. S. Viswanathan [Printers and publishers] Pvt. Ltd., Madras.
2. Jordan E. L. and P.S. Verma 1995. Chordate Zoology and elements of Animal Physiology. S. Chand and co., New Delhi.
3. Kotpal R.L. 1992. Vertebrata, Rastogi publication, Meerut.

Reference Books:

1. Nigam. H.C 1983 Zoology of chordates, Vishal publications, Jalandhar.
2. Waterman, Allyn J.et al. 1971, Chordate Structure and functions, Mac. Millan and co., New York.
3. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
4. Hyman. L.H. Comparative vertebrate zoology. McGraw Hill co. New York

I B.Sc (Zoo)	CORE PRACTICAL – I INVERTEBRATA AND CHORDATA	18ZOP21
SEMESTER - II		HRS/WK – 3
CORE PRACTICAL – I		CREDIT – 4

DISSECTIONS

Earthworm – Digestive system

Cockroach – Digestive, Nervous system and Reproductive system, **Prawn** – Nervous system, **Fish** – Digestive system

MINOR PARCTICAL

MOUNTING **-Insect Mouth parts :** Cockroach, Honey bee, House Fly and Mosquito **Prawn** – Appendages, **Shark** - Placoid scales, **Earthworm** – Body setae

SPOTTERS

Study of the following specimens

1. Classify by giving reasons

Paramecium,Sycon, Obelia, Taenia solium, Neries, Prawn, Freshwater mussel, Seastar, Amphioxus, Shark, Hyla, Rhacophorus, Calotes, Pigeon, Rat/Rabbit.

2. Adaptations to their respective modes of life

Entamoeba, Trypanosoma, Plasmodium, Corals [any 2], Ascaris, Fasiola, Wuchereria bancrofti, Cheatopterus, Leech, Limulus, Nauplius, Mysis, Zoea, Balanoglossus, Ascidian, Ichthyophis, Draco, sea snake and Bat.

3. Biological significance:

Paramecium conjugation and binary fission, physalia, Trochophore Larva, Peripatus, Sacculina On Crab, Sea Anemone on Hermit Crab, Pearl Oyster, Bipinnaria Larva, Anabas, Hippocampus, Narcine, Echeneis, Arius, Exocoetus, Eel, Amblystoma, Axolotl Larva, Bufo, Cobra, Krait, Russels Viper, Echis Carinata, Turtle, Parrot, Woodpecker, King Fisher and Ant eater

4. Relate structure and function:

Sponge Spicules, Obelia-Polyp, Taenia-Scolex, Nereis - Parapodium, Book lungs of scorpion/Honey bee sting apparatus, Pedicellaria of Sea star, Ctenoid Scale and Quill Feather of pigeon.

5.Draw labeled sketches:

T.S. of Nereis, T.S. of Leech, Obelia medusa, T.S. of Amphioxus through Pharynx, T.S. through arm of Sea star.

6.Osteology

Skeleton - Pectoral girdles of Frog and Pigeon.,Pelvic Girdles of Frog and Pigeon.

Fore and Hind limbs of Frog and Pigeon., Synsacrum of Pigeon. **Dentition -** Dog, Rabbit and Man.

Reference Books:

1. Verma. P.S. 2011 A Manual of Practical Zoology INVERTEBRATES Chand & Co, Ltd, Ram Nagar -New Delhi.
2. Verma. P.S. 2011 A Manual of Practical Zoology CHORDATES, Chand & co, Ltd. Ram Nagar – New Delhi.
3. Jayanpa Sinha . 2010 Advanced Practical Zoology, Books & Allied (p) Ltd. No.1. Subham Plaza IFloor, Calcutta.

II B.Sc (Zoo)	CELL BIOLOGY	19ZO305
SEMESTER - III		HRS/WK – 4
CORE - V		CREDIT – 3

Objective:

- Have an enhanced knowledge on microscopes, cytological techniques.
- To provide a basic information on structure and functions of cell and cell organelles

Course Outcome

On completion of the course students will be able

CO1: To understand the Principles of microscopes and Cytological techniques

CO2: To describe the Cell theory, Ultra structure of animal cell

CO3: To recognize the properties of cytoplasm and Ultra structure of nucleus.

CO4: To explain the structure and functions cell organelles

CO5: To obtain knowledge on cell cycle and cell division

SEMESTER III	COURSE CODE: 19ZO305					COURSE TITLE: CELL BIOLOGY									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	5	5	5	5	5	5	2	5	4.7
CO2	5	5	5	5	4	5	5	4	5	5	5	4	5	2	5	4.6
CO3	5	5	5	5	4	5	5	5	5	5	5	4	5	2	5	4.7
CO4	5	5	4	5	4	5	5	4	5	5	5	3	5	2	5	4.5
CO5	5	5	5	5	4	5	5	4	5	5	5	4	5	2	5	4.6
Mean Overall Score																4.6

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12 Hours**

History of Cell– Principles of microscopes light and electron, **Cytological techniques** - cell fractionation, Homogenization Centrifugation, Isolation of Sub-cellular components.

UNIT – II **12 Hours**

Cell – Cell theory, Ultra structure of animal cell – structure, composition and functions – cell components – Plasma Membrane – Endoplasmic reticulum.

UNIT – III **12 Hours**

Cytoplasm – Physical, chemical and biological properties. **Nucleus** – Ultrastructure, Composition and Function.

UNIT – IV **12 Hours**

Ribosomes, Golgi Complex, Lysomes, Glyoxisomes, peroxisomes, centrioles and Mitochondria.

UNIT – V **12 Hours**

Cell cycle and cell division - Amitosis, Mitosis and meiosis and their significance.

Text Book

1. Powar, C.B.,1989.Essentials of Cytology, Himalaya Publishing House, Bombay.
2. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
3. Rastogi. S.C. 2008 Cell and Molecular Biology, 2nd Edition, New Age International (p) Ltd., New Delhi

Reference Books:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong. 734p.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philadelphia, London, Toronto.
4. Jayanthi .G.P. 2009 Molecular Biology, M.J.P Publ. Chennai.

II B.Sc (Zoo)	MOLECULAR BIOLOGY	19ZO306
SEMESTER - III		HRS/WK – 4
CORE - VI		CREDIT – 3

Objective:

- Expose the students to the incipient field of research in molecular biology by providing basic knowledge on biochemical and cell culture techniques and cancer biology

Course Outcome

On completion of the course students will be able

CO1: To get knowledge on biochemical and cell culture techniques

CO2: To know chromosomes structure and giant chromosomes.

CO3: To understand the structure and function of DNA and types of RNA.

CO4: To realize cancer biology and process of aging

CO5: To describe the mechanism of DNA replication and Protein synthesis

SEMESTER III	COURSE CODE: 19ZO306					COURSE TITLE: MOLECULAR BIOLOGY									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	3	5	5	4	4	5	2	5	4.4
CO2	5	5	5	4	4	4	5	3	5	5	4	3	5	2	5	4.3
CO3	5	5	4	3	4	4	5	3	5	5	4	2	5	2	5	4.1
CO4	5	5	5	4	4	4	5	3	4	5	4	2	5	2	5	4.1
CO5	5	5	5	4	4	4	5	3	5	5	4	4	5	2	5	4.3
Mean Overall Score																4.2

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12Hours**

Biochemical techniques – Electrophoresis and their applications. **Cell culture techniques** and applications

UNIT – II **12Hours**

Chromosomes structure –Heterochromosome, Euchromatin - **Giant chromosomes** (Polytene and Lamp brush chromosomes).

UNIT – III **12Hours**

Structure and functions of DNA & types of RNA [mRNA, tRNA, rRNA].

UNIT – IV **12Hours**

Cancer biology – structure of cancer cell, carcinogenesis. **Aging** – Cell death and apoptosis.

UNIT – V **12Hours**

Mechanism and enzymology of DNA replication, Semi conservative replication.
Protein synthesis.

Text Book

1. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
2. Rastogi. S.C. 2008 Cell and Molecular Biology, 2nd Edition, New Age International (p) Ltd., New Delhi.

Reference Books:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong. 734p.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philadelphia, London, Toronto.
4. Jayanthi .G.P. 2009 Molecular Biology, M.J.P Publ. Chennai.

II B.Sc (Zoo)	GENETICS	19ZO407
SEMESTER - IV		HRS/WK – 4
CORE - VII		CREDIT – 3

Objective:

- To provide basic knowledge in the field of genetics and applications of modern genetics.

Course Outcome

On completion of the course students will be able

CO1: To acquire basic information on genetics and Mendelian laws

CO2: To understand multiple alleles and pedigree analysis in human traits.

CO3: To define linkage and crossing over.

CO4: To describe non-disjunction and gynandromorphs and fine structure of gene

CO5: To acquire knowledge on mutation, applied genetics and population genetics

SEMESTER IV	COURSE CODE: 19ZO407					COURSE TITLE: GENETICS										HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	5	5	4	4	5	3	3	5	5	2	5	2	4	4.1	
CO2	5	5	5	5	4	4	5	3	3	5	5	3	5	2	4	4.2	
CO3	5	5	5	4	4	4	5	3	3	5	5	2	5	2	4	4.1	
CO4	4	5	4	4	4	4	5	3	3	5	5	2	5	2	4	4.0	
CO5	5	5	4	5	4	4	5	3	3	5	5	3	5	2	4	4.1	
Mean Overall Score																4.1	

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12Hours**

Introduction to genetics – Basis of Mendelian Inheritance and Mendelian Laws – Interaction of Genes – Complementary Factors, Inhibitory and lethal Factors Atavism.

UNIT-II **12Hours**

Multiple Alleles – Blood Groups and their Inheritance in man. **Pedigree analysis** in human traits.

UNIT – III **12Hours**

Linkage and crossing over – Drosophila – Morgan's Experiments - Cytological Evidence for Crossing Over. **Sex determination and sex linkage** in Drosophila and Man.

