RADHA GOVIND UNIVERSITY
RAMGARH, JHARKHAND

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM CURRICULUM
FOR B.SC. (HONOURS) ZOOLOGY PROGRAMME
SUBJECT CODE = 15

FOR UNDERGRADUATE COURSES UNDER
RADHA GOVIND UNIVERSITY

Implemented w.e.f.
Academic Session 2024-2025 & onwards

Details of B.Sc. Honours Courses under CBCS

Duration of Course -3 yrs

Total number of semester -06

Total no. of papers

a. C- Core -14 (Theory) 6 (Practical)

b .G- Generic elective -4(1 in each Semster)

c. GEP (Generic elective paper) -4 (1 in each semester)

d. AECC(Ability Enhancement compulsory course) -2 (1 each in semester I & II)

e. SEC (Skill enhancement course) -2(1 each in semester I & II)

f. DSE (Discipline specific elective theory) -4 (2 in each in semester V & VI)

g. DSEP (Discipline specific elective Practical)-2 (1 each in Semester V & VI)

Generic Elective paper will be selected by the students and will continue from semester I to semester IV

After completion of course in Honours, candidate will get degree in Zoology Hons. With

Chem/Phy/Botany/- as per selection of generic elective paper

All candidate (Examinees) have to complete 140 credits in three yrs

A students can take up to extra 20 creditsi.e maximum credits 160 to enhance his/her study

General Instructions for question setters
for Theory examination Core Course

- **In all eight question are to be set of equal values and a total of four questions are to be answered. Question no. 1& 2 is compulsory.**

- **Q. No. 1 will be of short type from entire syllabi in the form of multiple choices/ True or false /fill in the blanks of each equal mark. (Total :15 marks)**

- **Q.No. 2 will be of short answer type with six option covering entire paper examinee has to answer any three.(5 marks X 3 questions)**

  Rest six question will be of long type and examinees are required to answer any two by selecting not more than one from each group

DSE

- **In all eight question are to be set of equal values and a total of four questions are to be answered. Question no. 1& 2 is compulsory.**

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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	Full Marks (I+E)	Pass Marks (%)
(A) CORE Course	C-1	Systematics & Diversity of Non chordate	04	75 (15+60)	40
	C-2	Principle of Ecology	04	75(15+60)	40
	P-1	Practical based in C-1 & c-2	04	50(10+40)	40
(B) AECC Ability Enhancement Compulsory Course	AECC-1	Communicative English /MIL	02	50(10+40)	40
(C) Generic Elective	GE-1	Chemistry/ /Botany	04	75(15+60)	40
		Practical-GE	02	25(5+20)	40
		Total credits	20	350	

SEMESTER II

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks	Pass Marks (%)
Core Course	C-3	Cell Biology	04	75(15+60)	40
	C-4	Diversity of Chordates	04	75(15+60)	40
	P-2	Practical based on C-3 & C-4	04	50(10+40)	40
(B) AECC Ability Enhancement Compulsory Course	AECC-2	Environmental Science	02	50(10+40)	40
(C) Generic Elective	GE-2	Chemistry/ /Botany	04	75(15+60)	40
		Total	20	25(5+20)	40
				350	

SEMESTER –III

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks (I+E)	Pass Marks (%)
Core Course	C-5	Physiology	04	75 (15+60)	40
	C-6	Biochemistry	04	75(15+60)	40
	C-7	Endocrinology	04	75(15+60)	40
	P-3	Practical based on C-5,C-6& C-7	06	75(15+60)	40
(B) Skill Enhancement Course	SEC-1	As per Univ. Rule	02	50(10+40)	40
Generic Elective	GE-3	Chemistry/ /Botany	04(T)	75(15+60)	40
	GE-3P		02	25(5+20)	40
		Total	26	450	

