

**COURSE CURRICULUM
FOR
UNDERGRADUATE COURSES
UNDER CHOICE BASED CREDIT SYSTEM**

B.Sc. (Honours in Zoology)

**UNIVERSITY DEPARTMENT OF ZOOLOGY
NETAJI SUBHAS UNIVERSITY
JAMSHEDPUR**

With effect from 2018

Details of courses under B.Sc. (honours)

Course	*Credits	
	Theory+ practical	Theory +Tutorial
I. Core Course (14 Papers)	14x4=56	14x5=70
Core course Practical/Tutorial* (14 Papers)	14x2=28	14x1=14
II. Elective Course (8 papers)		
A.1. Discipline Specific Elective (4 papers)	4x4=16	4x5=20

A.2. Discipline Selective Elective Practical/Tutorial* (4 Papers)	4x2=8	4x1=4
B.1. Generic Elective/Interdisciplinary (4 Papers)	4x4=16	4x5=20
B.2. Generic Elective Practical/Tutorial* (4 Papers)	4x2=8	4x1=4

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 Credits) in 6th Semester**

III. Ability Enhancement Courses

1. Ability Enhancement Compulsory Courses (AECC)

(2 Papers of 2 Credits each)	2x2=4	2x2=4
Environmental Science		
English/ MIL Communication		

2. Skill Enhancement Courses (SEC)

(Minimum 2)	2x2=4	2x2=4
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PROPOSED SYLLABI FOR CHOICE BASED CREDIT SYSTEM B.Sc.Hons. In Zoology

(Six Semester Course)

SEMESTER-I

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
(A) CORE Course	C-1	Systematics & Diversity of Non chordate	04	12
	C-2	Principle of Ecology	04	
	P-1	Practical based in C-1 & c-2	04	

(B) AECC Ability Enhancement Compulsory Course	AECC-1	Communicative English /MIL	02	02
(C) Generic Elective	GE-1	Chemistry/ /Botany	04	06
		Practical-GE	02	
			Total credits	20

Semester II

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	C-3	Cell Biology	04	12
	C-4	Diversity of Chordates	04	
	P-2	Practical based on C-3 & C-4	04	
(B) AECC Ability Enhancement Compulsory Course	AECC-2	Environmental Science	02	02
(C) Generic Elective	GE-2	Chemistry/ /Botany	04	06
			Total	20

Semester – III

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	C-5	Physiology	04	18
	C-6	Biochemistry	04	
	C-7	Endocrinology	04	
	P-3	Practical based on C-5,C-6& C-7	06	
(B)	SEC-1	Aquarium Fish Keeping	02	02

Skill Enhancement Course				
Generic Elective	GE-3	Chemistry/ /Botany	04(T)+02(P)	06
			Total	26

Semester -IV

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	C-8	Genetics	04	18
	C-9	Evolution	04	
	C-10	Animal behaviour	04	
	P-4	Practical based on C-8,C-9& C-10	06	
(B) Skill Enhancement Course	SEC-2	Vermi-culture and Composting	02	02
Generic Elective	GE-4	Chemistry/ /Botany	04+02	06
				26

SEMESTER V

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	C-11	Immunology	04	12
	C-12	Developmental Biology	04	
	P-5	Practical based on C-11& C-712	04	
Discipline specific Elective	DSE-1	Economic Zoology	04	12
	DSE-2	Biostatistics	04	

	P-6	Practical based on DSE-1 & DSE-2	04	
			Total	24

SEMESTER VI

COURSE	Code Of Papers	Name of Papers	Credit	Total Credit
Core Course	C-13	Molecular biology & Biotechnology	04	12
	C-14	Medical Zoology		
	P-7	Practical based on C-11 & C-12	04	
Discipline specific Elective	DSE-3	Wild Life conservation & Management	04	12
	DSE-4	Agrochemical & Pest management	04	
	P-8	Practical based on DSE-3 & DSE-4	04	
			Total	24

B.Sc. (Hons.) Zoology

Semester I Core Course C-1

Systematics and Diversity of Non Chordate

(Credit 4)

Hours of teaching =60 hrs

FM: 60

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x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

Core Course – (C-1):Systematics and Diversity of Non Chordate
Group-A

UNIT-1 Systematics

- 1.1 Binomial & Trinomial nomenclature,
- 1.2 New trends in animal Taxonomy (Chemotaxonomy, Cyto-taxonomy & Molecular Taxonomy
- 1.3 Species and Speciation
- 1.4 Linnaean hierarchy

UNIT-2 Non– Chordates: Characters & Classification

General characters and classification of different phyla of Non Chordates up to classes with examples showing distinctive / adaptive features

Group-B

UNIT-3 Non Chordata : Protists to Pseudocolmates

- 3.1 Phylum Protozoa: General account of locomotion, Nutrition and reproduction
- 3.2 Phyla Porifera: Canal system in Porifera
- 3.3 Coelentrate: Obelia Life cycle and metagenesis, Polymorphisms in Siphonophora ;Coral Reefs – types, formation and distribution
- 3.4 Platyhelminthes: Planaria (General organization)

UNIT-4 Non Chordate: Coelomates

- 4.1 Annelida: Segmental organs (Coelomo-ducts & meta-nephridia) in annelid
- 4.2 Arthropoda: Larval form of Crustacea
- 4.3 Mollusca: Torsion and Detorsion in Gastropods
- 4.4 Echinoderm: Water vascular System and locomotion in Asterias, Larval forms of echinoderms

Semester -1 Core Course (C-2)

Principle of Ecology

(Credit 4) Hours of teaching:4X15=60 hrs

FM:60

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examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

Core Course-(C-2) :Principle of Ecology

Group-A

UNIT- 1. General concepts

- 1.1 Introduction to environmental biology
- 1.2 Components of ecosystem
- 1.3 Major ecosystems in world
- 1.4 Energy flow in ecosystem
- 1.5 Productivity, food chain and food web, Food Pyramid
- 1.6 Bio- Geochemical cycle
 - 1.6.1 Water Cycle
 - 1.6.2 Gaseous Cycles- Carbon and Nitrogen
 - 1.6.3 Sedimentary Cycle- Phosphorous and sulphur