UNIT – IV **12Hours**

Non – Disjunction and Gynandromorphs– Cytoplasmic Inheritance Maternal effect on Limnaea [shell coiling], **Fine Structure of Gene** – Cistron –Recon, Muton – **Gene Regulation** – Operon concept – Lac Operon.

UNIT – V **12Hours**

Mutation – chromosomal Aberrations – examples from Human. **Applied Genetics** – Animal Breeding – Heterosis, Inbreeding, Out breeding, Out Crossing, Hybrid Vigour. **Population Genetics:** Hardy Weinberg Law – factors affecting Hardy Weinberg Law.

Text Books:

1. Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand & Co, New Delhi.
2. Veer Bala Bastogi, 2019 Genetics, Medtech Publishers

Reference Books:

1. Gunther S. Stent 1986. Molecular Genetics. Macmillan Publishing Co Inc.
2. Gardener. 1991. Principles of Genetics. 8th edition. John wiley & sons Inc. New York. Chichester,Brisbane, Toronto, Singapore.
3. Monroe. W. Strick Berger 2004 Genetics. Printice Hall of India New Delhi.
4. Nicholls. 2002 Genetic Engineering, Cambridge University Press. UK.

II B.Sc (Zoo)	BIOTECHNOLOGY	19ZO408
SEMESTER - IV		HRS/WK – 4
CORE - VIII		CREDIT – 3

Objective:

- To generate potential knowledge regarding the scope and applications of biotechnology.
- To understand the modern biotechnology practices and approaches with highlighting in genetic engineering, rDNA technology, cloning and gene transfer technology

Course Outcome

On completion of the course students will be able

CO1: To know the scope and applications of biotechnology

CO2: To acquire knowledge on techniques of genetic engineering and rDNA technology.

CO3: To realise gene cloning in prokaryotes and basics of human genome project.

CO4: To describe transgenic plants and animals

CO5: To understand the application of recombinant DNA technology

SEMESTER IV	COURSE CODE: 19ZO408					COURSE TITLE: BIOTECHNOLOGY									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	3	5	1	3	4	4	3	4	3	5	4.0
CO2	5	5	5	5	4	3	5	2	3	4	4	4	4	4	5	4.1
CO3	5	5	4	5	4	3	5	2	4	4	4	4	4	4	5	4.1
CO4	5	5	5	5	4	3	5	2	4	4	4	4	4	4	5	4.2
CO5	5	5	5	5	4	3	5	2	4	4	4	4	4	3	5	4.1
Mean Overall Score																4.1

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12Hours**

Definition – Scope and applications – isolation of DNA – cloning – Tools of Genetic Engineering – Enzymes, Linkers and Adaptors.

UNIT-II **12Hours**

Cloning vectors, [plasmids, pBr322, Phage I, Cosmids and phagemids]. Techniques of Genetic Engineering - recombinant DNA Technology.

UNIT-III **12Hours**

Gene Cloning in prokaryotes **[cDNA and Genomic Library].** Basics of human genome project.

UNIT – IV **12Hours**

Transgeneic plants and animals – DNA finger printing – gene therapy – biocensors – biochips – Production of Transgenic plant (Bt. Cotton) and transgenic animal (mice).

UNIT-V **12Hours**

Application of Recombinant DNA technology in Medicine & Agriculture – Socio economic issues of Biotechnology in India.

Text Books:

1. Dubey,R.C 2006 Text Book of Biotechnology S. Chand & co. New Delhi.
2. Kumar H. D.1998 A text book of Biotechnology, affiliated East West pvt. Ltd., New Delhi.

Reference Books:

1. Higgins II, Best GJ and Jones J 1996 Biotechnology – Principles and application Black well scientific Publication Oxford London.
2. Gupta, P.K. 2001 Elements of Biotechnology Rastogi publication, Meerut.
3. Vijayaraman, Chellammal K.S and Manikkili. P 1998. Uyiriyae Thozhilnutpam. Chimeeraa, Trichy.

II B.Sc Zoology	APICULTURE	19EZ402
SEMESTER – IV		HRS/WK – 3
Skill Based Course (Optional)		CREDIT – 2

Objective:

- Entrepreneur motivation for practicing Apiculture as cottage Industry.

COURSE OUTCOME

On completion of the course students will be able

CO1: To understand the classification of honey bee

CO2: To gain knowledge on method of bee keeping and extraction of honey

CO3: To understand the diseases and control measure of honey bee

CO4: To get knowledge on products of bee keeping

CO5: To describe bee keeping industry

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 19EZ402					COURSE TITLE: Skill Based Subject APICULTURE									HOURS: 3	CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	4	4	3	1	2	3	1	5	2	5	3.5
CO2	5	5	4	5	4	4	4	5	3	2	3	1	5	2	5	3.8
CO3	5	5	5	5	4	4	4	4	2	2	3	1	5	2	5	3.7
CO4	5	5	5	5	4	4	4	3	2	2	3	1	5	2	5	3.7
CO5	5	5	5	5	4	4	4	3	1	2	3	1	5	2	5	3.6
Mean Overall Score																3.7

Result: The Score of this Course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT-I **9Hours**

History – Biology and classification of honey bee, species of honey bees, Social organization of honey bee colony.

UNIT-II **9Hours**

Bee hive – Flora for apiculture – Selection of bees for apiculture, Method of bee Keeping – Indigenous method of Extraction of honey.

UNIT-III **9Hours**

Modern method of apiculture – Appliances for modern method, Diseases of Honey bee and control measures.

UNIT-IV **9Hours**

Products of bee keeping : Honey – Bee wax and Bee Yeman – Honey :Production, Chemical composition – Economic importance of Honey bee wax.

UNIT-V **9Hours**

Bee enemies – Bee keeping industry – Recent efforts – Modern method in employing honey bees for cross pollination in horticultural gardens.

Text Books:

1. Sardar Singh, Bee keeping in India
2. Sharma .P.L., & Singh S. Hand Book of Bee keeping.

References Books:

1. M.S. Nalina Sundari 2006,Entomology M.J.P publications , Chennai.
2. Honey – A comprehensive survey – International Bee Research Association for house – CNRC (England)
3. Roger. A. Morse, 1990. The ABC & XYZ of Bee culture, 40th ed., A.I Root & Co., Medina, ohio 44256. 516 pp.

II B.Sc (Zoo)	CORE PRACTICAL – II CELL AND MOLECULAR BIOLOGY, GENETICS AND BIOTECHNOLOGY	19ZOP42
SEMESTER - IV		HRS/WK – 3
CORE PRACTICAL – II		CREDIT – 4

CELL AND MOLECULAR BIOLOGY

Cytometry

Compound microscope, Camera Lucida, Stage ad Ocular Micrometers

Blood Smear Preparation – Differential count of W.B.C.

Total count of RBC using Haemocytometer.

Total count of WBC using Haemocytometer.

Slide Preparation

Buccal Smear.

Mitosis in onion root tip squash.

Squash preparation of Grass hopper testes.

Study of prepared slides of histology.

Columnar Epithelium, Ciliated epithelium, Glandular Epithelium. Cartilage T.S., Bone T.S., Cardiac Muscle, Striated muscle, Non Striated muscle, Neuron, C.S of mammalian Testis and Ovary.

GENETICS

Squash preparation of Salivary glands of chironomous larva (Giant chromosome).

Male & Female identification of Drosophila.

Observation of common Mutants of Drosophila.

Human Blood Grouping.

BIOTECHNOLOGY

Study of prepared slides, Models or specimen.

Escherichia coli, Bacteriophage, Plasmid.

Demonstration of P.C.R technique: Southern blot, Electrophoresis.

Visit to Biotechnology lab and Report – compulsory.

III B.Sc (Zoo)	BIOSTATISTICS AND COMPUTATIONAL BIOLOGY	20ZO509
SEMESTER - V		HRS/WK - 5
CORE – V		CREDIT - 4

Objective:

- To learn basics of Biostatistics and their application in biology
- To acquire knowledge on Computational Biology

Course Outcome

On completion of the course students will be able

CO1: To acquire knowledge on scope and sampling methods in biostatistics

CO2: To understand the measure of central tendency and measures of dispersion.

CO3: To understand types of computers, operating systems and its applications

CO4: To acquire knowledge on biological databases like NCBI, GenBank etc.

CO5: To gain knowledge on DNA and RNA sequencing

SEMESTER V	COURSE CODE: 20ZO509					COURSE TITLE: BIOSTATISTICS AND COMPUTATIONAL BIOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	5	5	4	5	5	4	1	5	2	5	4.3
CO2	5	5	4	5	4	5	5	3	5	5	4	1	5	2	5	4.2
CO3	5	5	4	5	4	4	5	2	5	5	4	2	5	4	5	4.3
CO4	5	5	4	5	4	5	5	3	4	5	4	1	5	2	5	4.1
CO5	5	5	4	5	4	4	5	3	4	5	4	1	5	1	5	4.0
Mean Overall Score																4.2

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

BIOSTATISTICS

UNIT – I **15 Hours**

Definition and Scope, Census and sampling methods – collection and presentation of data. Diagrams and graphs; bar, pie, Histogram, Line graph – concept of Statistical population and sample characteristics of frequency distribution.

UNIT – II **15 Hours**

Measures of central tendency: mean, median and mode. Measures of Dispersion, Range, Quartile deviation, mean deviation & Standard deviation. Test of significance (t- Test).

COMPUTATIONAL BIOLOGY

UNIT – III **15 Hours**

Introduction – computer – types of modern computers – operating systems – applications of MS-WORD, MS-EXCEL and MS-PPT- Documentation and Presentation of Bio Statistical data– Browsers – search engines - Use of Internet, Messenger and E-mail – Basic Knowledge of Medical transcription.

UNIT- IV **15 Hours**

Biological databases – definition – Literature databases- NCBI – Pubmed, Medline, Protein and Nucleic acid Sequence, databases and their relationship – PIR, Swiss – Prot, GeneBank, DDBJ – Structural Databases – PDB, SCOP, CATH, Structural visualization tools, RasMol, Swiss PDB viewer.