SEMESTER -IV

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks (I+E)	Pass Marks (%)
Core Course	C-8	Genetics	04	75 (15+60)	40
	C-9	Evolution	04	75(15+60)	40
	C-10	Animal behaviour	04	75(15+60)	40
	P-4	Practical based on C-8,C-9& C-10	06	75(15+60)	40
(B) Skill Enhancement Course	SEC-2	As per Univ. Rule	02	50(10+40)	40
Generic Elective	GE-4	Chemistry/ /Botany / Physics	04	75(15+60)	40
	GE-4P	Practical (GE)	02	25(5+20)	40
				450	

SEMESTER V

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks (I+E)	Pass Marks (%)
Core Course	C-11	Immunology	04	75 (15+60)	40
	C-12	Developmental Biology	04	75(15+60)	40
	P-5	Practical based on C-11& C-712	04	50(10+40)	40
Discipline specific Elective	DSE-1	Economic Zoology	04	75(15+60)	40
	DSE-2	Biostatistics	04	75(15+60)	40
	P-6	Practical based on DSE-1 & DSE-2	04	50(10+40)	40
		Total	24	400	

SEMESTER VI

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks (I+E)	Pass Marks (%)
Core Course	C-13	Molecular biology & Biotechnology	04	75 (15+60)	40
	C-14	Medical Zoology		75(15+60)	40
	P-7	Practical based on C-13 & C-14	04	50(10+40)	40
Discipline specific Elective	DSE-1	Wild Life conservation & Management	04	75(15+60)	40
	DSE-2	Pest & Pest management	04	75(15+60)	40
	P-8	Practical based on DSE-1 & DSE-2	04	50(10+40)	40
		Total	24	400	

B.Sc. (Hons.) Zoology
Semester I Core Course C-1

- **In all eight question are to be set of equal values and a total of four questions are to be answered. Question no. 1& 2 is compulsory.**
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- **Q.No. 2 will be of short answer type with six option covering entire paper examinee has to answer any three.(5 marks X 3 questions)**
- **Rest six question will be of long type and examinees are required to answer any two by selecting not more than one from each group.**

Core Course (C-1)

Systematics and Diversity of Non Chordate Credit -4 Hours of teaching -60
FM:60

Group A

UNIT-1 Systematics

1.1 Binomial & Trinomial nomenclature,

1.2 Species and Speciation

1.3 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

UNIT-3 NonChordata : Protists to Pseudocolmates

3.1 **Phylum Protozo**a: General account of locomotion 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& Aschelminthes:** Parasitic Adaptation

Group B

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 inAsterias&Larval forms of echinoderms

Books Recommended

Systematics (Animal Taxonomy)

1. Dalela& Sharma: Animal Taxonomy and Museology (1976, Jai PrakashNath).

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

1. Ruppert and Barnes ,RD(2006) Invertebrate Zoology, VIII edition .Holt Saunders International edition
2. Barnes ,R.S.K.,Calow, P.Olive.,Golding,D.W.andSpicer,J.LI.(2002) The Invertebrates; E.J.W, III Edition ,Blackwell Science
3. Barrington,E.J.W.(1979)Invertebrate structure & function .II edition .E.L.B.S and Nelson
4. Boolotian and stiles: College Zoology (10th Ed. 1981,Macmillin)
5. Campbell & Reece: Biology (7thedn. 2005, Pearson
6. Nigam: Biology of Non-chordates (1997, S Chand)
7. Miller and Harley : zoology (6th Ed. 2005,W.C.Brown)
8. Parker &Haswell: Text Book of Zoology, Vol. I (2005, Macmillan)

Semester -1 Core Course (C-2)