UNIT - 2. Population and communities

- 2.1 Population characteristics: Density, Natality, Mortality, Age pyramid and growth curve
- 2.2 Nature, Structure and attributes of biological communities
- 2.3 Ecological succession and concept of climax

Group-B

UNIT- 3. Pollution

- 3.1 Sources and impact of environmental pollutants- air, water ,soil and Noise
- 3.2 Global environmental changes- green house gases and their effects
- 3.3 Acid rains

UNIT- 4. Natural resources

- 4.1 Soil, water, mineral resources and their conservation
- 4.2 Biodiversity- benefits, hotspots, threats and conservation
- 4.3 Human impact on mineral resources
- 4.4 Renewable and Non Renewable Source of Energy

Books Recommended

Systematics (Animal Taxonomy)

- 1. Dalela& Sharma: Animal Taxonomy and Museology (1976, Jai Prakash Nath).
- 2. Kapoor: Theory and Practicals of Animal Taxonomy (1988, Oxford & IBH).
- 3. Simpson: Principles of Animal Taxonomy (1962, Oxford).
- 4. Roymahoney: Laboratory Techniques in Zoology (1966, Butterworths).
- 5. Mayer & Ashlock: Principles of Systematic Zoology (1991, McGraw Hill).

Non Chordates

- 6. Boolotian& Stiles: College Zoology (10thed 1981, Macmillan)
- 7. Campbell & Reece: Biology (7th edn. 2005, Pearson)

8. Dorit, Walker & Barnes: Zoology (1991, Saunders)
9. Taylor, Green & Stout : Biological Sciences (3rd ed. 2005, Cambridge)
10. Mader: Biology (9th ed. 2007, W.C. Brown)
11. Marshall & Williams: Text book of Zoology
1. I (Parker & Haswell, 7th ed. 1972, Macmillan)
12. Miller & Harley: Zoology (6th ed. 2005, W.C. Brown)
13. Nigam: Biology of Non-chordates (1997, S Chand)
14. Parker & Haswell: Text Book of Zoology, Vol. I (2005, Macmillan)
15. Purves et al: Life-the Science of Biology, (7th ed. 2004, Sinauer)
16. Starr: Biology, Concepts and Applications (1991, Wadsworth)

P-1: Practical Based on C-1 & C-2

**SYSTEMATICS AND DIVERSITY OF NONCHORDATES &
PRINCIPLE OF NON CHORDATES**

(Credit 4)

Hours of teaching: 4X15=60 hrs

Part A: Systematics and Diversity of Non Chordates

Semester I	Practical	Full Marks-40
	Practicals	Marks distribution
	1. Dissection:	08
	2. Slide preparation	05
	3. Spotting	2X05= 10
	a. Slides (03)	2X3=06
	b. Museum Specimens (02)	2X2=04
	4. Ecology experiment	07
	6. Class record, poster/models/collection	05
	7. <i>viva-voce</i>	05
		<u>40</u>

Suggested Practicals

1. Study of Available Museum Specimens of animals

- Sycon (As an example of parazoa), Hydra (as an example of diplo-blastic animal), Fasciola (as an example of triplo-blastic acoelomate animal), Ascaris (as an example of triplo-blastic pseudo-coelomate animal), Hirudinaria (as an example of triploblastic schizocoelomate animal), Hermit Crab, Scorpion, Unio, Sepia, Aplysia, Loligo, Sea Urchin, Ophiothrix (Brittle star) (Example of Triplo-blastic coelomate)

2. Study of the following through permanent slides

1. Paramecium Slide (WM)
2. Gemmules of sponges
3. Conjugation in Paramecium,
4. Sporocyst of Fasciola with developing Redia, Cercaria and Metacercaria larvae
5. Nauplius, Metanauplius, Cypris, Megalopa and Zoea larvae of Crustacea
6. Bipinnaria

3. Dissection:

1. Dissection of Digestive and nervous system of Earthworm
2. Dissection of digestive system of *Palaemon* and Nervous system of *Palaemon*
3. Dissection of Nervous system of Pila

4. Mounting

Mounting of Nephridia & ovary of earth worm, statocyst of *Palaemon*, heart, trachea and salivary gland of *Periplaneta americana*, Radula of Pila, Cephalic appendages of *Palaemon*

B. Ecology

1. Collection & Identification of different biotic component of pond Ecosystem
2. Estimation of dissolved oxygen.
3. Estimation of carbon dioxide
4. Estimation of Total alkalinity

B.Sc. (Hons.) Zoology Semester II
Core Course C-3

C-3 Cell Biology Credit-4 Hours of teaching 4X15=60

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Core Course (C-3): Cell Biology

Group-A

UNIT-1. The Cell and its Organization

- 1.1 Introduction to cell theory
- 1.2 Comparison of a generalized pro- and eukaryotic cell
- 1.3 Methods in cell biology: Elementary idea of microscopy (Light, Electron and Phase contrast Microscope) and cell fractionation
- 1.4 Structure and function of plasma membrane and cell junctions
- 1.5 Introduction to endo-membrane system (Endoplasmic reticulum, Golgi complex, Lysosome
- 1.6 Structure and functions of cytoskeleton
- 1.7 Structure and function of mitochondria

UNIT-2.Nucleus

- 2.1 Nuclear envelope
- 2.2 Chromosome: Structure & function
- 2.3 Introduction to polytene and lampbrush chromosomes

Group-B

UNIT - 3. Cell Division

- 3.1 Basic feature of Cell cycle
- 3.2 Mitosis & Meiosis and their significance
- 3.3 Elementary idea of cancer

UNIT-4. Elementary idea of Apoptosis & Necrosis

B.Sc. Semester-II

C-4: Diversity of Chordates

Credit -4

Hours of teaching: 4X15=60hrs

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Core course (C-4): Diversity of Chordates