UNIT – V **15 Hours**

DNA and RNA sequencing - Pairwise sequence Alignment –Scoring Matrices - PAM and BLOSUM- statistics of alignment scored Dot Plot – local and global alignment – Database searching – FASTA and BLAST multiple sequence alignment clustal W- Phylogenetic Tress – PHYLIP.

Text Books:

1. Gupta SP 1996. Statistics –S. Chand and Co., New Delhi.
2. Christine Solomon. MS. OFFICE for Win – Microsoft office press. Developing Application with MS-OFFICE – Microsoft Office Press.

Reference Books:

1. Jerold H. Zar 1984. Bio Statistical analysis [2nd edition] printice Hall of International edition.
2. Goutham Roy 2002. Introduction to Computing and computing lab and Cad Books and allied [pvt]ltd. Kolkata.
3. Cynthia Gibbs. Developing Bioinformatics Computer Skills. Sheoff Publishers & Distributors Pvt.Ltd., Mumbai.
4. Arthur. M. Lesk 2003. Introduction to Bioinformatics, Oxford University Press, New Delhi.
5. Arthur. M. Lesk, Introdution to protein Structures Oxford University Press, New Delhi, 2000
6. Baxevanis, A and Outllette 2005. Bioinformatics a practical guide to the analysis of genes and proteins, Willy – Intersience, Hoboken, NJ. USA.

III B.Sc (Zoo)	DEVELOPMENTAL BIOLOGY & IMMUNOLOGY	20Z0510
SEMESTER - V		HRS/WK – 5
CORE - VI		CREDIT – 4

Objective:

- To learn basic concepts of developmental biology and artificial reproductive technology
- To acquire knowledge on immune system and immune deficiency diseases

Course Outcome

On completion of the course students will be able

CO1: To acquire knowledge on gametogenesis and parthenogenesis

CO2: To understand the process of cleavage and blastulation.

CO3: To realize embryonic adaptation and artificial reproductive technology.

CO4: To describe lymphoid organ and immune system

CO5: To gain information regarding immunoglobulin and immune deficiency diseases

SEMESTER V	COURSE CODE: 20Z0510					COURSE TITLE: DEVELOPMENTAL BIOLOGY & IMMUNOLOGY								HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	5	5	4	5	5	4	1	5	2	5	4.3
CO2	5	5	4	5	4	5	5	3	5	5	4	1	5	2	5	4.2
CO3	5	5	4	5	4	4	5	2	5	5	4	2	5	4	5	4.3
CO4	5	5	4	5	4	5	5	3	4	5	4	1	5	2	5	4.1
CO5	5	5	4	5	4	4	5	3	4	5	4	1	5	1	5	4.0
Mean Overall Score																4.2

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

DEVELOPMENTAL BIOLOGY

UNIT – I **15 Hours**

Gametogenesis – **Fertilization -** polarity & symmetry of eggs – types of eggs – Fertilization Mechanism, Physiology & theories – parthenogenesis –Natural – artificial – Experiments on Artificial Parthenogenesis.

UNIT – II **15 Hours**

Cleavage – Factors influencing cleavage – fate map – blastulation and gastrulation in amphioxus, frog and chick – Experimental works of Speeman and Mangold- Development of brain and eye in frog.

UNIT – III **15 Hours**

Embryonic adaptations; Embryonic membranes and their functions in chick – placentation in mammals. Puberty – Menstrual cycle-contraception – family welfare reproductive technology; Artificial insemination - cryopreservation - IVF - Embryotransfer – Test tube babies – Bioethics.

IMMUNOLOGY

UNIT- IV **15 Hours**

Introduction - **Lymphoid organs,** cells of immune system – their role in immune response.Types of immunity – their role in parasitic, bacterial & Viral Infection, in hyper – sensitivity and graft rejection. –Antigen – Antibody reaction.

UNIT – V **15 Hours**

Immunoglobulin – types, structure, Physico chemical and biological properties – Immunoprophylaxis – Immunization schedule of children. Immuno deficiency – AIDS, Immunotechniques.

Text Books:

1. M.S.Jayaraj An Introduction to embryology Veer Bala Rastogi Publication.
2. Verma, P.S., V.K. Agarwal and Tyagi, 1995. Chordate embryology. S. Chand & co., New Delhi.

Reference Books:

1. Balinsky, B.L., Introduction to embryology 1981.Saundeers, Philadelphia.
2. Berril & Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
3. Majumdar, N.N. 1990. Text Book of Vertebrate embryology. Tata McGraw – hill Publishing company Ltd. New Delhi.
4. McEwen, R.S., 1969.Vertebrate Embryology. Oxford and IBH Publishing Co., New Delhi.
5. Jain, P.C 1998, Elements of Developmental Biology. Vishal Publication, New Delhi.
6. Roitt.I.M 2000 Essential Immunology, Blackwell Scientific Publishers.
7. Paul, W.E.M. 1989,Fundamental Immunology, Raven Press, New York.
8. Kuby. J.1999, Immunology. W. H. Free man and Co. New York.
9. Current protocols in Immunology – 3 Volumes 1994 Wiley Publications.
10. Roitt. I, Brostoff, J. and Male. D. 2002. Immunology, Mosby, New York.
11. Richard, A. Golds, Thomas I, Kindt & Barbara A. Osborne 2000 Kuby Immunology, Freeman and Co.New York.

III B.Sc (Zoo)	ANIMAL PHYSIOLOGY	20ZO511
SEMESTER – V		HRS/WK – 5
CORE – VII		CREDIT – 4

Objective:

- To impart an overview of basic physiological functions of various organ system in human.

Course Outcome

On completion of the course students will be able

CO1: To describe the process of nutrition and digestion

CO2: To understand the process of respiration and circulation.

CO3: To recognize excretory system and osmo-ionoregulation in fishes and mammals.

CO4: To describe nervous system and muscular system

CO5: To understand receptors and structure, secretions and functions of endocrine glands

SEMESTER V	COURSE CODE: 20ZO511					COURSE TITLE: ANIMAL PHYSIOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO2	5	5	4	4	4	5	5	4	4	5	4	3	5	1	5	4.2
CO3	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO4	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO5	5	5	4	4	4	5	5	4	4	5	4	2	5	1	5	4.1
Mean Overall Score																4.1

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Nutrition and Digestion

Introduction– Food requirements – Carbohydrates, proteins, fats, minerals, and vitamins. Digestive enzymes and their role in digestion – absorption and assimilation.

UNIT – II **15 Hours**

Respiration and Circulation

Introduction – Respiratory Pigments and functions. Transport of gases [Co2 and O2] – Respiratory quotient. Circulation Types, Composition, Properties and Function of Blood – Human – Cardiac Cycle – Cardiac Rhythm – Origin of heart Beat – Regulation of heart Beat – ECG – Blood Pressure – Factors Contributing to heart Problems – coronary circulation.

UNIT – III **15 Hours**

Excretion and Osmoionoregulation

Introduction – kinds of excretory products – Kidney - structure and Mechanism of urine formation in mammals, hormonal regulation of excretion. Kidney failure and Transplantation. Osmoionoregulation in fishes and mammals.

UNIT – IV **15 Hours**

Neuromuscular Co-ordination

Nervous tissue – Neuron – Structure, types of neurons. Nerve impulse – Synapse – Synaptic transmission of impulses – Neurotransmitters. Muscles – Types of muscles – Muscle Proteins – Mechanism of contraction – Cori cycle – Theories of muscle contraction.

UNIT – V **15 Hours**

Receptors and Endocrine system

Receptors – Photoreceptor – mammalian eye –structure of retina – visual pigments – physiology of vision – phonoreceptors – mammalian ear- Organ of Corti – working mechanism – phonoreception in bat. Endocrine glands – structure, secretions and functions of endocrine glands of vertebrates – Pituitary, Hypothalamus, Thyroid, Parathyroid, Adrenal, Thymus, Islets of langherhans, Testis and Ovary.

Text Books:

1. Verma, P.S, Tyagi B.S. and Agarwal V.K. 2000. Animal Physiology. S. Chand Publication.
2. Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Reference Books:

1. Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [printers & Publishers] Pvt. Ltd.
2. William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.
3. Wood.D.W, 1983, Principles of Animal Physiology 3rd Ed.,
4. Prosser,C.L. and Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra – 282 003.

III B.Sc (Zoo)	ELECTIVE-I APPLIED ENTOMOLOGY	20EZ512A
SEMESTER - V		HRS/WK – 5
ELECTIVE-I (Compulsory)		CREDIT – 3

Objective:

- To provide extensive knowledge in the field of Entomology.
- The familiarity between insect and environment was highlighted to the entomological research in many directions which have immense value in the control measures various disease causing insects.

Course Outcome

On completion of the course students will be able

CO1: To describe the economic classification of insects

CO2: To understand the types of insect development

CO3: To know pests of stored products and their control

CO4: To describe pest control methods and application

CO5: To understand the production and marketing of pesticides

SEMESTER V	COURSE CODE: 20EZ512A					COURSE TITLE: ELECTIVE-I APPLIED ENTOMOLOGY									HOURS:5	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	4	4	5	2	2	3	2	5	4	5	4.0
CO2	5	5	4	5	3	4	4	4	3	2	3	2	5	3	5	3.8
CO3	5	5	4	5	4	4	4	3	2	2	3	2	5	5	5	3.9
CO4	5	5	4	5	5	4	4	3	1	3	3	2	5	5	5	4.0
CO5	5	5	5	5	5	4	4	2	1	3	3	2	5	5	5	4.0
Mean Overall Score																3.9

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Introduction – **economic classification of insects** - Types of pests – types of damage caused by pests in crops - causes for insects assuming pest status – outbreak of pests.

UNIT – II **15 Hours**

Types of insect development – ametabola and metabola (hemi metabola, holometabola, paurometabola and hypermetabola) - Pests of agricultural importance, their bionomics, life cycle and control measures of paddy, ground nut, cotton, tomato, coffee & Banana.

UNIT – III **15 Hours**

Pests of stored products and their control – Household pests – cockroach and termities – and their control – pest in relation to public health – rodents and their control. Mosquitoe borne diseases and their control measures.