Principle of Ecology (Credit 4) **Hours of teaching** **4X15=60 hrs** **FM:60**

Group A

UNIT- 1. General concepts

1.1 Components of ecosystem

1.2 Energy flow in ecosystem

1.3 food chain and food web, Food Pyramid

1.4 Bio- Geochemical cycle

1.4.1 Water Cycle

1.4.2 Gaseous Cycles- Carbon and Nitrogen

1.4.3 Sedimentary Cycle- Phosphorous and sulphur

UNIT- 2. Population and communities

2.1 Population characteristics: Density, Natality, Mortality, Age pyramid and growth curve

2.2 Ecological succession and concept of climax

Group B

UNIT- 3. Pollution

3.1 Sources and impact of environmental pollutants- air & water

3.2 Global environmental changes- greenhouse gases and their effects

3.3 Acid rains

UNIT- 4. Natural resources

4.1 Soil & water and their conservation

4.2 Biodiversity- benefits, hotspots, threats and conservation

4.3 Renewable and Non Renewable Source of Energy

Books Recommended

1. **Colinnvaux ,P.A.(1993). Ecology. II Edition .Wiley Johnandsons,Inc.**
2. **Kerbs,C,J.(2001),Ecology.Vi Edition ,Benjamin Cuming**
3. **Odum,E.P.,(2008), Fundamentals of Ecology and field Biology, Harpper and Row publishers**
4. **Ecology Environment and Resources conservation: J.S. Singh, S.p.Singh and S R Gupta , Anamaya Publishers, New Delhi**
5. **Ecology Concept and application :Manual C MollesJr, McGraw Hill**

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

SYSTEMATICS AND DIVERSITYOF NONCHORDATES &
PRINCIPLE OF NON CHORDATES

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

Part A: Systematics and Diversity of Non Chordates

Semester-I **Practical** **FM: 40 External + Internal 10**

Practicals				Marks Distribution
1. Dissection :				08
2. Slide Preparation :				05
3. Spotting :		2X5	=	10
a. Slides	(03)	2X3		
b. Museum Specimens	(02)	2X2		
4. Ecology Expt.				07
5. Class record				05
6. Viva voce				05
				40

Suggested Practicals

1. Study of Available Museum Specimens of animals

Sycon (As an example of parazoa), Hydra Fasciola,Ascaris, Hirudinaria,Hermit Crab, Scorpion, Unio, Sepia, Aplysia, Loligo, Sea Urchin , Ophiothrix (Brittle star)

2. Study of the following through permanent slide

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

3. Dissection:

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

4. Mounting

Mounting of Nephridia& ovary of earth worm, trachea and salivary gland of*Periplanetaamericana* , 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. Determination of pH of water sample

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

C-3-Cell Biology **Credit-4** **Hours of teaching 4X15=60** **FM: 75**
(External 60 + 15 Internal)

Group A

Cell Biology

UNIT-1. The Cell and its Organization

1.1 Methods in cell biology: Elementary idea of microscopy (Light, Electron)and cell fractionation

1.2 Structure and function of plasma membrane and cell junctions

1.3 Introduction to cell organelle: Endoplasmic reticulum, Golgi complex, Lysosome Ribosomes & 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 theirsignificance

3.3Elementary idea of cancer

UNIT-4. Elementary idea of

4.1 Apoptosis &
4.2 Necrosis

C-4 Diversity of Chordates **Credit -4** Hours of teaching: 4X15=60hrs FM: 75 (60+15)

Group A

UNIT-1. Protochordates

1.1 General characters and Affinities of Amphioxus

1.2 Retrogressive metamorphosis in Herdmania

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

2.1 Amphibians
2.2 Reptiles
2.3 Mammals

UNIT- 3. Fish & Amphibians

3.1 Difference between cartilaginous & bony fishes

3.2 Accessory Respiratory organ in fishes

3.3 Pedogenesis and neoteny with special reference to Axolotl larvae
3.4 Origin and evolution of Amphibia

Group B

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 Structure and Affinities of Prototheria & Metatheria
4.4 Comparative anatomy of heart, Aortic Arches and kidney in vertebrates

Books Recommended

Cell Biology

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

Chordate

6. Miller & Harley: Zoology (6thed. 2005, W.C. Brown
7. Nigam: Biology of Chordates (1997, S Chand)
8. Parker &Haswell, A Text Book of Zoology Vol.II (2005, Macmillan)
9. Purves et al: Life-the Science of Biology, (7^{th}ed. 2004, Sinauer)
10. Romer, A.S.,Parsons , T.S .,The vertebrate body ,6^{th} Edison ,CBS publishing ,Japan Ltd. ,1986
11. Sinha, A.K., &Adhikari,S and Ganguli, B.B Biology of Animals Vol.II New Central Agency, Calcutta
12. Young,J.J. The life of Vertebrates ,3^{rd} Edition ,ELBS with oxford press ,1981
13. Vishwanath – vertebrate Zoology

