अटल बिहारी वाजपेयी विश्वविद्यालय बिलासपुर

(छत्तीसगढ़)

सेमेस्टर पाठ्यक्रम

M.Sc. ZOOLOGY

SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER - I

Paper No.	Title of the Paper	Marks	
		External	Internal
I	Invertebrate structure and function, Minor Phyla	80	20
II	Animal Behaviour	80	20
III	Quantitative Biology	80	20
IV	Ecology and environmental physiology	80	20
	M.Sc. Zoology Lab Course I	100	
	M.Sc. Zoology Lab Course II	100	

SEMESTER - II

Paper No.	Title of the Paper	Marks	
		External	Internal
I	General & comparative endocrinology of vertebrates	80	20
II	Gamete biology and reproductive physiology in human beings	80	20
III	Molecular cell biology	80	20
IV	Tools and techniques for biology	80	20
	M.Sc. Zoology Lab Course I	100	
	M.Sc. Zoology Lab Course II	100	

SEMESTER - III

Paper No.	Title of the Paper	Marks	
		External	Internal
I	Comparative anatomy of vertebrates	80	20
II	Biosystematics, taxonomy & biodiversity	80	20
III	Immunology and developmental biology	80	20
IV	Population genetics & evolution	80	20
	M.Sc. Zoology Lab Course I	100	
	M.Sc. Zoology Lab Course II	100	

SEMESTER - IV

Paper No	Title of Paper	Marks	
		External	Internal
I	General physiology and neurophysiology (*compulsory*)	80	20
II	Biochemistry and metabolic regulation and cell function (*compulsory*)	80	20
Optional Group-I			

III	Fish(Ichthyology) structure and function	80	20
IV	Applied Fisheries	80	20
Optional Group-II			
III	Cell biology	80	20
IV	Cellular organization and molecular organization	80	20
Optional Group-III			
III	Entomology	80	20
IV	Applied Entomology	80	20
Optional Group-IV			
III	Wildlife conservation	80	20
IV	Environment and biodiversity conservation	80	20
	M.Sc. Zoology Lab Course I	100	
	M.Sc. Zoology Lab Course II	100	

Student has choice to opt. For any one group out of four optional groups.(Paper III and IV in semester four)

Each theory paper will have 5 questions of equal marks. First question will be compulsory encompassing all the five units without any internal choice, whereas rest questions will be unit wise with internal choice.

Internal Assessment shall comprise of two parts- Ten marks for test and ten marks for seminar/ assignment /presentation.

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M.Sc. ZOOLOGY

SEMESTER-I

PAPER-I

INVERTEBRATE STRUCTURE AND FUNCTION, MINOR PHYLA

Unit 1

- Origin of life unicellular and multicellular cellular organisms
- Body cavity-Acoelome, Pseudocoelome, Coelome
  Locomotion;
  Amoeboid movement, ultra structure of cilia and flagella, ciliary and flagellar movements
  Myonemes and muscle fibres in invertebrates, structure and their involvement in locomotive action

  Hydrostatic movements in Coelenterates, Annelida and Echinodermata

Unit 2

- Nutrition and digestion
  Patterns of feeding and digestion in lower metazoa
  Filter feeding in Polychaete, Mollusca and Echinodermata
- Respiration.
  Respiratory organs- Gills, Trachea and Lungs
  Physiology of Respiratory pigments in Invertebrates
  Mechanism of Respiration in invertebrate phyla

Unit 3

- Excretion
  Excretion in lower invertebrates -simple diffusion, contractile vacuole, protonephridea and Solenocytes
  Excretion in higher invertebrates – Coelom, Caelomoduct, Nephridia, Coaxal gland , malphigian tubes, organs of Bojanus and green gland
  Mechanism of excretion
- Nervous system.
  Primitive nervous system.-Coelenterata and Echinodermata
  Advances Nervous system- Annelida, Anthropoda(Crustacea and Insecta) and Mollusca (Cepholopoda) Torsion in Gastropoda.