UNIT- IV **15 Hours**

Pest control methods and application: cultural, mechanical, biological and chemical methods – classification of pesticides – LC 50 and LD 50 values – First Aid & precautions in handling pesticides – pesticide spraying appliances. Residual effects of pesticides on non target organisms.

UNIT – V **15 Hours**

Pesticide industry - production and marketing – recent trends in pest control – pheromones, attractants, repellants and chemosterilants Integrated pest management, its importance & applications.

Text Books:

1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.
3. P.G. Fenemore and Alka Prakash 1997 Allied Entomology, Wiley Eastern Ltd., New York

Reference Books:

1. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
2. Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.
3. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques,3rd Ed, Himamalaya publishing house.
4. H.B.Bull, F.H.Davis, 1971. An introduction to physical Biochemistry 2nd Ed, Philadelphia
5. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

III B.Sc Zoology	ELECTIVE – II PUBLIC HEALTH AND HYGIENE	20EZ513B
SEMESTER – V		HRS/WK – 4
ELECTIVE –II (Optional)		CREDIT – 3

Objective:

- To impart awareness on Public Health and Hygiene
- To create knowledge on Health Education.

Course Outcomes

On completion of the course students will be able

CO1: To understand public health and hygiene

CO2: To realize environment and health hazards

CO3: To understand the communicable diseases and their control measures.

CO4: To understand the non-communicable diseases and their control measures

CO5: To know the health education in India

SEMESTER VI	COURSE CODE: 20EZ513B					COURSE TITLE: ELECTIVE - II PUBLIC HEALTH AND HYGIENE								HOURS:4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7
CO2	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7
CO3	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
CO4	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
CO5	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
Mean Overall Score																3.8

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT-I **12Hours**

Scope of Public health and Hygiene – nutrition and health – classification of foods – Nutritional deficiencies - Vitamin deficiencies.

UNIT-II **12Hours**

Environment and Health hazards – Environmental degradation – Pollution and associated health hazards.

UNIT-III **12Hours**

Communicable diseases and their control measures such as Measles, Polio, Chikungunya, Rabies, Plauge, Leprosy and AIDS.

UNIT-IV **12Hours**

Non-Communicable diseases and their preventive measures such as Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health.

UNIT-V **12Hours**

Health Education in India – WHO Programmes – Government and Voluntary Organizations and their health services – Precautions, First Aid and awareness on sporadic diseases.

Text Books:

1. Park and Park, 1995: Text Book of Preventive and Social Medicine – Banarsidas Bhanot Publ. Jodhpur – India.
2. Dubey, R.C and Maheswari, D.K. 2007 : Text Book of Microbiology – S. Chand & Co. Publ. New Delhi – India.

Reference Books:

1. Verma, S. 1998 : Medical Zoology, Rastogi publ. – Meerut – India
2. Singh, H.S. and Rastogi, P. 2009 : Parasitology, Rastogi Publ. India

III B.Sc (Zoo)	ENVIRONMENTAL BIOLOGY	20ZO614
SEMESTER - VI		HRS/WK – 5
CORE - VIII		CREDIT – 4

Objective:

- To learn the scope of environmental biology, importance of protection and conservation of wild life to maintain the ecosystem balance.
- To create awareness about the environmental problems and motivate the students to participate in environment protection and sustainable utilization of natural resources.

Course Outcome

On completion of the course students will be able

CO1: To realize the scope and concept of environmental biology

CO2: To describe structure and functions of ecosystem.

CO3: To understand biogeochemical cycles and animal association

CO4: To describe population and community of an ecosystem and management of natural resources

CO5: To get knowledge on environmental degradation and their effects and remedy measures

SEMESTER VI	COURSE CODE: 20ZO614					COURSE TITLE: ENVIRONMENTAL BIOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	3	1	4	3	1	5	5	5	4.1
CO2	5	5	5	5	4	5	5	3	1	4	3	1	5	5	5	4.1
CO3	5	5	4	5	4	5	5	5	1	4	3	1	5	5	5	4.1
CO4	5	5	4	5	4	5	5	4	1	4	3	1	5	5	5	4.1
CO5	5	5	4	5	4	5	5	3	1	4	3	1	5	5	5	4
Mean Overall Score																4.1

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Scope – concept – Branches in ecology – Autecology, synecology - types of media and substratum and their influences on animals – **Water:** Properties, Forms of water, Soft and hard water. **Air** composition – properties. **Substratum**: Soil -Types, soil formation, soil group of India, soil profile.

UNIT – II **15 Hours**

Biosphere – Hydrosphere – Lithosphere – Atmosphere – temperature: Distribution of temperature, thermal stratification – Temperature as a limiting factor, thermal adaptations. Light as a limiting factor. Ecosystem-concept, components, types, structure and functions.

UNIT – III **15 Hours**

Biogeochemical cycles – gaseous cycle [C,N2 & S] sedimentary cycle, [phosphates]. **Animal association** - Intra specific and inter specific - colony formation, social organization, predation, parasitism, commensalisms, mutualism, inter specific competition – competitive principle or Gause's principle.

UNIT – IV **15 Hours**

Population: Definition – characteristics – Natality, Mortality, age distribution of Population growth forms, population fluctuation. Community Ecotone and edge effects – ecological succession. Conservation - **Wild life management,** Preservation – laws enforced – sanctuaries, National parks. **Natural resources management:** renewable and non-renewable.

UNIT – V **15 Hours**

Environmental degradation – deforestation, urbanization, population explosion and other environmental hazards – Environmental ethics and laws – Earth summits – role of governmental agencies for environmental monitoring.

Text Books:

1. Kotpal. R.L, and N.P. Bali, 1986. Concepts of Ecology, Vishal Publications, New Delhi-7
2. Rastogi V.B, and M.S. Jayaraji, 1988 – 1989 Animal Ecology and Distribution of animals, Kedar nath, Ram Nath Meerut – 250 001.

Reference Books:

1. Clark, G.L. 1954, Elements of Eology, John wiley & Sons Inc., New York, London.
2. Ananthakrishnan, T.N, and S. Viswanathan, Principles of Animal Ecology.
3. Eugene P. Odum, 1971. Fundamentals of ecology, Saunders International Student Edition, W.B. Saunders Company, Philadelphia London, Toronto.
4. Verma, P.S and Agarwal 1986, Environmental Biology, S. Chand & Co Ltd. New Delhi.

III B.Sc (Zoo)	ECONOMIC ZOOLOGY	20ZO615
SEMESTER – VI		HRS/WK - 5
CORE - IX		CREDIT – 4

Objective:

- To impart the importance of valuable animals like earth worms, silk worms, honey bees, fishes, prawns, oysters and cattle.
- To study the rearing methods of these organisms with an economic point of view.

Course Outcome

On completion of the course students will be able

CO1: To acquire knowledge on vermiculture, apiculture and sericulture

CO2: To describe prawn culture, pearl culture and pisciculture

CO3: To acquire knowledge on poultry

CO4: To describe dairy farm and sheep farm

CO5: To understand future strategies for livestock development

SEMESTER VI	COURSE CODE: 20ZO615					COURSE TITLE: ECONOMIC ZOOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO2	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO3	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO4	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO5	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
Mean Overall Score																4.5

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Vermiculture: Composting of Earthworms-Methods of composting.

Apiculture - Species of Honeybees –Construction of Apiary-Honey extraction – Economics of Apiculture and management.

Sericulture – Nature and economic importance of sericulture in India.

UNIT –II **15 Hours**

Prawn culture – Culture techniques of fresh water [Macrobrachium rosenbergii] & Marine water (Penaeus monodon)

Pearl culture: Formation and nature of Pearls – Commercial importance of Pearl Culture in India.

Pisciculture– Techniques of induced breeding, commercial culture of catla & catfish, By–products of fishing and its commercial values.

UNIT – III **15 Hours**

Poultry- Morphology of different breeds of Chicken – Brooding and Rearing of Chicks – Processing of Egg, Meat and By–Products of Poultry.

UNIT – IV **15 Hours**

Dairy farm - management, Milch breeds. Draught Breeds, Dual Purpose breeds and New cross Breeds of Cows and Buffaloes in India.

Sheep farm: Indigenous and Exotic breeds of sheep

UNIT – V **15 Hours**

Future strategies for Livestock Development – Transgenic animal Technology – Genetic Improvement for best Breeds – Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

Text Books:

1. Sukla, G.S. and Upadhyay, V.B., 2000 Economic Zoology – ISBN – 81- 7133 -137 -8 Rastogi Publication, Meerut, India
2. Jawaid Ahsan and Subhas Prasad sinha – 2000 A Handbook on Economic Zoolgy - Chand & co., Ltd., New Delhi.

Reference Books:

1. Ashok Kumar and Prem Mohan Nigam, 1991 Economic and Applied Entomology Emkay Publication, New Delhi.
2. Shammi,Q.J. and Bhatnagar, S., 2002 Applied Fisheries Agrobios [India],Jodhpur - India
3. Major Hall, C.B. 2005 Ponds and Fish culture. Agrobios [India], Jodhpur - India
4. Keith Wilson, N.D.P., 2005 A Handbook of Poultry Practice Agrobios [India], Jodhpur - India
5. Banerjee, G. C. 1992 Poultry – III – Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Banerjee, 1988 A Text book of Animal Husbandry – VIII- Edition xford & IBH Publishing co. Pvt. Ltd., New Delhi.
7. Kaushish, S.K., 2001 Trends in livestock Research Agrobios [India], Jodhpur - India
8. Ismail, S.A1997. Vermicology the Biology of Earth worm orient Longman, India.
9. Mary Violet chrishty .A 2008 Vermi technology MJP Publ. Chennai.

III B.Sc (Zoo)	EVOLUTION	20ZO616
SEMESTER – VI		HRS/WK - 5
CORE - X		CREDIT – 4

Objective:

- To learn the outline of major transitions in evolution from origin of life, process of evolution and biological diversity.
- To gain knowledge on natural selection, behavior and distribution of animals

Course Outcome

On completion of the course students will be able

CO1: To describe the evidences of evolution

CO2: To realize the theories of evolution like Lamarckism and Darwinism,

CO3: To recognize natural selection and types of variation.