B.Sc. Semester-II

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

Credit-4 **Working hours -60**

FM: 40 External + internal 10

Practicals			**Dissection**
1. Dissection :			**08**
2. Mounting :			**04**
3. Spotting: 2 specimens; 2 bones , 1 slides	**2X5**	**=**	**10**
4. Preparation of cytological slide			**08**
5. Practical Record			**05**
6. Viva Voce:			**05**
			40

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, Turtle, Hydrophis, Krait, Viper, Naja, Python, Water Snake, Rat Snake
10. Aves :Ostrich model or nay ave model
11. Prototheria Models of Duck bill platypus ,spiny ant eater
12. Bones of Amphibia, Reptiles, Aves 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

B.Sc. (Hons.) Zoology Semester III

C-5 Mammalian Physiology Credit -4 Hours of teaching: 60 FM: 75 (60+15)

Group A

UNIT_1. Digestion

1.1 : 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 Composition of blood and lymph

2.4 Blood groups and Blood clotting

2.5 Cardiac cycle /ECG

Group B

UNIT3. Renal & Reproductive Physiology

3.1 Histo-Physiology of Kidney

3.2 Histo-Physiology of Testes

3.3 Histo-Physiology of Ovary

3.4 Menstrual cycle in human

UNIT-4. Nerve physiology

4.1 Propagation of nerve impulse in Myelinated and non- myelinated nerve fibers

4.2 Synapse & Synaptic Transmission

C-6 BIOCHEMISTRY Credit 4(T) Teaching Hrs.60 FM: 75 (60+15)

Group A

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: m RNA, t RNA& r RNA

UNIT-4. Metabolic path way

4.1 Glycolysis

4.2 Kreb's cycle

4.3 Beta oxidation of fatty acid

B.Sc. Semester III

C-6 Endocrinology **Credit 4(T)** **Teaching: 60** **FM: 75 (60+15)**

Group A

UNIT-1. Classification of chemical messengers

1.1 Hormones and its classification
1.2 Pheromones
1.3. General mechanism of hormone action

Group B

UNIT -2 Structures and functions of endocrine organs

2.1 Pituitary
2.2 Thyroid
2.2 Adrenal
2.3 Endocrine pancreas

UNIT-3. Gastrointestinal hormones (Gastrin, Secretin, CCK & Motilin)

B.Sc Semester III

SEC -1 (CREDITS 2) Teaching hrs: 30 FM: 50 (40 External + 10 Internal)

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's illustrated biochemistry

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 F.M.: 60External +Internal 15

Practicals	Marks Distribution
1. Physiology Experiment	**15**
2. Biochemistry practical	**15**
3. Spotting (5 endocrine/organ Slides) 5X3 =	**15**
4. Practical Record	**08**
5. Viva Voce	**07**

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 Sphygnomanometer
5. Study of permanent slide of transverse section/L.S .of organs:

   Skin, Lung , Stomach, Intestine, Liver, Kidney,

Biochemistry

1. Detection of biomolecules in the unknown sample –
   a. Glucose
   b. Amino acids
   c. Ptoteins
   d. Lipids
   e. Citric Acids (Antioxidants)
2. Quantitative estimation of glucose
3. Separation of Chlorophyll by chromatography

Endocrinology

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

B.Sc. Semester IV

C-8 : Genetics **Credit-4** **Total teaching hrs: 60** **FM:60**

Genetics

Group A

UNIT-1. Elements of heredity and variation

1.1 Mendel an d 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 Multipleallelism
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 and basis of sex determination : XX/XO, XX/XY, ZZ/ZW
3.2 dosage compensation

UNIT-4. Mutation

4.1 Structural and numerical alterations of chromosomes and related disorder
4.2 Genetic counselling

C-9 Evolution Credit 4(T) +2(P) Teaching Hrs.60 FM: 75 (60+15)