Unit 4

- Invertebrate larval forms
  Larval forms of Trematoda and Cestoda
  Larval forms of Crustacea
  Larval forms of mollusca

Larval forms of Echinodermata

- Minor phyla
  Organization and general characters of-
- Ctenophora
- Rotifera
- Brachiopoda
- Acanthocephala

Suggested Reading Materials

1. Invertebrate structure and functions:-
   E. J. W Barrington English language Book Society UK
2. Invertebrate Zoology :-
   Robert Barnes IVth edition Holt Saunders International Edition Japan
3. The Cambridge Natural History Vol1-9
   S.F Harmer, A.E. Shipley
   Todays & Tomorrows Book Agency, N Delhi India
4. A text book on Zoology Invertebrate
   Park Hasvell, Marshall & Williams, AITBS
   Publishing & Distributers, Delhi
5. The invertebrates Vol. 1-9
   Libbic Henrietta Hyman, McGraw Hill Book Company

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SEMESTER-I
PAPER-II
ANIMAL BEHAVIOUR

Unit 1

- **Introduction-**
  Introduction to Ethology
  History of Ethology, observation and Description
  Ethology as a branch and its significance
  Methods of studying behaviour
- **Ecological aspects of behaviour-**
  Food selection and feeding behaviour
  Antipredator defences
  Aggression
  Territoriality
  Innate Behaviour

Unit 2

- **Perception of the environment**
  Mechanical
  Electrical
  Olfactory
  Auditory
  Visual
- **Communication**
  Chemical
  Visual
  Light
  Audio
  Species specificity of Songs
  Evolution of Languages
- **Neural and Hormonal Control of Behaviour**

Unit 3

- **Social Behaviour**

a. Aggregations

Schooling in Fishes
Flocking in Birds
Herding in Animals

b. Group selection
Kin selection
Altruism

c. Social Organization in insects and primates

- **Reproductive Behaviour**
  Reproductive strategies
  Mating System
  Courtship
  Sexual selection

Unit 4

- **Biological rhythms**
  Circadian and circannual rhythms
  Orientation and navigation
  Migration of fish and birds
- **Learning and memory**
  Conditioning
  Habituation
  Insight Learning
  Associative Learning
  Reasoning

Suggested Reading Material

1. Alcock. J Animal Behaviour : An evolutionary approach. SinauerAsoc. Sunderland, Mass. USA
2. Bradbury, J.W. and Vehrencamp S.L, Principles of animal communication, Sinauer Assoc. Sunderland, Mass, USA
3. Clutton-Brock, T.H. The evolution of Parental Care, Princeton University, Press Princeton NJ, USA
4. Eibl-Eibesfeldt, I. Ethology. The biology of behaviour. Holt , Rinehart & Winston, New York
5. Goud, J.L The mechanisms and evolution of behaviour
6. Hauser, M. he evolution of communication, MIT press , Cambridge, Mass, USA
7. Hinde, R. A Animal Behaviour: The synthesis of Ethology and Comparative psychology McGrawHill, New York
8. Krebs, J.R. and N.B. Davier : Behavioural Ecology. Blackwell, Oxford, UK
9. Wilson, E.O Sociobiology : The new synthesis Harvard University Press, Cambridge

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SEMESTER-I
PAPER-III
QUANTITATIVE BIOLOGY

Unit 1

- **Basic mathematics for biologists**
  Matrices and vectors
  Exponential functions
- **Biostatics**
  Collection and presentation of data, Tabulation, diagrammatic and graphical presentation

Unit 2

- General ideal about normal, binomial and poisson distribution
- Measures of Central tendencies –Mean, Median ,Mode, Standard Error
- Mean and standard deviation , Variance
- Hypothesis testing-t test, chisquare test, f test

Unit 3

- Probability theory, distribution and their properties
- Correlation
- Regression
- Analysis of Variance