CO4: To describe mimicry behavior and distribution of animals

CO5: To understand isolation and evolution of man

SEMESTER VI	COURSE CODE: 20ZO616					COURSE TITLE: EVOLUTION									HOURS:5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7
CO2	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7
CO3	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
CO4	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
CO5	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8
Mean Overall Score																3.8

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Evidences: The need of evidences for the fact of evolution – Morphological, anatomical, Embryological,Physiological and Biochemical evidences.

UNIT – II **15 Hours**

Theories: Lamarckism, Neolamarckism, Darwinism, NeoDarwinism, Devries concept of Mutation. Modern version of Mutation theory.

UNIT – III **15 Hours**

Natural selection: Types, stabilizing and diversifying directional selection. **Variation:** Types of variation.

UNIT-IV **15 Hours**

Mimicry – Batesian and mullerian mimicry and evolution, living fossils. Distribution of animals.

UNIT – V **15 Hours**

Isolation – Premating and post mating isolating mechanism, speciation. **Evolution of man** – Biological and cultural

Text Books:

1. Agarwal, V.K and Usha Gupta –1990. Evolution and animal distribution, Chand and Co.,
2. Veer Bala Rastogi. Organic Evolution, Meerut Publications.

Reference Books:

1. Dodson,E.O.. Evolution, Reinhold, Newyork.
2. Francisco.J.Ayla – Evolution, Surject publication.
3. Gopalakrishnan.T.S. Itta Sambasivaiah and A.P.Kamalakara Rao. Principles of organic Evolution, Himalaya publishing house.
4. Ranganathan T.K., Evolution. 1994 Rainbow Printers, Palayankottai.
5. Arumugam.N. Organic Evolution, 2009 Saras. Publ. Nagarcoil.

III B.Sc (Zoo)	ELECTIVE-III AQUACULTURE	20EZ617A
SEMESTER – VI		HRS/WK – 5
ELECTIVE-III (Compulsory)		CREDIT – 3

Objective:

- To provide basic information on production of low cost, protein rich, nutritive, edible and easily digestible human food by aquaculture.
- To introduce new species and technique to strengthen the stocks of existing fish from natural resources by artificial recruitment.

Course Outcome

On completion of the course students will be able

CO1: To understand the principles of site selection for aquaculture.

CO2: To describe different types of aquaculture practices.

CO3: To know the criteria for aquaculture species selection and water quality management.

CO4: To describe nutritional requirements and feed formulation for aquaculture organisms

CO5: To acquire knowledge in Mari culture

SEMESTER VI	COURSE CODE: 20EZ617A					COURSE TITLE: ELECTIVE-III AQUACULTURE									HOURS: 5	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO2	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO3	5	5	5	5	4	4	5	4	1	2	4	2	5	4	5	4.0
CO4	5	5	5	5	4	4	5	3	1	2	4	2	5	4	5	4.0
CO5	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
Mean Overall Score																3.8

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT I **15 Hours**

Definition of aquaculture – Principles of site selection for fish farms, water, soil, types and other parameters.

UNIT II **15 Hours**

Types of aquaculture - Monoculture, Poly culture, Integrated farming, Pond culture, Pen and Cage culture, Raft culture, Race way culture, Warm and cold water fish culture .

UNIT III **15 Hours**

Criteria for selection of variety – Seed procurement and stocking management. Water quality management.

UNIT IV **15 Hours**

Nutritional requirements and formulation of artificial diets. Breeding and culture of fresh water fishes – Catla, *Mrigala*, Rohu and Tilapia.

UNIT V **15 Hours**

Mari culture – Culture of edible oyster, pearl oyster, mussels, clams, sea urchins, sea cucumbers

Text Books:

1. Arumugam N. 2008. Aquaculture, Saras Publication

Reference Books

1. Fish and Fisheries in India, Jhingran,V.G., 1982, Hindustan Publishing Corporation, NewDelhi
2. Principles and practices of Pond Aquaculture, Annan, J.F, R.O.Smiterman and G. Tehebenoglous (Eds) ,1983 , Oregan State University , U.S.A.
3. Home Aquarium:aquatic gema and tropical fish ,1970, Makinos Japan Publications.
4. Aquaculture principles and practices, 2005 TVR Pillai, John Wiley Publisher.

II UG	NON MAJOR ELECTIVE ORNAMENTAL FISH CULTURE	4N ZO FC
SEMESTER – IV		HRS/WK – 3
NME (Optional)		CREDIT – 2

Objectives:
To impart training on Ornamental fish culture technology.
To create knowledge on self employment opportunity.

Course Outcome

On completion of the course students will be able

CO1: To understand the scope of ornamental fish culture.

CO2: To describe Common characters and sexual dimorphism of Ornamental fishes.

CO3: To know the food and feeding of ornamental fishes.

CO4: To describe handling and packing of live fish transport.

CO5: To acquire knowledge on maintenance of aquarium.

SEMESTER IV	COURSE CODE: 4N ZO FC					COURSE TITLE: NON MAJOR ELECTIVE ORNAMENTAL FISH CULTURE									HOURS: 3	CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO2	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO3	5	5	5	5	4	4	5	4	1	2	4	2	5	4	5	4.0
CO4	5	5	5	5	4	4	5	3	1	2	4	2	5	4	5	4.0
CO5	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
Mean Overall Score																3.8

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **9 Hours**

The potential scope of Ornamental fish culture as a Cottage Industry. Exotic and Endemic species of Aquarium Fishes.

UNIT – II **9 Hours**

Common characters and sexual dimorphism of Fresh water and Marine Ornamental fishes such as Guppy, Molly, Sword tail, Gold fish, Angel Fish, Blue Morph, Anemone fish and Butterfly fish.

UNIT – III **9 Hours**

Food and feeding of Ornamental fishes– use of live fish feed organisms. Preparation and composition of formulated fish feeds.

UNIT – IV **9 Hours**

Live fish transport– Fish handling, packing and forwarding techniques.

UNIT – V **9 Hours**

General Aquarium maintenance– budget for setting up an aquarium fish farm as a cottage industry.

Text Books:

1. Shanmugam K. 1992, Fishery Biology and Aqua Culture – Leo Pathipagam – Chennai- India.
2. Arumugam N. Aquaculture, Saras Publication

Reference Books:

1. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York –USA
2. Hall, C.B. 2005: Ponds and Fish culture – Agrobios – Jodhpur – India.
3. Day,F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.
4. Jingran V.G., 1991: Fish and fisheries in India – Hindustan Publ. co New Delhi – India.
5. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi – India

III B.Sc (Zoo)	Skill Based Subject SERICULTURE	20EZ618B
SEMESTER – VI		HRS/WK - 4
Skill Based Subject		CREDIT – 3

Objective:

- To acquire knowledge on economic importance of sericulture.
- To understand the species of silk moth and techniques in sericulture.

Course Outcome

On completion of the course students will be able

CO1: To gain knowledge on introduction and importance of sericulture

CO2: To understand classification and biology of silk moth

CO3: To describe the tools of sericulture

CO4: To get knowledge on harvesting methods in sericulture

CO5: To realize the economic status of sericulture

SEMESTER VI	COURSE CODE: 20EZ618B					COURSE TITLE: Skill Based Subject SERICULTURE										HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	4	5	4	4	4	3	1	2	3	1	5	2	5	3.5	
CO2	5	5	4	5	4	4	4	5	3	2	3	1	5	2	5	3.8	
CO3	5	5	5	5	4	4	4	4	2	2	3	1	5	2	5	3.7	
CO4	5	5	5	5	4	4	4	3	2	2	3	1	5	2	5	3.7	
CO5	5	5	5	5	4	4	4	3	1	2	3	1	5	2	5	3.6	
Mean Overall Score																3.7	

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **12 Hours**

Introduction - Importance of sericulture– Mulberry plant - Classification of commercial varieties of mulberry. Mulberry plant cultivation practices.

UNIT – II **12 Hours**

Classification and Biology of silk moth – familiar and economically import types of silkworms – life cycle study of Bombyx mori. Diseases of silk worms – fungal, bacterial, viral and nematode diseases, deficiency diseases and their remedial measures.

UNIT – III **12 Hours**

Tools of sericulture– cultural methods and management of mulberry silk worms - Silkworm rearing operations – Chawki rearing and late age rearing techniques.

UNIT – IV **12 Hours**

Harvesting methods- Physical and commercial characters of cocoons. Reeling operations, importance of by – products of Sericulture.

UNIT – V **12 Hours**

Economics of Sericulture – Future and progress of sericulture in India. Role of State and central silk board – employment opportunities - Prospects of sericulture as self Employment as cottage industry.

Text Books:

1. Johnson M. and Kesary M., Sericulture. Saras Publication.
2. Ganga, G. and Sculochana Chetty, J. 1997: An Introduction to sericulture Oxford – IBH Publ. Co. India.

Reference Books:

1. Ganga, G. 2003: comprehensive sericulture Vol-l, Moriculture – Oxford –IBH Puubl. Co. India.
2. Ganga, G. 2003: comprehensive sericulture Vol –II Silkworm rearing – Oxford – IBH Publ. Co. India.

III B.Sc (Zoo)	CORE PRACTICAL – III BIOSTATISTICS, ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY	20ZOP63
SEMESTER – VI		HRS/WK – 3
CORE PRACTICAL – III		CREDIT – 4

BIOSTATISTICS:
Biological data – calculation of mean, median, mode, Mean and standard deviation.
Graphical representation – Bar, Pie, frequency distribution.
Demonstration of MS- word, MS-Excel and MS-PPT.

ANIMAL PHYSIOLOGY:
Activity of human salivary amylase in relation to PH, Enzyme concentration and Temperature.
Estimation of Oxygen consumption in a fish with reference to body weight.
Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine.
Use of Kymograph Unit, B.P. apparatus, stethoscope.