Group-A

UNIT-1 History & Evidence of Evolution

1.1. Geological Time Scale And Geological Era
1.2. Zoogeographical regions and Animal Disrtibution
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

Group B

UNIT-3 . Population Genetics

3.1 Hardy Weinberg Law of Equilibrium
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

B.Sc. (Hons.) Zoology Semester IV

C-10 Animal Behaviour Credit 4(T) Teaching Hrs.:60 FM: 75 (60+15)

Group A

UNIT-1. **Concepts and pattern of Behaviour**

1.1 Innate /Instinct Behaviour

1.2 Acquired/ learned behaviour

UNIT-2. **Control of Behaviour**

4.1 Neural control

4.2 hormonal control

UNIT-3 **Social organisation**

3.1 Evolution of Social organization

3.2 Social organization in honey bee and Termites

3.2 Communication in animals (Chemical , Audio & Visual)

UNIT-4 Miscellaneous

4.1 Migration in Fishes and Birds

4.2. Biological Rhythms

4. 3.Parental Care in fishes and Amphibia

B.Sc (Hons.) Zoology Semester IV

SEC-2 Credits 2 Hours of Teaching 30 FM: 50 (External 40 + Internal 10)

P-4 Practical based on C-8, C-9 & C-10
FM (External 60+ Internal 15)

Credit: 6(2+2+2) **Total practical hrs.:90 (external :60 Internal:15)**

Practicals	Marks Distribution
1. Verification of law of segregation	10
2. Identification & comment on given fossil Analogous/homologous organ	10
3. Pedigree analysis	10
4. Comments on Bee Hive/termite mound Specimens showing behaviour	05
5. Experiment on geotaxis/phototaxis	05
6. Sessional Record	10
7. Viva Voce	10

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.

4. Genotype analysis in the pedigree chart of the Victorian family affected with haemophilia

5. Study of Colour blind by Ishihara

Evolution

1. Genotypic analysis of Taster and Non Taster for PTC in human population to estimate allele frequencies byHardy -Weinberg equation

2. Fossils study:, Trilobites,Archeopteryx*Brontosaurus,, Archaeopteryx, Dinosaurs*

3. Evolution of Horse – through models

5. Study of Serial homology exhibited by teeth and appendages

6. Study of Homologus and Analogus organ

Animal Behaviour

.1. Study of geo-taxis, photo -taxis ,hygro- taxis in animals

2 Locomotorybehaviour of dipteran larvae (Housefly/blowfly/fruitfly):

3. Locomotion on different types of substrata (writing paper, plastic sheet and sand paper

5. Specimen showing Behaviour – Prey mantis , Hippocampus ,Alytes, Migratory fish 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 &Bartlet)

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,)

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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).

B.Sc.(Hons .) Zoology Semester V

C-11 Immunology Credit- 4 (T) Hours of Teaching 60

Immunology

Group A

UNIT-1 . Types of 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 Complement System

UNIT-4. Cell mediated immunity

4.1 Structural organization of MHC complex

4.2 Antigen processing and presentation

4.3 Monoclonal Antibody

4.4 ELISA

C-12 Developmental Biology Credit -4 Hours of teaching -4X15=60 FM-60

Group A

UNIT-1 Early embryonic development

1.1 Spermatogenesis
1.2 Oogenesis
1.3 Pre fertilization Events: Attraction of gamets,Fertlizin –Antifertilzin Interaction, capacitation , Acrosomal Reaction , Amphimixis
1.4 Types of cleavage
1.5 Role of yolk in cleavage
1.6 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

UNIT-4 Embryo transfer technology

4.1. Principles of collections of Umblical cord, gametes and embryos
4.2. In Vitro fertilization
4.3. Embryo transfer technology

Practical –P5

P-5 Practical based on C-11 & C-12 **FM 75 (External -40 + Internal 10)**

Credits 3+3=6 Total Practical hrs-60

Practicals	**Marks Distribution**
1. Comment on Embryological slides (02) 02X05 =	**10**
2. Immune cells in Blood Film preparation	**05**
3. Histology of slides/photographs of thymus & spleen	**05**
4. Study of types of placenta through photographs	**05**
5. Sessional Records	**07**
6. Viva Voce	**08**
	40