Unit 4

- **Mathematical Modelling**
  Types of models-statistical, empirical and mechanistic , simulation
  Properties of models- generality, precision and realism
  Detailed treatment of model of cycling of nutrients in an ecosystem

Suggested reading materials:-

1. Batschelet, E. Introduction to mathematics fr site scientist , springer-verlag , Berling
2. Jorgenser, S.E. Fundamental of Ecological Modelling E. sevier New York
3. Lenderen D Modelling in behavioural ecology, chapman & Hall London U.K
4. Sokal, R.R and F.J Rohit Biometry Freeman San Fransisco
5. Snedecor, G. W and W.G Cochran, Statistical methods, AffliatedEast , West Press New Delhi (Indian ed.)
6. Murray, J.D Mathematical Biology, Springer Verlag Berlin

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SEMESTER-I
PAPER-IV
ECOLOGY AND ENVIRONMENTAL PHYSIOLOGY

Unit 1

- **Ecology:-**

  Abiotic, Climatic, Edaphic and Biotic Factors
  Limiting Factors
  Biogeochemical cycle-Nitrogen, Phosphorous, Sulphur, Carbon and Water Cycle
  Community Ecology-Biotic community, community structure and its characteristics, Ecotone and Edge effects
  Ecological Succession

- **Adaptation:-**

  Levels of adaptation
  Types of adaptation
  Significance of body size
  Physiological adaptation to different Environment of-
  a)Marine b)Freshwater c)Terrestrial d)Extreme aquatic & extreme terrestrial

Unit 2

- **Population Ecology**

  Exponential growth
  Logistic growth model
  Stochastic and time lag model of population growth

- **Demography**

  Life table
  Net reproductive rate
  Reproductive value

- **Population regulation**

  Extrinsic mechanism
  Intrinsic mechanism

- **Models of pray-predator dynamics**

Unit 3

- **Pollution Ecology**

  Definition and types of pollution
  Bio indicator of pollution
  Environment and impact assessment

- **Environmental toxicology**

Toxic chemicals
Toxicity, toxicants and mechanisms of action

- **Environmental Issues**

Green House gases
Ozone Depletion
Environmental awareness programmes

Unit 4

- **Stress Physiology**

Basic concept of stress and strain , stress resistance, stress tolerance and stress avoidance
Adaptation-acclimatization and acclimation
Concept of homeostasis
Endothermy and Physiological mechanisms of regulation of body temperature
Osmoregulation in aqeous and terrestrial environment
Physiological response to Oxygen deficient stress
Physiological response to body exercise
Meditation, yoga and their effects

Suggested reading material

1. Eckert, r Animal Physiology : Mechanism and adaptation W.H. freeman & co, NY
2. Environmental Physiology: Pat Willmer, Grahum Stone
3. Hochanchka, P.W. and Somero, G.N:Biochemical Adaptation, Princeton NJ
4. Hoar, W.S General and comparative animal physiology, Prentice hall of India
5. Schiemdt Nielsen, animal Physiology : adaptation and environment, Cambridge
6. Strand, F.L Physiology: Regulatory systems approach, Macmillan Pub Co,NY
7. Pummer,L. Practical Biochemistry, Tata McGraw Hill
8. Prosser, C.L. Environmental and metabolic animal physiology, Willey-Liss Inc. NY
9. Wilson,K. and Walker,J. Practical Biochemistry
10. Wilmer, P.G.Stoneand, Johnston, environmental Physiology. Blackwell Sci Oxford
11. Newell, R.C(ed.)1976 Adaptation to environment Essays on the physiology of marine animals , Butterworths , London , UK
12. Townsend, C.R. and P. Calow : Physiology Ecology : an evolutionary approach to resource use, Blackwell Sci. Publ.Oxford, UK
13. Alexander, R.M.N. Optima for animals Princeton Univ press, Princeton NJ