Group-A

UNIT-1. Hemichordates & Protochordates

- 1.1 General characters and Affinities of hemichordates

UNIT-2 Chordates: General characters and classification of the following up to order with examples

- 2.1 Cyclostomes
- 2.2 Fishes
- 2.3 Amphibians
- 2.4 Reptiles
- 2.5 Birds
- 2.6 Mammals
- 2.7 Affinities of Prototheria & Metatheria

Group-B

UNIT- 3. Proto-chordates, Cyclostome, Fish & Amphibians

- 3.1 Retrogressive metamorphosis in Herdmania
- 3.2 Comparative account of Petromyzon and Myxine
- 3.4 Accessory Respiratory organ in fishes
- 3.5 Pedogenesis and neoteny with special reference to Axolotl larvae
- 3.5 Origin and evolution of Amphibia

UNIT-4. Reptiles, Birds & Mammals

- 4.1 Poisonous & Non-poisonous Snakes of India, Poison' s Apparatus and biting Mechanisms
- 4.2 Flight Adaptation and mechanisms of flight
- 4.3 Comparative anatomy of heart, integument, Aortic Arches and kidney in vertebrates

Books Recommended

Cell Biology

1. Alberts *et al*: Essential Cell Biology (1998, Garland)
2. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
4. Karp: Cell and Molecular Biology (2008, John Wiley)
5. Lodish *et al*: Molecular Cell Biology (2008, Freeman) 2004
6. Pollard & Earnshaw: Cell Biology (2002, Saunders)
7. Cooper and Hausman: The Cell A Molecular approach (2007, Sinauer)

Chordate

Marshall & Williams: Textbook of Zoology, Vol

1. I (Parker & Haswell, 7th ed. 1972, Macmillan)
12. Miller & Harley: Zoology (6th ed. 2005, W.C. Brown)
14. Nigam: Biology of Chordates (1997, S Chand)
15. Parker & Haswell: Text Book of Zoology, Vol. II (2005, Macmillan)
16. Purves *et al*: Life-the Science of Biology, (7th ed. 2004, Sinauer)

B.Sc. Semester-II

P-2 Practical based on C-3 & C-4

Credit-4

Working hours -60

FM:40

Practicals

Marks distribution

1. Dissection:		08
2. Slide preparation		05
3. Spotting		
a. Slides: Cell Division-1; Histological-1	2X2=04	10
b. Museum Specimens (02)	2X2=04	
c. Bones (01)	2X1=02	
4. Cytological Slide Preparation (Mitosis/Meiosis)		07
6. Class record, poster/models/collection		05
7. <i>viva-voce</i>		05
		<u>80</u>

Suggested Practicals

Cell biology

1. Study of slides of prokaryotic cell-Bacteria
2. Study of slides of Unicellular Eukaryotic cell – Amoeba, Paramecium
3. Study of various stages of cell division through permanent slides Mitosis and Meiosis
4. Preparation of mitotic slides from onion root tips.
5. Study of Blood cells through slide preparation
6. Study of Barr body through slide preparation from hair follicle /cheek cells of female.

Chordate Diversity

7. Pisces: Rohu, *Exocoetus*, Hippocampus, Torpedo (Electric Ray)
8. Amphibia: Hyla, Alytes, Salamander
9. Reptiles: Draco, Hydrophis, Bungara, Pit Viper, Naja, Python
10. Aves :Ostrich model
11. Prototheria Models of Duck bill platypus ,spiny ant eater
12. Bones of Amphibia and Mammal
13. Study of histological slides : Skin ,Bone ,Lung, Stomach, Intestine, Liver, Kidney of mammals
14. Dissection of local bony fishes ; Afferent and efferent and nervous system
15. Mounting of Scale
16. Mounting of rectrices

B.Sc. Semester III

C-5 Mammalian Physiology	Credit -4(T) + 2(P)
C-6 Endocrinology	Credit -4(T) + 2(P)
C-7 Developmental Biology	Credit -4(T) + 2(P)

C-5 : Mammalian Physiology

Total teaching hrs: 75

FM:60

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Core course (C-5): Mammalian Physiology

Group-A

UNIT_1. Nutrition and Digestion

1.1 Balanced diet

1.2 Digestion and absorption of carbohydrates, proteins and fats

UNIT-2. Respiration and Circulation

2.1 Mechanism and regulation of breathing

2.2 Transport of oxygen and carbon dioxide

2.3 Respiratory quotient

2.4 O₂ and CO₂ dissociation curve, Bohr and Haldane effect, chloride shift

2.5 Composition of blood

2.6 Blood groups and Blood clotting

2.7 Cardiac cycle and its regulation

Group-B

UNIT3. Urino- Genital Physiology

3.1 Nephron

3.2 Urine formation

3.3 Hormonal control of renal function

3.4. Anatomy of Human reproductive organs

3.5. Menstrual Cycle in Humans

UNIT-4. Nerve physiology

4.1 Myelinated and non- myelinated nerve fibers

4.2 Resting and action potential

4.3 Initiation and conduction of nerve impulse through myelinated nerve

4.4 Synapse & Synaptic Transmission

B.Sc. Semester III

C-6 BIOCHEMISTRY Credit 4(T)

Teaching Hrs.60

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Core Course(C-6): BIOCHEMISTRY

Group-A

F M:60

UNIT-1. Biomolecules

- 1.1 **Amino acids** : Properties, Structure and classification
- 1.2 **Proteins** : Classification, Structural organisation & conformation
- 1.3 **Carbohydrates**: Structure, Classification & biological significance
- 1.4 **Lipids**: Structure, Classification & biological significance

UNIT-2. Enzymes

- 2.1. General properties
- 2.2. Major classes of enzymes
- 2.3. Mechanism of enzyme action

Group-B

UNIT-3. Nucleic acids

- 3.1. DNA structure: DNA double helix (Watson and Crick model)
- 3.2. Types of RNA

UNIT-4. Metabolic path way

- 4.1 Glycolysis
- 4.2 kreb' s cycle
- 4.3 Beta oxidation

B.Sc. Semester III

C-6 Endocrinology Credit 4(T)