Suggested practicals

Developmental biology & Immunology

1. Study of chick embryological slides
2. Study of WM & section of developmental stages of frog through permanent slides Morula gastrula Cleavage , Neurula , Tadepole
3. Preparation of blood flim to study various types of blood cells
4. Histological study of spleen,thymus& lymph nodes through slides/ photographs 5. Study of placenta through photographs

Suggested Books

Developmental Biology

2. Balinsky: An Introduction to Embryology (1981, CBS)

3. Gilbert: Developmental Biology (8_{th} ed., 2006, Sinauer)

4. Wolpert: Principles of Development (3_{rd} 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)

DSE-1 Economic Zoology Credit-4(T) Hours of Teaching-60

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

1.1 Varieties of honey bees in India
1.2 Setting up an apiary Rearing equipments
1.3 Diseases of honey bee and their management
1.4 Beneficial products of honey bee;

Unit 2: Silk and Silk Production (Sericulture)

2.1 Different types of silk and silkworms in India;

2.2 Host plants &Rearing of *Bombyx mori* –

2.3 Silkworm diseases: Pebrine, Flacherie, Muscardine and their management;

2.4 Silkworm pests and parasites: Uzi fly and their management;

Unit-3 Lac Culture

3.1 Species of Lac Insect (taxonomy & Identification)

3.2 Host Plants, Methods of Rearing /Cultivation and crops of lac in Jharkhand

3.3 Enemies of Lac insect

3.4 Economic Importance of Lac

SUGGESTED READINGS

1. Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
2. Sericulture, *FAO Manual of Sericulture.*
5. Sardar Singh, *Beekeeping in India,* Indian council of Agricultural Research, New Delhi.45
6. Dhyan Singh Bisht, *Apiculture,* ICAR Publication.
7. Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction,* Vol. 2, Elsevier Publishers.
8. Kumar& Nigam-Economic and applied entomology

DSE-2 Biostatistics Credit-4 Hrs of Teaching -60

UNIT-1 Sampling (Data collection)

1.1 Primary Data
1.2 Secondary data

UNIT-2 Graphical Representation of data

2.1 Diagramatic Representation: Histogram &Pie Diagram

UNIT-4. Measurement of central tendency

4.1 Mean
4.2median
4.3 mode

UNIT-5Measurment of Variation

5.1 standard deviation
5.2 standard error

UNIT-6 Test of Significance

6.1 Chi square test
6.2 student 't 'test

Suggested Books

1. Mariyappam –Biostatistics (Pearson Publications)
2. P.N.Arora , P.K.Mallhotra – Biostatistics
3. Rout K. Sourya – Biostat& Human health

Practical based on DSE-1 & DSE-2 FM 75 (External 40 + Internal 10)

Practicals	Marks Distribution
1. Identification & comments on cast of Honey bees/ Life cycle /honey bee comb	05
2. Comments on silk coccon /life cycle	05
3. Comments on life cycle of lac insect /lac stick /lac	05
4. Biostatistics – Calculation / presentation of Data as per instruction	10
5. Sessional Records/Collection/report of visit	07
6. Viva Voce	08
	40

Suggested Practicals

Practical DSE-1 Economic Zoology

1. Report on field Visit to sight of sericulture,
2. Apiculture – life cycle &honey comb, collection
3. Lac Culture- Study of Infested Lac stick, Cocoon collection
4. Silk worm – life cycle & collection

Practical DSE-2 Biostatistics

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

B.Sc. (Hons.) Zoology Semester VI

C-13 Molecular Biology &Biotechnology Credidt 4 Teaching Hours 60 FM:75

(60+15)

C-13 (Molecular Biology & Biotechnology)

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 translationin 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.DNA damage & DNA 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

C-14 Medical Zoology Credidt 4 Teaching Hours 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 Trypanosoma