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SEMESTER-I

LAB-COURSE I

Time-06 Hours
Max. Marks-100

Invertebrates

1. Study of non-chordates through museum specimen
2. Study of permanent slides of non-chordates
3. Dissection of representative types (invertebrates)
4. Squilla, Mytilus, Sepia, Aplysia, Echinus

5. Mounting-

Permanent and suitable stained micro-preparation

Earthworm-nerve ring, ovary, spermathecal, nephridia
Cockroach-mouth parts , salivary glands, trachea
Prawn appendages, statocyst
Protozoan- rhizopods, flagellates and ciliates (fresh water forms) prolozoon ullase
Porifera-spicule sand gemmules of fresh water sponges
Crustaceans and rotifers
Larval forms of the free living invertebrates

Animal behaviour-

6. Experiments related to Animal Behaviour

Feeding behaviour in house fly
Life cycle of Lac insect and honey bee (chart/model/material)
Study of structural organization of the bee hive
Learning behaviour-
Conditioned and unconditioned reflex

7. Projects-

a)Visit to study the management of following->
Fish farm, dairy farm, poultry farm, sericulture and apiculture
b) Study of Invertebrate local fauna
c) Any other relevant topic

Student should prepare a report and submit

Note-

1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act
2. External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or colourable species without paining them

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SEMESTER-I
LAB-COURSE I

Time-06 Hours
Max. Marks-100

Distribution of marks in practical exam

1. Spotting (1-10)-invertebrates	(20)
2. Mounting	(10)
3. Dissection (virtual)	(10)
4. Exercises based on behaviour (Two exercises)	(30)
5. Viva	(10)
6. Sessional	(20)
Total =	**100**

M.SC. SEMESTER I
LAB-COURSE II

Quantitative Biology

1. Collection methods of different types of data
2. Data analysis- tabulation
3. Different graphical and diagrammatic methods of data presentation
4. Calculation of central tendencies based on given data
5. Application of parametric and non-parametric tests
6. ANOVA
7. Study of model types
8. Exercises based on regression
9. Exercise based on correlation

Ecology and Environmental Physiology

10. Study of animals showing adaptation to different environments
11. Soil analysis physical and chemical composition of soil
12. Effect of physical exercise on blood pressure
13. Exercise based on blood glucose level
14. Carbonates and nitrates from soil sample
15. Determination of free CO_2 and salinity in pond

Note-

1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act
2. External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or culturable species without paining them

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M.SC. SEMESTER I
LAB-COURSE II

Time-06 Hours
Max. Marks-100

Distribution of marks in practical exam

1. Exercises based on biostatics (Three)	(30)
2. Exercises based Soil and Water analysis (Two)	(20)
3. Exercises based on Physiology (Two)	(20)
4. Viva	(10)
5. Sessional	(20)
Total =	100

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SEMESTER-II

PAPER-I

GENERAL AND COMPARATIVE ENDOCRINOLOGY OF VERTEBRATES

Unit 1

- **AIMS and scope of endocrinology**

  Discovery of hormones

  Classification of endocrine glands and hormones

  Experimental methods of hormones research

- **Comparative morphology of Endocrine tissue**

  Pituitary gland

  Thyroid, Adrenal

  Gastrointestinal tract

  Juxtaglomerular apparatus (kidney)

Unit 2 (*15 Lectures*)

- **Life history of horones-**

  Biosynthesis of hormones

  - Biosynthesis of simple peptide hormone
  - Biosynthesis of amino acid derived small size hormone (T3,T4, epinephrine and nor-epinephrine
  - Biosynthesis of steroid hormone (cortisol, cortisone, cortico sterone, progesterone Release of hormone from endocrine gland
  - Releasing stimuli
  - Pulsatile release of hormone
  - Releasing mechanism

- **Concentration and transport of hormone in the blood**
- **General mechanism of hormone action**

  Plasma membrane hormone receptor and its action

  Cgksolic hormone receptor and its action

- **Termination of hormone action and metabolism of hormone**

Unit 3 (*15 Lectures*)