Teaching: 60hrs

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Core Course (C-6): Endocrinology

Group-A

FM:60

UNIT-1. Classification of chemical messengers

- 1.1 Hormones and its classification
- 1.2 Neurohormones and neurotransmitters
- 1.3 Pheromones
- 1.4. General mechanism of hormone action

UNIT-2. Gastrointestinal hormones (gastrin, CCK, secretin and motilin)

Group-B

UNIT -3. Structures and functions of endocrine organs

- 2.1 Pituitary
- 2.2 Thyroid
- 2.2 Adrenal
- 2.3 Endocrine pancreas
- 2.4 Pineal

UNIT-4. Hormones, Drugs and Human health- production of hormones as pharmaceuticals

Suggested Reading

Mammalian Physiology

1. Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2008, Cambridge)
2. Marshall and Hughes: Physiology of Mammals and Vertebrates (2nd ed. 1980, Cambridge)
3. Hoar: General and Comparative Physiology (3rd ed., 1987, Prentice Hall)
4. Prosser: Comparative Animal Physiology (4th ed. 1991, Satish Book)
- 5.C.C.Chaterjee Medical physiology
- 6.Guyton– a book on medical physiology

Biochemistry

1. Boyer: Concepts in Biochemistry (3rd ed. 2006, Brooks/Cole)
2. Lehninger, Nelson & Cox: Principles of Biochemistry (4th ed, 2007, Worth),
3. Murray *et al*: Harper' s Biochemistry (25th ed. 2000, Appleton & Lange)
4. Stryer: Biochemistry (5th ed. 2001, Freeman)+
5. Conn, Stumpf, Bruening & Doi: Principles of Biochemistry (5th ed. 1987, Wiley)
6. Harper ;

Endocrinology

1. Hadley: Endocrinology (5th ed. 2000, Prentice Hall)
2. Turner and Bagnara: General Endocrinology, 6th ed.1984, Saunders)
3. Williams
- 4.Nooris

P-3 Practical based on C-5, C-6 & C-7

Credits 2+2+2=6

Total Practical hours -90

FM:60

Practicals

Marks distribution

1. Physiology Experiment:	10
2.Biochemistry Practical	10
3. Spotting	5X4= 20
a. Endocrine Slides (04)	
4. Class record, poster/models/collection	10
5. <i>viva-voce</i>	10
	<u>60</u>

Suggested Practicals

Mammalian Physiology

1. Preparation of Haemin Crystal
2. RBC count by using haemocytometer
3. Estimation of Haemoglobin using Sahil' s method
4. Record of blood pressure by Sphygmanometer

Biochemistry

1. Detection of biomolecules in the unknown sample –
 - a. Glucose
 - b. Amino acids
 - c. Proteins
 - d. Lipids
 - e. Citric Acids (Antioxidants)
2. Quantitative estimation of glucose

2. Separation of Chlorophyll by chromatography
3. Test for salivary amylase action

Endocrinology

1. Study of permanent slide of Endocrines gland: Thyroid, Islets of Langerhans , Adrenal, Testes and Ovary

B.Sc. Semester III SEC -1 Aqua fish farming

Credit-2

Teaching hrs: 30

FM:40

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SEC -1 Aqua fish farming

Group-A

Unit 1: The potential scope of aquarium fish industry as a Cottage Industry. Exotic and Endemic species of Aquarium fishes

Unit 2: Common Characters and sexual dimorphism of fresh water and marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold Fish, Angel fish, Blue morph, Anemone fish and butterfly fish.

Group-B

Unit 3: Food and feeding of Aquarium fishes- Use of live fish feed organisms. Preparation and composition of formulated fish seeds.

Unit 4: Live fish transport- Fish handling, packing and transport techniques

Unit 5: General Aquarium maintenance- budget for setting up an aquarium fish farm as a cottage industry, Common disease of aquarium fishes and their treatment

B.Sc. Semester IV

C-8 Genetics

Credit -4(T) + 2(P)

C-9 Evolution

Credit -4(T) + 2(P)

C-10 Animal Behaviour

Credit -4(T) + 2(P)

SEC-2 Vermi culture & Composting

credit – 2

C-8 : Genetics

Credit-4

Total teaching hrs: 90

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Core Course (C-8) : Genetics

Group-A

FM:60

UNIT-1. Elements of heredity and variation

1.1 Mendel and his experiments

1.2 Principles of segregation and independent assortment and their chromosomal basis

UNIT-2. Extension of Mendelism

2.1 Dominance relationships (Complete dominance incomplete dominance and co-dominance)

2.2 multiple allelism

2.3 Lethal alleles

2.4 Pleiotropy

2.5 Epistasis

2.6 Polygenic inheritance

2.7 cytoplasmic inheritance

2.8 Linkage and crossing over

2.9 sex- linkage

Group-B

UNIT-3 Sex Determination

3.1 sex chromosomes systems and sex determination : XX/XO, XX/XY, ZZ/ZW and haploidy/ diploidy types

3.2 dosage compensation

3.3 Sex limited and sex influenced traits

UNIT-4. Mutation

4.1 Structural and numerical alterations of chromosomes and related disorder

4.2 Single gene disorder

4.3 Genetic counselling

C-9 Evolution

Credit 4(T) +2(P)

Teaching Hrs.75

In all **TEN questions are to be set**. Question number 1 & 2 is compulsory. Q.No.1 will be of objective type from entire syllabi in the form of multiple choice/true or false/fill in the blanks

etc. of each 1 mark (Total: 12 marks) . Q.No.2 shall consist of short answer type covering complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (3 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

Core Course (C-9): Evolution

Group-A

FM:60

UNIT-1 History & Evidence of Evolution

- 1.1. Geological Time Scale And Geological Era
- 1.2. Zoogeographical regions and Animal Distribution
- 1.3. Fossil as direct evidence
- 1.4. Types of Fossil
- 1.5. Dating of fossil
- 1.6. Phylogeny of Horse
- 1.7. Chronological order of fossils of man