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

2.1Taenia
2.2Wuchereria
2.3Ascaries

Group B

UNIT-3 Vector Biology

3.1 Mosquito (Anopheles Female), Yellow Fever ,Dengue Fever,(Aedes) Filariasis (Culex Female)
3.2 Epidimic typhus ticks (pediculus**)**

UNIT-4 Non Vector Diseases

4.1 Typhoid
4.2 Cholera
4.4 HIV
4.5 Swine Flu

UNIT-5 General Account of Vaccine &Vaccination, Eradication Programme (Polio & AIDS)

Practical based on C-13 & C-14

Credit: 4 Practical hrs: 30 FM: (40 External + 10Internal)

Practical			**Marks Distribution**
1. Comments on transgenic animals /cloned animals photographs /maize specimens /photographs of transposition (2)		**5X2=**	**10**
2. Spotting on specimens & slides of Ascaries /Teania/mosquito Parasitic Protozoa	**2 specimens 2slides**	**4X 2.5**	**10**
3. Sessional records			**10**
4. Viva Voce			**10**
			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.Slides of parasites

2. Museum specimens of helminthes parasites

R**ecommended Books**

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)

Medical Zoology

1. Parasitology by K.D.Chaterjee 21 edition

DSE-3WILD LIFE CONSERVATION AND MANAGEMENT

CREDITS: -4 Hours of Teaching -60 FM: 75 (External -60+ internal 15)

THEORY

Unit 1: Wild Life- Importance of conservation; Depletion & conservation

Unit 2:, Faecal analysis of ungulates and carnivores; Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit 3: 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/Bird Watching.

Unit 4: Protected areas -National parks and sanctuaries, community reserve; Important features of protected areas in India;

Project Tiger - Tiger reserves in India ;

Project Elephant

Red data book, IUCN, WWF

Recommended Books

1. **Techniques for wild life census in India: A field manual by W A Rdgers**
2. **Wild life ,conservation & management by A. R.E. Sinclair and Graeme James Caughley**
3. **Conservation Biology in Theory and practice by Graeme James Caughley**

DSE-4: PEST& PEST MANAGEMENT

CREDITS: -4 Hrs. of Teaching: 60 FM: 75 (60External 15Internal)

Group A

UNIT-1 Fundamentals of Pest management

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

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 : Mechanical, biological, chemical, genetic control.

Common pesticides and insecticides , Nomenclature , Mode of action ,

Tools & techniques for pesticide application

Group B

UNIT-3 Study of Pest in laboratory and field

Biology, damage and management of Pest of agriculture crops

Recommended Books

PEST & PEST MANAGEMENT

1. Pradhan S 91969)Insect pest of crops ,National book trust , India Book house
2. Dennis, S. Hill(2005)Agricultural Insect Pests of Tropics and their management
3. Atwal,A.S.(1993)Agriculture pest of India and south east Asia, Kalyani Pub.New Delhi
4. PedigoL.p.(2002)Entomology & Pest management Prentice hall publication
5. Kumar & Nigam –A Text Book of Entomology –Emkay Publications

Practicals based on DSE-3 and DSE-4
FM: 50 (external 40 + Internal 10)

Practicals	**Marks Distribution**
1. Identification of wild fauna on the basis of pug marks/pellet/nest	**10**
2. Comments on the common pest (2)	**10**
3. Comment on the photographs of endangered species	**05**
4. Comment on the equipment used in wild life study/pest management	**05**
5. Seasonal Records	**05**
6. Viva Voce	**05**
	40

DSE-3 Wild Life Conservation & Management

Suggested Practicals

DSE-3 PRACTICALS

1. Identification of mammalian fauna, avian fauna (Bird Watching) in near by national park./Zoological park /sanctuary
2. Demonstration of basic equipment needed in wildlife studies (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, pellet groups, nest, antlers etc. 4.visits to National park/ zoological park /protected areas
5. Study of endangered species through photographs

DSE-4: Pest & Pest Management

Suggested Practicals

1. Study of pest & infested plants
2. Collection, preservation and slide preparation of pest
3. Trip to ICAR governing field of your locality / FCI /agricultural field for study of pest
4. Study of instrument used in pest management (IPM)