DEVELOPMENT BIOLOGY:
Study of the following prepared slides / museum specimens.
Section of testis and Ovary [Mammalian].
Slides of Mammalian sperm and ovum.
Study of Egg types – Frog's Egg, Hen's Egg.
Study of cleavage stages 2 Cell, 4Cell, 8Cell – Blastula and gastrula of Frog.
Slides of different stages of chick embryo –24 hours, 33 hours,48 hours 72 hours and 96 hours.
Placenta of Sheep, Pig and Man.

IMMUNOLOGY:
Study of Antigen – Antibody reaction –Human Blood grouping [ABO and Rh].
Study of prepared slides of histology: Thymus, Spleen, Bone marrow, Lymph node.

III B.Sc (Zoo)	CORE PRACTICAL - IV ENVIRONMENTAL BIOLOGY, ECONOMIC ZOOLOGY AND EVOLUTION	20ZOP64
SEMESTER – VI		HRS/WK – 3
CORE PRACTICAL – IV		CREDIT – 4

Estimation of Dissolved oxygen, salinity, pH, Free CO2, Carbonate and Bicarbonates in water samples.
Use of rain gauge, Maximum and Minimum thermometer, Hygrometer and Anemometer.
Plankton study – fresh water and Marine plankton.
Study of natural ecosystem and field report.

ECONOMIC ZOOLOGY:
Study of the following prepared slides / specimens.
Earthworm types [any two] – [vermiculture].
Megacolex mauritii – south Indian species – surface crawlers.
Drawida modesta – Redsoil with calciferous gland.
Pheretima posthuma – North Indian – Large specimen.
Eudrilus eugenia – Redworm, Exotic.
Fish parasites [Lernea, Argulus].
Larvivorous fishes :
Poecelia reticulate – Guppy.
Gambusia Affinis – Gambusi.
Colisa labia – Dwarf gowrami.

Different stage of **Silk worm.**
Types of Honey **Bees.**
Common **Pests.**

EVOLUTION
Fossils – ammonite.
Living fossils – Limulus, sphenodon.
Conneting link – peripatus, archaeopteryx.
Evolutionary significance – exocoetus, draco, hippocampus.
Mimicry – monarch butterfly.
Camouflage – chameleon.

DEPARTMENT OF ZOOLOGY

ALLIED ZOOLOGY
&
ENVIRONMENTAL STUDIES (SKILL- BASED)

COURSE PATTERN

SEMESTER	PART	CODE	COURSE TITLE	HOURS	CREDITS
III	III	19AZMB31	Classical Genetics & Biostatistics / Laboratory animal care (II Year MicroBiology)	5	4
III	III	19AZMP31	**Practical-** Classical Genetics & Biostatistics / Laboratory animal care (II Year MicroBiology)	3	2
IV	III	19AZMB42	Applied Entomology/Solid waste Management (II Year MicroBiology)	5	4
IV	III	19AZMP42	**Practical** - Applied Entomology/Solid waste Management (II Year MicroBiology)	3	2
IV	III	AZBC401T	Advanced Zoology-Theory (II Year Bio –Chemistry)	5	4
IV	III	AZBP401	Advanced Zoology-Practical (II Year Bio –Chemistry)	3	2
III & IV	IV	EVS301S & EVS401S	Environmental Science (All UG B.Sc/B.A/B.COM/B.C.A	3	2

II B.Sc (MB)	CLASSICAL GENETICS & BIO-STATISTICS	19AZMB31
SEMESTER - III		HRS/WK - 5
ALLIED		CREDIT - 4

(For II Year B.Sc., Microbiology)

Objective:

- To provide basic knowledge in the field of genetics and applications of biostatistics for data analysis.

Course Outcome

On completion of the course students will be able

CO1: To understand the history of genetics and Mendel's laws

CO2: To understand recombination in Eukaryotes

CO3: To describe molecular, human and and cytogenetics

CO4: To obtain knowledge on introduction, scope, importance and functions of biostatistics

CO5: To analyze correlation, regression and test of significance

SEMESTER III	COURSE CODE: 19AZMB31					COURSE TITLE: CLASSICAL GENETICS & BIO-STATISTICS									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	3	5	4	5	4	2	2	4	4	3	5	2	5	3.9
CO2	5	5	4	5	4	4	4	2	3	4	4	3	5	2	5	4.0
CO3	5	5	4	5	4	4	4	2	4	4	4	3	5	2	5	4.0
CO4	5	5	4	5	4	4	4	2	2	4	4	4	5	2	5	4.0
CO5	5	5	4	5	4	4	4	2	1	4	4	4	5	2	5	3.9
Mean Overall Score																4.0

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

Unit – I: **15 Hours**

Unit – I : Genetics and Mendel's laws :

History of genetics – Mendel's experiments: monohybrid, dihybrid Cross - hybrid vigour – pleiotropism - epistasis - lethal genes – atavism –polygenic inheritance Multiple Alleles and linkage - ABO Blood Group inheritance - Rh factor – linkage and linkage group.

Unit – II : Recombination in Eukaryotes :

Crossing over –Mechanism- factors controlling crossing over – mitotic and meiotic crossing over – somatic and germinal crossing over – significance of crossing over - construction of chromosome maps –chromosomes – size, shape, structure, types and physiology of chromosomes.

Unit – III: Molecular, Human and cytogenetics:

DNA as the genetic material – structure of DNA, euploidy - aneuploidy – chromosomal aberarrations - Pedigree analysis – eugenics and euphenics – inbreeding, outbreeding and hybrid vigour - population genetics.

BIO-STATISTICS

Unit – IV:

Introduction – Scope – Definition –Data collection – Methods of data collection – Classification of Data – Tabulation of Data – Diagramatic, Graphical presentation of Data – Histogram – Frequency polygon – Oogive curves. Measures of central tendency - Arithmetic mean – Median – Mode – standard deviation– mean deviation – skewness – kurtosis.

Unit –V:

Correlation – simple correlation – Rank correlation – Regression – Probability – Addition theorem – Multiplication theorem – Test of significance – Hypothesis testing – Null hypothesis – Large sample test – small sample test (Students 't' test) – chi-square test – standard error – ANOVA (Analysis of variance) – one way ANOVA.

Text Books:

1. Verma, P.S and Agarwal, V.K 2005. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology', S. Chand and Co., New Delhi.
2. P. Ramakrishnan, Biostatistics. Saras Publications 1996 A.R.P. Camp Road, Kottar, Nagarkoil, Kanyakumari District.
3. Gurumani, Elements of Biostatistics, Nithi Publishers.

Reference books:

1. Veer Bala Rastogi. 1992 .A textbook of Genetics, 9th edition, Keda Nath Ram Nath, New Delhi.
2. Karvita B. Aluwalia , 1991. 'Genetics' Wiley Eastern Ltd, New Delhi .
3. Sarin, C.1990. ' Genetics' Tata Mcgraw – Hill Publishing Co ., Ltd., New Delhi.
4. Burns. G.W .and Boltsmo, P.J. 1989. The Science of Genetics' Macmillan publishing Co ., New York.

II B.Sc (MB)	**CLASSICAL GENETICS & BIO-STATISTICS PRACTICALS**	**19AZMP31**
SEMESTER – III		**HRS/WK – 3**
ALLIED PRACTICALS		**CREDIT – 2**

Genetics

1. Squash preparation of Salivary glands of chironomous larva (Giant chromosome).
2. Male & Female identification of Drosophila.
3. Observation of common Mutants of Drosophila.
4. Human Blood Grouping
5. Human pedigree construction for a family data

Biostatistics

- Mean, Median, Mode and Standard deviation.
- Correlation and Regression Analysis.

II B.Sc (MB)	SOLID WASTE MANAGEMENT	AZMB402
SEMESTER – IV		HRS/WK - 8
ALLIED		CREDIT - 6

(For II Year B.Sc., Micro-Biology)

Objective:

- To provide basic knowledge solid waste management and their handling rules as well as vermicomposting technology

Course Outcome

On completion of the course students will be able

CO1: To describe the types, sources and generation of solid waste and their handling rules

CO2: To identify the types of industrial waste and their treatment and disposal methods

CO3: To describe biomedical waste and hazardous waste and their handling rules

CO4: To understand various species of earthworm, vermiculture and vermicomposting

CO5: To gain information regarding composting technology and economics of vermicomposting

SEMESTER IV	COURSE CODE: AZMB402					COURSE TITLE: SOLID WASTE MANAGEMENT									HOURS: 8	CREDITS :6
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	3	4	1	1	3	3	2	5	5	5	3.7
CO2	5	5	5	5	4	3	4	1	1	3	3	2	5	5	5	3.7
CO3	5	5	5	4	4	3	4	1	1	3	3	2	5	5	5	3.7
CO4	5	5	4	4	4	3	4	1	1	4	5	2	5	5	5	3.8
CO5	5	5	4	4	4	3	4	1	1	4	5	2	5	5	5	3.8
Mean Overall Score																3.7

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

Unit I : Introduction **(20 Hrs)**

Waste – classification, quantification, solid waste management and disposal, source and generation of solid wastes – characterization, composition and classification, physico-chemical properties - Municipal solid wastes: Collection, storage and transportation – disposal methods – sanitary land fills, shreeding and pulverizing, baling, incineration, composting, vermicomposting, recycling – energy recovery from wastes – municipal wastes management and handling rules (1999)

Unit II: Industrial wastes: **(20 Hrs)**

Industrial solid wastes and description – health hazards – collection and storage – treatment and disposal - liquid wastes – primary, secondary and tertiary treatments – water pollution and their effects on animals and plants – water quality standards – gaseous pollution – types and sources – air pollution control.

Unit III: Bio-medical wastes: **(20 Hrs)**

Generation – legal aspects and environmental concern – Bio-medical waste management and handling rules, 1998 – storage, handling and transportation of bio-medical wastes – disposal technologies - Hazardous wastes: Definition – characteristics – sources and transportation – radioactive wastes – half life, mode of decay, effect on plants, animals and man – treatment methods; physical, chemical and biological methods – site remediation – waste minimization – hazardous waste rules, 1989.