UNIT -2 Introduction to source of evolution & evolutionary Theories

- 2.1 Lamarkism
- 2.2 Dawarnism
- 2.3 Neo Darwinism
- 2.4. Source of Variation : Mutation & Recombination
- 2.5 Sexual Isolation
- 2.6 Natural Selection in action (Industrial Melanism)

Group-B

UNIT-3 .Hardy Weinberg law of Equilibrium

- 3.1 Principle and attributes
- 3.2 Genetic Drift
- 3.3 Founder effect
- 3.4 Bottle Neck Effect

UNIT-4 Level of Evolution

- 4.1 Micro- evolution
- 4.2 Macro-evolution
- 4.3 Mega- Evolution

C-10

Animal Behaviour

Credit 4(T)

Teaching Hrs.60(T)

In all **TEN questions are to be set**. Question number 1 & 2 is compulsory.Q.No.1 will be of objective type from entire syllabi in the form of multiple choice/true or false/fill in the blanks etc. of each 1 mark (Total: 12 marks) . Q.No.2 shall consist of short answer type covering complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (3 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and

examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

Core Course(C-10): Animal Behaviour

Group-A

FM:60

UNIT-1. Concepts and pattern of Behaviour

- 1.1 Innate /Instinct Behaviour
- 1.2 Acquired/ learned behavior

UNIT-2. Control of Behaviour

- 4.1 Neural control
- 4.2 hormonal control

Group-B

UNIT-3 Social organisation

- 3.1 Social organization in honey bee and Termites
- 3.2 Communication in animals

UNIT-4 Miscellaneous

- 4.1 Migration in Fishes and Birds
- 4.2. Biological Rhythms
- 4.3.Parental Care in fishes and Amphibia

P-4 Practical based on C-8, C-9 & C-10

Credit:
FM:60

Working Hrs:

Practicals

Marks distribution

1.Genetics Experiment: (Mendel' s law verification)	10
2.Evolution Experiment (Genetic law of Equilibrium)	10
3.Pedigree analysis-	05
4.Comment on Fossil/analogous/Homologous organs/models	05
5.Comment upon specimen showing behaviour	05
6.Experiment on behaviour (Geotaxis/Phototaxis/chemotaxis/locomotion)	10
4. Class record, poster/models/collection	10
5. <i>viva-voce</i>	05
	60

Suggested Practical

Genetics

1. Experimental verification of principles of segregation and independent assortment using coloured beads and chi-square test.
2. Study of pattern of inheritance in human population of the traits Rolling of tongue and Mid digital hair, hypertrichosis, widow' s peak.
3. Study of mutants in *Drosophila*

4. Genotype analysis in the pedigree chart of the Victorian family affected with haemophilia
5. Study of Colour blind by **Isihara** test

Evolution

1. Genotypic analysis of Taster and Non Taster for PTC in human population to estimate allele frequencies by Hardy -Weinberg equation
2. Fossils study:, Trilobites,
3. Models of Chordate fossils – *Brontosaurus, Dimetrodon, Archaeopteryx, Dinoceras.*
4. Evolution of Horse – through models
5. Study of Serial homology exhibited by teeth and appendages
6. Study of Homologous and Analogous organ

Animal Behaviour

1. Study of geo-taxis, photo -taxis , hygro- taxis in animals
2. Locomotory behaviour of dipteran larvae (Housefly/blowfly/fruitfly):
3. Locomotion on different types of substrata (writing paper, plastic sheet and sand paper)
5. Study of individual and behavioural patterns of dog
5. Study of inter-specific association between cattle and crow
6. Study of bee hive and mound of termites

Recommended Books

Genetics

1. Brooker: Genetics : Analysis and Principles (1999, Addison-Wesley,)
2. Gardner *et al*: Principles of Genetics (1991, John Wiley)
3. Griffith *et al*: An Introduction to Genetic Analysis (2005, Freeman)
4. Hartl & Jones: Essential Genetics: A Genomic Perspective (2002, Jones & Bartlett)
5. Russell: Genetics (2002, Benjamin Cummings)
6. Snustad & Simmons: Principles of Genetics (2006, John Wiley)
7. Lewin: Genes IX (2008, Jones & Bartlett)

Evolution

1. Moody: Introduction to Evolution (1978, Kalyani).
2. Savage: Evolution (1963, Holt, Reinhart and Winston)
3. Rastogi: Organic Evolution (1988, Kedarnath & Ramnath)
4. Strickberger: Evolution (2004, Jones & Bartlett)

Animal Behaviour

1. Drickamer & Vessey : Animal Behaviour – concepts, processes and methods (2nd ed. 1986, Wadsworth,)
2. Freeland: Problems in Practical Advanced Level Biology (1985, Hodder & Stoughton,)

3. Goodenough et al.: Perspectives on Animal Behaviour (1993, Wiley)
4. Grier: Biology of Animal Behaviour (1984, Mosby)
5. Lorenz: The Foundation of Ethology (1981, Springer)
6. Manning & Dawkins: An Introduction to Animal Behaviour (5th ed. 1998, Cambridge).
7. Mcfarland : Animal Behaviour, Psychology, Ethology and Evolution (1985, Pitman).
8. Slater: An Introduction to Ethology (1985, Cambridge).

SEC-2 Vermi-culture & composting

SKILL ENHANCEMENT COURSE

Credits 2

Lectures 30

FM;40

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Group A

UNIT-I: General properties of the soil - structure of the soil -sand, clay, salt, types of soils - soil organisms.

UNIT-II: Physical properties of soil - soil colour, soil moisture, soil temperature, bulk density of soil, chemical properties of soil PH, Electrical conductivity, organic, Nitrogen, Phosphate and potash.

Group-B

UNIT-III: Composting -anaerobic composting, aerobic composting, types of composting, vermi-compost- earthworm species used in vermi-compost production - endemic species, exotic species.

UNIT-V: Vermicompost -setting up vermicompost quality N, P, K, C, N, Microbial quality applications —vermiculture -vermiwash —role of vermicompost in organic farming - its quality and advantages over chemical inputs. Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as a tool for solid waste management - a small scale industry and it's economics.