Unit IV : Earthworms: **(20 Hrs)**

Characteristics, types – Indian species – suitable species for vermicomposting – digestion, decomposition and humification – role of microorganisms - Earthworm culture: Steps involved in the culture of indigenous and exotic species of earthworms – physical, chemical and biological requirements – protection of worms from predators – enemies of earthworms - Organic wastes: Definition – types and sources of various organic wastes – utilization of organic wastes in vermiculture and vermicomposting.

Unit V: Composting technology: **(20 Hrs)**

Definition – types of vermicomposting – requirements – advantages – precautionary measures - nutrients enhancement of vermicompost – effect of vermicomposting in the soil fertility - Economics of vermicomposting: Small scale and large scale applications of vermicomposting – loan facilities – marketing strategies.

Field Work: **(20 Hrs)**

Methods of vermicomposting – preparation of vermi bed – monitoring – bio-manure production – application of compost for culture operations – minor project reports.

Text Books:

Study materials given

Reference Books:

1. K.C.Agarwal, 2001. Environmental pollution: Causes, Effects and Control, Nidhi Publisher (India), Bikaner.
2. Verma, P.S., and VK. Agarwal. 2003. Environmental Biology, S. Chand and Company. Ram Nagar, New Delhi.

3. Pradyot Patnik, 1977. Hand book of Environmental Analysis. Chemical Pollutants in Air, Water, Soil and Solid wastes, Lewis Publishers, CRC Press. U.S.A.
4. S.A. Abbasi, 1998. Water Quality, Sampling and Analysis. Discovery Publishing House, New Delhi.
5. P.K. Gupta, 2000. Methods in Environmental Analysis. Water Soil and Air, Agrobios (India) Jodhpur.
6. Bhatnager and R.K. Patra (1996); Earthworm, Vermiculture and Vermicompositing, Kalyani Publishers, New Delhi.
7. C.A. Edwards and B.J. Bohlen (1996); Biology and Ecology of Earthworms, Chapman and Hall, London.
8. S. Ismail (1997); Vermicology, Orient Long man Limited, Chennai.
9. K.E. Lee (1985) 'Earthworms; Their Ecology and Relationship with Soils and Land Use', Academic Press, Sydney.
10. J.E. Satchell (Ed) (1983) - Earthworm Ecology: From Darwin to vermi culture. Chapman and Hall,"London.

II B.Sc (Microbiology)	ALLIED APPLIED ENTOMOLOGY	19AZMB42
SEMESTER – IV		HRS/WK – 5
ALLIED		CREDIT – 4

Objective:

- To provide extensive knowledge in the field of applied entomology.
- The familiarity between insect and environment was highlighted to various field like agricultural entomology, medical entomology and industrial entomology

Course Outcome

On completion of the course students will be able

CO1: To obtain knowledge on basic introduction of entomology

CO2: To recognize beneficial and harmful insects in the agricultural entomology

CO3: To describe vector borne diseases, control measures and awareness in medical entomology

CO4: To identify productive insects in industrial entomology

CO5: To understand pest control methods and application

SEMESTER IV	COURSE CODE: 19AZMB42					COURSE TITLE: ALLIED APPLIED ENTOMOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

UNIT – I **15 Hours**

Introduction to Entomology

Definition – classification upto orders - scope- Agricultural entomology, Forest entomology, Veterinary entomology, Medical entomology, Forensic entomology, Industrial entomology.

UNIT – II **15 Hours**

Agricultural entomology

Pest identification marks, nature, symptoms of damage. Any three pests - rice, Maize, pulses, sugar cane, cotton, coconut, ground nut, brinjal, cardamom, tea, coffee.

Pollinators, Destroyers of insect pests, Serve as food, Destroyers of weeds, Improve soil fertility.

UNIT – III **15 Hours**

Medical entomology

Life cycles of arthropod vectors - ticks, mites and fleas. Vector borne diseases: malaria, filariasis, dengue. Vector control- Chemical, Biological, Genetic and Environmental. Insecticide resistance in vectors. Drug resistance in pathogens. Importance of education, awareness and Community participation.

UNIT – IV **15 Hours**

Industrial Entomology

Productive Insects (a) Honey bee: Apiculture and its scope; life history, Bee products- Honey and Bee wax, and Uses, Bee diseases. (b) Silk moth: Different types of silkworms, life cycle; Sericulture, uses of silk, silk worm diseases. (c) Lac insect: Different strains of Lac insects, uses of lac.

UNIT – V **15 Hours**

Pest control methods and application: cultural, mechanical, biological and chemical methods – classification of pesticides. First Aid & precautions in handling pesticides – pesticide spraying appliances. Residual effects of pesticides on non target organisms. Pesticide industry - production and marketing –Integrated pest management, its importance & applications.

Text Books:

1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.

Reference Books:

1. P.G. Fenemore and Alka Prakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.
2. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
3. Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.
4. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques,3rd Ed, Himamalaya publishing house.
5. H.B.Bull, F.H.Davis, 1971. An introduction to physical Biochemistry 2nd Ed, Philadelphia
6. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

II B.Sc (MB)	ALLIED APPLIED ENTOMOLOGY-PRACTICAL	19AZMP42
SEMESTER - IV		HRS/WK – 3
ALLIED		CREDIT -2

Major Practical

1. Methods of insect collection and preservation - Submission of insect box, Field visit.
2. Identification of at least 10 insects belonging to different orders.
3. Mounting of salivary gland of cockroach, mouth parts of cockroach, housefly, and mosquito.
4. Mounting of different types of antennae and legs of insects, wings and their venation.
5. Demonstration of digestive, reproductive (male and female) and nervous system of insects (Cockroach or Odontopus).

Spotters

1. Histological slides –T.S of testis, L.S. of ovary and types, T.S. of carpus cardiacum and T.S. of carpus allatum.
2. Life history of silkworm (egg, larva, cocoon and adult).
3. Identification of honey bee sting Identification of honey bees, drone, workers and queen.

II B.Sc (BC)	ADVANCED ZOOLOGY For the students admitted in the year 2019	AZBC401T
SEMESTER - IV		HRS/WK – 5
ALLIED		CREDIT – 4

Objective:

- To understand the basic concepts of animal kingdom, Invertebrates, Chordates, cytological techniques, human genetics, developmental biology, ecology and evolution.

Course Outcome

On completion of the course students will be able

CO1: To describe structure and functions of some invertebrate species

CO2: To describe structure and functions of some chordate species

CO3: To analyze cytological techniques and human genetics

CO4: To understand developmental biology

CO5: To understand the basic concepts of ecology and evolution

SEMESTER IV	COURSE CODE: AZBC401T					COURSE TITLE: ADVANCED ZOOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	5	5	5	5	5	5	2	5	3	5	4.5
CO2	5	5	4	5	4	5	5	5	5	5	5	2	5	3	5	4.5
CO3	5	5	4	5	4	5	5	5	5	5	5	5	5	3	5	4.7
CO4	5	5	4	5	4	5	5	5	5	5	5	3	5	3	5	4.6
CO5	5	5	4	5	4	5	5	5	4	5	5	3	5	3	5	4.5
Mean Overall Score																4.6

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

Unit: 1 **15 Hours**

INVERTEBRATES - Structural and functional details of phylum–Protozoa-*Plasmodium vivax*, Helminthes-*Taenia solium*, Annelida-Earthworm- Digestive system,

Unit: 2

CHORDATES- Prochordata – amphioxus- Morphological details of chordates- Pisces-shark, Amphibia -Frog, Reptiles- Calotes, Aves- pigeon, Mammalia- Rat.

Unit: 3

CYTOLOGICAL TECHNIQUES AND HUMAN GENETICS – Histological techniques – Fixation- selective fixatives- Embedding- Sectioning and Staining Principles. Mendals experiments, Fine structure of Gene, Mutation, Linkage and crossing over, Eugenics, Human chromosome, Chromosome number, Idiogram. Population genetics- Hardy Weinberg principle and its application in human population. Genetic engineering and its applications in human being. Pedigree chart and its uses.

Unit: 4

DEVELOPMENTAL BIOLOGY- Gametogenesis in mammals – Spermatogenesis, Oogenesis, Fertilization. Types of Eggs, Pattern of cleavage & Blastulataion in chick, Gastrulation. Human Reproduction- puberty, Menstrual cycle, Menopause, Pregnancy and related problems-parturition and lactation- Human cloning- Ethics.

Unit: 5

ECOLOGY AND EVOLUTION- Principles and Applications of Environmental biology. ecological succession, ecological niche, Animal relationships, Interspecific- Antagonism, symbiosis, Parasitism, Mutualism, commensalisms. Lamarckism, Darwinism, mimicry, Fossil and Fossilization

Books for reference:

INVERTEBRATES AND CHORDATES:

1. Ekambaranatha Ayyar & T.N.Ananthakrishnan (1992) Manual of Zoology Vol – I, part I & II S.Viswanathan Pvt. Ltd. Chennai.
2. Jordan.E.L & P.S.Verma (2000) 'Chordate Zoology' S.Chand & Co New Delhi.

CYTOLOGICAL TECHNIQUES AND HUMAN GENETICS:

1. Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand & Co., New Delhi
2. Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics, Jaiprakash Nath and Company., Meerut.
3. Max Levitan Tex Book of Human Genetics - Oxford University Press.

DEVELOPMENTAL BIOLOGY

1. Verma.S and Agarwal V.K(2000) Chordate Embryology S.Chand & Co. New Delhi.
2. Balinsky.B.I (1981) An Introduction to Embryology S.Chand & Co. New Delhi.
3. Saunders.J.W (1982) Developmental Biology – Pattern and Principles, Macmillan New York.

ECOLOGY AND EVOLUTION

1. Text book of Ecology & Animal Distribution by P.S.Verma V.K.Agarwal S.Chand & Co. New Delhi.
2. Odum E.P.Basic Ecology (1983) Saunders College Publishing's New York.
3. Arumugam.N (2002) Organic Evolution, Saras Publication., Nagercoil.