REFERENCE

1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman
3. Kale Radha,D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore.
4. Satchell,J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London Stephenson J., 1923. The fauna of British India -Oligo

B.Sc. Zoology Hons .Semester V

Semester V

C-11	Microbiology & Immunology	Credits 4 (T) +2 (P)
C-12	Environmental biology & toxicology	Credits 4 (T) +2 (P)
DSE-1	Economic Zoology	Credits 4 (T) +2 (P)
DSE-2	Biostatistics	Credits 4 (T) +2 (P)

C-11 Immunology

Credit- 4 (T) +2 (P) Teaching Hours 60 (T)

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complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (3 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

Core Course (C-11):Immunology

Group-A

FM:60

UNIT-1 . Introduction to Immunity

UNIT-2. Cell and organs of immune system

- 2.1 Types of immune cells, lymphoid and myeloid
- 2.2 Primary and secondary lymphoid organs and lymphatic system

Group-B

UNIT-3. Humoral immunity

- 3.1 Antigen
- 3.2 Immunoglobulins: types, structure and function
- 3.3 Generation and diversity of antibodies
- 3.4 Function of B cell
- 3.4 Complement System

UNIT-4. Cell mediated immunity

- 4.1 Structural organization of MHC complex
- 4.2 Antigen processing and presentation
- 4.3 Function of T-Cells
- 4.4 Monoclonal Antibody
- 4.5 ELISA

Core Course (C-12): Developmental Biology

In all **TEN questions are to be set**. Question number 1 & 2 is compulsory. Q.No.1 will be of objective type from entire syllabi in the form of multiple choice/true or false/fill in the blanks etc. of each 1 mark (Total: 16 marks) . Q.No.2 shall consist of short answer type covering complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (4 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 16 marks each) selecting at least one from each group.

Core Course (C-12): Developmental Biology

Group-A

UNIT-1 Early embryonic development

- 1.1 Spermatogenesis
- 1.2 Oogenesis
- 1.3 Ultra structure of sperm and ovum
- 1.4 Pre fertilization Events: Attraction of gamets,Fertilizin – Antifertilizi Interaction, capacitation , Acrosomal Reaction , Amphimixis
- 1.5 Post fertilization events: Prevention of Polyspermy , Cortical reaction

- 1.6 Types of cleavage
- 1.7 Role of yolk in cleavage
- 1.8 construction of fate map

UNIT_2 Late embryonic Development

- 2.1. Extra embryonic membranes in chick
- 2.2 Placenta: Structure, Type and function

Group-B

UNIT-3, Post Embryonic Development

- 3.1 Metamorphosis in Insect
- 3.3 Regeneration
- 3.5 Concepts of Ageing

UNIT-4 Embryo transfer technology

- 4.1. Principles of collections of Umbilical cord, gametes and embryos
- 4.2 Cryopreservation of gametes
- 4.3. Superovulation and embryo transfer technology
- 4.4 Teratogen and their effects on Embryonic development , Amniocentesis

Recommended Books

Developmental Biology

1. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
2. Balinsky: An Introduction to Embryology (1981, CBS)
3. Gilbert: Developmental Biology (8th ed., 2006, Sinauer)
4. Wolpert: Principles of Development (3rd ed. 2007, Oxford)

Immunology

1. Abbas *et al*: Cellular and Molecular Immunology (2001, Saunders)
2. Alberts *et al*: Molecular Biology of the Cell (5th ed. 2008, Garland)
3. Kuby: Immunology (2003, Freeman)
4. Roitt and Delvis: Roitt' s Essential Immunology (6th ed. 2006, Blackwell)

Practical -P5

Based on C-11 & C-12

Practicals	FM:40
	Marks distribution
1.Immunology (Blood Film Preparation /Blood group test	08
2.Development biology (window preparation)	10

3Spotting	1.T.S of Lymphoid organs	2	2X6=	12
	2.Embryological Slides	4		
4.	Class record, poster/models/collection			05
5.	<i>viva-voce</i>			05
				<u>80</u>

Suggested Practicals
Immunology

- 1.Study of different Immune cells by blood film preparation
- 2.Demonstration of agglutination by blood group test on slide
- 3.Study of Different antibody structure through model
- 4.demonstration of Immuno diffusion technique
- 5.Demonstation of ELISA
- 6.Study of T.s of Bone, Thymus spleen as lymphoid organs

Developmental biology

- 1.study of embryonic slides of frog
- 2.study of embryonic slides of chick:WM of 18 hrs, 21 hrs,24hrs,36 hrs ,48 hrs and 72 hrs
3. Window preparation in chick egg

DSE-1 Economic Zoology Credit-4(T) +2(P)

Teaching Hrs -60 (T)

FM:60

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DSE-1:Economic Zoology

Group-A

Unit 1: Bee-keeping and Bee Economy (Apiculture)

Varieties of honey bees, stingless honey bee and Bee pasturage; Setting up an apiary Rearing equipments, handling of bees, artificial diet; Diseases of honey bee, , and their management; Honey extraction techniques; Physico-chemical analysis of honey; Other beneficial products from bee.

Unit 2: Silk and Silk Production (Sericulture)

Different types of silk and silkworms in India; Rearing of *Bombyx mori* – Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages, harvesting of cocoons; Silkworm diseases: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis, and their management; Silkworm pests and parasites: Uzi fly, Dermestid beetles, and their management; Silk reeling techniques; Quality assessment of silk fibers.