II B.Sc (BC)	**ADVANCED ZOOLOGY- PRACTICAL**	**AZBP401**
SEMESTER – IV		**HRS/WK – 3**
ALLIED		**CREDIT -2**

MAJOR PRACTICALS

1. Dissection of digestive system and body setae in earthworm.
2. Prawn- Appendages
3. Estimation of Unit metabolism of fish.

MINOR PRACTICALS

1. Squash preparation of onion root tip for mitosis.
2. Human pedigree construction for a family data.
3. Mouth parts- Honey bee and Mosquito.

SPOTTERS

T.S. of Chick embryo- 24hrs, 48hrs, 72hrs and 96hrs, *Taenia solium*, Placoid scale, T.S. of Pituitary gland, Adrenal gland, Thyroid gland, Testis and Ovary.

II YEAR	ENVIRONMENTAL SCIENCE	EVS301S/ EVS401S
SEMESTER – III		HRS/WK - 3
AEC		CREDIT - 2

(For All UG II Year Students Any One Semester)

Objective:

- The need for sustainable development is a key to the future of mankind.

Course Outcome:

On completion of the course students will be able

CO1: To understand the natural environment and its relationships with human activities.

CO2: To demonstrate an awareness and knowledge of the intrinsic values of ecological system.

CO3: To characterize and analyze human impacts on biodiversity and its conservation.

CO4: To demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns

CO5: To integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at local and global levels**.**

SEMESTER III	COURSE CODE: EVS301 S/ EVS401S					COURSE TITLE: ENVIRONMENTAL SCIENCE									HOURS: 3	CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	3	4	4	5	5	5	2	3	5	1	5	5	5	4.1
CO2	5	5	3	4	4	5	5	5	2	3	5	1	5	5	4	4.1
CO3	5	5	3	4	4	5	5	5	2	4	5	1	5	5	3	4.1
CO4	5	5	3	4	4	4	5	4	2	4	5	1	5	5	3	4.0
CO5	5	5	3	4	4	4	5	4	2	4	5	1	5	5	5	4.1
	Mean Overall Score															4.1

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

Unit I : Environmental studies and Natural resources **9 Hours**

Definition, scope and importance of environmental studies – forest resources: deforestation, mining, dams – water resources: over – utilization, floods, drought – mineral resources: exdploitation, extraction and usage – food resources: food problems, overgrazing, pesticide problems, water logging, salinity – energy resources: energy needs, renewable and non renewable energy – land resources: land degradation, landslides, soil erosion and desertification – conserving natural resources.

Unit II: Ecosystems : **9 Hours**

Concept, structure and function of an ecosystem – producers, consumers and decomposers – energy flow – ecological succession – food chains, food webs and ecological pyramids – types, characteristics, structure and function of forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem –

Unit III: Biodiversity: **9 Hours**

Definition of biodiversity – genetic, species and ecosystem diversity – value of biodiversity – India as a mega diversity nation – hot spots – threats to biodiversity – endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

Unit IV: Environmental Pollution: **9 Hours**

Cause, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards – solid waste management: causes, effects, control measures and disposal of wastes – disaster management: floods, earthquakes, cyclone, land slides and tsunami.

Unit V: Social Issues, Human population and the Environment: **9 Hours**

Water conservation, rain water harvesting, watershed management – environmental ethics: issues and possible solution – climate change, global warming, acid rain, ozone depletion, nuclear accidents and holocaust – wasteland reclamation – Environment protection Act – Wildlife protection Act – Forest Conservation Act – public awareness – Population explosion – Environment and human health – Role of Information Technology in Environment and human health.

Field work:

1. Visit to a local area to document environmental assets – river / forest / grassland/mangrove.
2. Visit to a local polluted site – urban / rural / industrial / agricultural.
3. Study of common plants, insects, birds.
4. Study of simple ecosystems – pond, river, forest, etc.,
5. Practical work

Reference Books:

1. Joseph C.Daniel,2004. Principles of Environmental Science. Brightson's Publications,Chennai.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email:mapin@icenet.net

4. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi
5. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
6. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA,
7. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
8. 8. Trivedi R.K., Hand book of Environmental Laws, Rules Guidelines, Compliances and Standards. Vol I and II, Enviro Media9.Wanger K.D., 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA

சுற்றுச் சூழல் அறிவியல்

Unit/அலகு-1 சுற்றுச் சூழ்யியல் மற்றும் இயற்கை வளங்கள்

சுற்றுச் சூழல் இயலின் இலக்கணம், நோக்கம், முக்கியத்துவம் - காடும் அதன் வளங்களும், காடுகள் அழிப்பு, சுரங்கம், நீர் தேக்க அணை – நீர் ஆதாரங்கள், பயன்பாடுகள், வெள்ளம், வறட்சி, கனிம வளங்கள் - சுரண்டல்,அளவாக எடுத்தல் (ம) பயன்பாடு உணவு வளங்கள் - உணவும் அதன் நிறை குறைகளும், அதி தீவிர மேய்ச்சல், பூச்சுக்கொல்லி (ம) உயிர்கொல்லியின் குறைகள், நீர் தேங்குதல், உப்புத்தன்மை, சக்தி வளங்கள் - சக்தியின் தேவைகள், புதுப்பிக்க கூடிய (ம) புதுப்பிக்க இயலாத சக்திகள் நில வளங்கள் - நிலவளக் குறைவு, நிலச்சரிவு, மண்சரிவு மற்றும் பாலைவனமாகுதல், இயற்கை வளங்களின் பாதுகாப்பு நன்மைகளும்.

Unit/அலகு-2 சூழல்நிலை மண்டலங்கள்

கோட்பாடு, அமைப்பு மற்றும் செயல்பாடு உற்பத்தியாளர்கள், நுகர்வோர்கள் மற்றும் சிதைப்பவர்கள் - சூழ்நிலை மண்டலத்தின் ஆற்றல் ஓட்டம் சூழியல் வழிமுறை வளர்ச்சி,உணவுச்சங்கிலி, உணவுவளை, சூழ்நிலை மண்டலங்கள் வகைகள், தன்மைகள், அமைப்பு மற்றும் செயல்பாடு – காட்டு சூழ்நிலை மண்டலம், புல்வெளி சூழ்நிலை மண்டலம், பாலைவனம் மற்றும் நீர்ச்சூழ்நிலை மண்டலம்.

Unit/அலகு-3 உயிரியப் பல்வகைமை

வரையறை, வகைகள், உயிரியப் பல்வகைமையின் பயன்கள், இந்தியா ஓர் உயிரியமிகை பல்வகைமை மண்டலம், உயிரியமிகை பல்வகைமை இடங்கள், உயிரியல் பல்வகைமைக்கு அச்சுறுத்தல், உயிரிய பல்வகைமையின் பாதுகாப்பு.

Unit/அலகு-4 சுற்றுச்சூழல் மாசுபாடு

காற்று மாசுபாடு, நீர் மாசுபாடு, மண் மாசுபாடு, கடல் மாசுபாடு, இரைச்சல் மாசுபாடு, அனல் மாசுபாடு மற்றும் கதிரியக்க மாசுபாடு – திடகழிவு மேலாண்மை, காரணிகள், விளைவுகள், தடுக்கும்முறை மற்றும் பாதுகாப்பான அப்புறப்படுத்தும் முறை பேரிடர் மேலாண்மை, வெள்ளம், நிலநடுக்கம், புயல், நிலச்சரிவு மற்றும் ஆழிப்பேரலைகள்.

Unit/அலகு-5 சமூக சிக்கல்களும் மக்கள் பெருக்கமும் சுற்றுச்சூழலும்

நீர்வள பாதுகாப்பு, மழைநீர் சேகரிப்பு, நீர்வள மேலாண்மை – சுற்றுச்சூழல் வரைமுறை சிக்கல்களும் அதன் நீர்க்கும் காரணிகளும், வானிலை மாற்றங்கள், உலகவெப்பமயமாதல், அமிலமழை, ஓசோன் சிதைவு, கதிரியக்க விபத்துகள் மற்றும் பேரிடர்கள் நீர்பிரிகை முகடு சீரமைப்பு, சுற்றுச்சூழல் பாதுகாப்பு சட்டம், வன உயிரினப் பாதுகாப்பு சட்டம், வனப்பாதுகாப்பு சட்டம், சூற்றுச்சூழல் விழிப்புணர்வு, மக்கள் தொகைப் பெருக்கம், சுற்றுச்சூழல் (ம) மனித நலன் - மனித நலனிலும், சுற்றுச் சூழலிலும் தகவல் தொழில் நுட்பத்தின் பங்கு.

QUESTION PAPER PATTERN

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks
Total	**25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
10 very short answer questions without choice. Each question is to be answered in about 50 words. Two questions from each unit. Each answer is to be valued out of 2 marks.

Part-B
5 questions are to be answered in either or type. Each question is to be answered in about 300 words. Two questions from each unit. Each answer is to be valued out of 5 marks.

Part-C
3 questions are to be answered out of 5 questions given, one question from each unit to be answered in about 1000 words. Each answer is to be valued out of 10 marks.

Part-A
Very Short Answers (50 words) 10 questions each 2 marks. (10x2=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1000 words) 3 questions each 10 marks. (3x10=30 Marks)

TOTAL **75 Marks**

PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA) (40 marks)

Based on the periodical evaluation of Record, Observation record and Experiments assessed by the staff incharge.

External Examination (60 marks)

Time: 3 Hrs

Practical	- 50marks
Record	- 10marks
Total	**- 60marks**

QUESTION PAPER PATTERN
(For Environmental Science)

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25 marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks
Total	**25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
20 choose the answer question. Each answer is to be valued out of 1 marks.

Part-B
5 questions are to be answered out of 8 given. Each question is to be answered in about 300 words. Each answer is to be valued out of 5 marks.

Part-C
Essay questions containing internal choice to be answered in about 1200 words. Each answer is to be valued out of 15 marks.

Part-A
Choose the answer 20 questions each 1 mark. (20x1=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1200 words) 3 questions each 10 marks. (3x10=30 Marks)

Field work

TOTAL	**75 Marks**