Group-B

Unit 3: Aquaculture

Brood stock management; Induced breeding of fish and prawn; Management of hatchery of fish; Management of nursery, rearing and stocking ponds; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish; Fishery by-products

Unit 4: Dairy/Poultry Farming

Introduction; Indigenous and exotic breeds; Rearing, housing, feed and rationing; Commercial importance of dairy and poultry farming; Varietal improvement techniques; Diseases and their management; Dairy/poultry farm management and business plan; Visit to any Dairy farm/Poultry farm

Unit-5 Lac Culture

* Submission of report on any one field visits mentioned above

SUGGESTED READINGS

1. Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
2. Sericulture, *FAO Manual of Sericulture*.
3. Hafez, E. S. E. (1962). *Reproduction in Farm Animals*, Lea and Fabiger Publishers.
4. Srivastava, C. B. L. (1999). *Fishery Science and Indian Fisheries*. Kitab Mahal publications, India.
5. Sardar Singh, *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.45
6. Dhyhan Singh Bisht, *Apiculture*, ICAR Publication.
7. Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction*, Vol. 2, Elsevier

Publishers.

8. Dunham R. A. (2004). *Aquaculture and Fisheries Biotechnology - Genetic Approaches*. CABI publications, U.K.

DSE-2 Biostatistics Credit-4(T) +2(P)

Teaching Hrs -60 (T)

FM;60

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Group-A

UNIT-1 Sampling (Data collection)

- 1.1 primary Data
- 1.2 Secondary data
- 1.3 Frequency distribution and tally marks

UNIT-2 Classification & Tabulation

UNIT-3 Representation of data

- 3.1 Diagrammatic Representation: Histogram & Pie Diagram
- 3.2 Graphical representation of Data

Group-B

UNIT-4. Measurement of central tendency

- 4.1 Mean
- 4.2 median

4.3 mode

UNIT-5 Measurement of Variation

5.1 standard deviation

5.2 standard error

5.4 Coefficient of variation

UNIT-6 Test of Significance

6.1 Chi square test

P-6 Practical based on DSE-1 & DSE-2

Practicals	FM:40 Marks distribution
1. Biostat practicals (Mean.Median/Chi Square/Std.deviation)	07
2. Graph/Histogram/Pie chart preparation	03
3. Spotting on economic slides/specimens (3 slides ,3 specimens)	2X6=12
4. Report on Visit to any animal culture centre/Institute	08
4. Class record, poster/models/collection	05
5. <i>viva-voce</i>	05
	<hr/>
	40

Suggested Practicals

Practical DSE-1 Economic Zoology

1. Report on field Visit to sight of sericulture, Apiculture, Lac Culture and Aquaculture
2. Study of Infested Lac stick, Cocoon, honey comb, Infested fishes
3. Study of Paddy pests, Pest of Sugar cane
4. Study of some economically Important fishes

Practical DSE-2 Biostatistics

1. Determination of mean, median & mode
2. Determination of Deviation
3. Diagrammatic representation of statistical data

B.Sc .Semester VI

C-13 Molecular Biology & Biotechnology	Credits 4 (T) +2 (P)
C-14 Medical Zoology	Credits 4 (T) +2 (P)
DSE-3 Wild Life Conservation & management	Credits 4 (T) +2 (P)
DSE-4 Agro chemical & pest management	Credits 4 (T) +2 (P)

Molecular Biology & Biotechnology	Credit 4 (T) +2 (P)	Teaching Hours 60
hrs (T)+30hrs (P)		

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Core Course (C-13): Molecular Biology & Biotechnology

FM:60

Group-A

UNIT-1. Nucleic Acids

- 1.1 Mechanism of DNA replication in prokaryote
- 1.3 Mechanism of transcription in prokaryote
- 1.4 Mechanism of translation in Prokaryote

UNIT 2. Gene Regulation

- 2.1 Concepts of operon (Positive& Negative; Inducible & Repressible)
- 2.3 Lac operon,
- 2.4 trp operon,

Group-B

UNIT 3. Elementary idea of Repetitive DNA damage & DNA repair mechanism

- 3.1 transposable genetic elements,
- 3.2 DNA damage by Mutagen

- 3.3 Mismatch repair
- 3.4 Thymine Dimer Repair

UNIT-4 Biotechnology

- 4.1 Tools: Restriction enzymes, Cloning Vectors
- 4.2 Construction of recombinant DNA
- 4.3 Transgenic animals, a concept
- 4.4 DNA fingerprinting

Core Course (C-14): -Medical zoology

FM:60

Group-A

UNIT-1 Life Cycle, Pathogenicity , clinical features, prophylaxis and control of pathogenic protozoan

- 1.1 Plasmodium*
- 1.2 Entamoeba histolytica*
- 1.3 Leishmania donovani*
- 1.4 Giardia*
- 1.5 Trichomona*
- 1.6 Trypanosoma*

UNIT-2 Pathogenic Helminthes parasites ,clinical Features ,Control and prophylaxis

- 2.1 Fasciola sp.*
- 2.2 Taenia*
- 2.3 schistosoma*
- 2.4 Wuchereria*
- 2.5 Ascaries*

Group-B

UNIT-3 Vector Biology

- a. Mosquito (Anopheles Female), Yellow Fever ,Dengue Fever,(Aedes)Filariasis (Culex Female)Japanese B encephalitis
- b. Plague
- c. Epidemic typhus ticks (pediculus)

UNIT-4 Non Vector Diseases

- 4.1 Typhoid
- 4.2 Cholera
- 4.3 Small pox
- 4.4 HIV
- 4.5 Swine Flu

UNIT-5 General Account of Vaccine & Vaccination , Eradication Programme , drug Therapy and drug resistance

P-7 Practical based on C-13 & C-14

FM:40

Practicals	Marks distribution
1. Estimation of sugar by colorimeter	08
2. Spotting: 1. photographs of Molecular Biology/biotech importance- 2	3X5= 15
2. Slides of parasites -3	
5. Physical characterisation of urine/Bleeding & clotting Time	07
4. Class record, poster/models/collection	05
5. <i>viva-voce</i>	05
	<hr/> 40

Suggested Practicals

Molecular biology & Biotechnology

1. Demonstration of DNA separation on Gel
2. Use of micropipette
3. Protein estimation by Colorimeter
4. study of transposition through Maize specimens /Photographs
5. study of Cloned animal through photographs
6. study of transgenic animals through photographs

Medical Zoology

1. Physical examination of urine
2. Blood film preparation
3. Determination of Bleeding and clotting time
4. Glucose presence in Urine and serum
5. Slides / museum specimens of parasites

Books Recommended

Molecular biology & biotechnology

1. B.D.Singh – A Text book of Biotechnology
2. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
3. Karp: Cell and Molecular Biology (2008, John Wiley)
4. Lodish *et al*: Molecular Cell Biology (2008, Freeman)

Microbiology

1. Madigan and Martinko: Brock Biology of Microorganisms (2006, Prentice Hall)
2. Prescott, Harley and Klein: Microbiology (1999, McGraw)
3. Pelzar – Microbiology

DISCIPLINE CENTRIC ELECTIVE (DSE-3)

In all TEN questions are to be set. Question number 1 & 2 is compulsory. Q.No.1 will be of objective type from entire syllabi in the form of multiple choice/true or false/fill in the blanks etc. of each 1 mark (Total: 12 marks) . Q.No.2 shall consist of short answer type covering complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (3 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

WILD LIFE CONSERVATION AND MANAGEMENT (CREDITS: THEORY-4, PRACTICALS- 2)

THEORY

Teaching Hrs: 60

Group-A

Unit 1: Wild Life- Values of wild life- positive and negative; conservation ethics; Importance of conservation; causes of depletion

Unit 2: Habitat analysis, Evaluation and management of wild life- Physical parameters; topography, Geology, Soil and water; Biological parameters: food, cover, forage, browse and cover ;**Remote sensing and GIS.**

Unit 3: Population estimation: Population density, Natality, Birth Rate, Mortality, fertility, Faecal analysis of ungulates and carnivores; Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Group-B

Unit 4: National Organisations involved in wild life conservation; wild life Legislation- Wild protection act 1972, its amendments and implementation, Eco-tourism/ Wild life tourism in forests.

Unit 5: Management of excess population and translocation; bio-telemetry; Care of injured and diseased animal; Quarantine; common diseases of wild animal.

Unit 6: Protected areas National parks and sanctuaries, community reserve; Important features of protected areas in India; Tiger conservation- Tiger reserves in India; Management challenges in Tiger reserve.

Unit-7 Red data book, IUCN, WWF

Recommended Books

Wild Life Conservation & Management

1. Fundamentals of Wildlife Management. Author: **Rajesh Gopal**, Publisher: Natraj Publisher, Dehara Dun.
2. Techniques for Wildlife Census in India : A Field Manual. W.A. Rodgers, Dehra Dun : Wildlife Institute of India, 1991
3. S.H. Prater, The book of Indian animals Natraj Publications
4. Salim Ali, Book of Indian Birds, Bombay Natural Historical Society
5. P.C. Sinha, Wildlife and forest conservation Anmol Publications
6. Anand S. Khati, Indian National Parks and Sanctuaries, Pelican Creations
7. Saharia V B, 1982. Wildlife in India, Natraj Publishers, Dehra Dun
8. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York
9. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun.
10. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York.
11. Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun.
12. Teague R D (ed.), 1987. A Manual of Wildlife Conservation (The Wildlife Society, Wsashington D.C.). Nataraj Publishers, Dehra Dun.
13. A Guide to Chemical Restraint of Animals. WII.
14. Technical Manual -T M -2. WII.
15. Right of Passage: Published by Vivek Menon, Sandeep Kumar Tiwari, P. S. Easa, R. Sukumar, WTI.

DISCIPLINE CENTRE ELECTIVE (DSE-4)

In all TEN questions are to be set. Question number 1 & 2 is compulsory. Q.No.1 will be of objective type from entire syllabi in the form of multiple choice/true or false/fill in the blanks etc. of each 1 mark (Total: 12 marks) . Q.No.2 shall consist of short answer type covering complete syllabi. 8 short questions are to be set and examinees are required to answer 4 (3 marks x 4 questions). Rest eight questions are to be set from the each group covering whole syllabi and examinees are required to answer **three** questions (long answer of 12 marks each) selecting at least one from each group.

AGROCHEMICAL & PEST MANAGEMENT (CREDITS: THEORY-4, PRACTICALS- 2)

THEORY

Teaching Hrs: 60

Group-A

FM:60

UNIT-1 Fundamentals of Pest management

Pest : Definition ,types of pest according to damage (sub-economic, Occasional, perennial , economic threshold

UNIT-2 Practical approach to pest management

General morphology of different types of insect, biting and chewing type, Piercing & sucking type of mouth parts , integrated pest management : Cultural, biological, chemical, genetic control

Group-B

UNIT-3 Agrochemical: common pesticides and insecticides , Nomenclature , Mode of action , tools & techniques for pesticide application , measurement of insecticides Toxicity by LD₅₀

UNIT-4 Study of Pest in laboratory and field

Visit to agriculture field to study biology, damage and management practices of pests of agriculture crops

Rearing of stored grain pests and study of different stages

P-8 Practicals Based on DES-3 &DSE-4

Practicals

Marks distribution

1 Comment upon given Photographs /model of avian fauna(1X5)=	05
2. Comment on given endangered Mammalian species (1X5) =	05
3.Comment upon given Equipment.: Wild Life management-1	05
Pest Mangement-1	05
5. Spotting a. animal marks (1); Pest (1) 2X5	10
4. Class record, poster/models/collection	05
5. <i>viva-voce</i>	05
	40

DSE-3 PRACTICALS

1. Identification of flora, mammalian fauna, avian fauna,
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Binoculars, GPS (Global Positioning System), various types of cameras and lenses)
3. Familiarization and study of animal evidences in the field, identification of animals through pug marks, hoof marks, scats, pellet groups, nest antlers etc.
4. Demonstration of different field techniques for flora and fauna

Practicals DSE-4

1. Trip to ICAR governing field of your locality / FCI
2. Collection preservation and slide preparation of pest
3. Study of infested plants / parts
4. Study of instrument used in pest management (IPM)
5. Determination of LD 50 from the generated data.

Recommended Books

AGROCHEMICAL & PEST MANAGEMENT

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2. Dennis, S. Hill (2005) Agricultural Insect Pests of Tropics and their management
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