- **Neuro-endocrine system-types of neuro-hormones, synthesis and function of endorphins, enkephalin and hypothalanic hormones**

- **Synthesis, function control and disorder of following endocrine gland hormones**

Pituitary hormones
Adrenal hormones
Thyroid and parathyroid hormones
Gastro-intestinal hormones
juxta-glomerular hormones

Unit 4 (*15 Lectures*)

- **Hormonal regulation and its metabolic activity**

Role of hormone in –

- Carbohydrate metabolism
- Protein metabolism
- Fat metabolism
- Calcium metabolism

- **Role of hormone in fasting**
- **Hormone & behaviour**
- **Role of hormone in growth & development**

Suggested Reading Materials-

1. General & comparative endocrinology : E.J.W. Barrington, oxford, Clarendon Press
2. Text book of Endocrinology : R.H. Williams, W.B Saunders
3. Endocrine Physiology : C.R Martin, Oxford Univ. Press
4. Comparative endocrinology : A. Gorbman et al, john Wiley and sons
5. Medical Physiology : W.F. Ganong(1981) :10th edition Lange Medical Publications
6. Principles of anatomy and physiology : Torota Grabowski, 9th edition, John Wiley & sons
7. Reproductive Physiology of vertebrates: Van Tienhoven, A,(1983) 2nd edition Cornell Univ.Press,NY
8. The pituitary gland :Imura.H(1994)2nd editionCompreshensive Endocrinology revised series Raven, NY
9. Comparative vertebrate endocrinology : Bentley, PJ.(1976),Cambridge Univ. press, Cambridge
10. Comparative vertebrate endocrinomental: Bentley, P.J(1976) Cambridge Univ. press, Cambridge
11. Invertebrate endocrinology:D.B. Temblare,Himalaya Publishing house
12. Endocrinology : Hardley
13. Endocrinology : Negi

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SEMESTER-II

PAPER-II

GAMETE BIOLOGY & REPRODUCTIVE PHYSIOLOGY IN HUMAN BEINGS

Unit 1

- **Endocrinology of sex differentiation & judgment-**
  Chromosomal (genetic) basis of sex determination
  Gonadal sex
  Phenotypic sex
  Brain sex differentiation
- **Reproductive cycle-**
  Adrenarche
  Pubarche and puberty
  Ovarian cycle
  - Formation of ova
  - Luteal cycle
  - Uterine cycle
  - Menstruation cycle

  Estrous cycle

Unit 2 (*15 Lectures*)

Male reproductive system-

Anatomy, physiology and morphology of male reproductive system
Spermatogenesis and development of spermatozoa
Biochemistry of semen
Endocrine function in male-
Endocrine control of testicular function
Chemistry and biosynthesis of androgens
Secretion transport and metabolism of testis hormone
Physiological role of androgens-

- Role in spermatogenesis
- Secondary sex characteristics
- Anabolic function

Physiological roles of estrogens in male

- Fertility
- Male behaviour
- Epiphyseal fusion

Unit 3 (*15 Lectures*)

- **Female reproductive system**

Anatomy of female reproductive system-

- Ovary
- Fallopian tube
- Uterus

Oogenesis

- **Ovarian hormones**

Chemistry, biosynthesis, secretion, transport, function, action and metabolism of Estrogens Progesterone and Relaxin
Control of ovarian function
Abnormalities of ovarian function

Unit 4 (*15 Lectures*)

- **Fertilization**
  Pre-fertilization event
  Biochemistry of fertilization
  Post fertilization event
- **Collection and cryopreservation of gamete and embryo**
- **Formation and development of placenta and its endocrine function**
- **Role of hormone in Paturition and Lactation**
- **Hormonal and immune contraception**

Suggested reading material-

1. Developmental Biology, 2nd edition,Leon, W.B Saunders College publishing
2. Current topics in Developmental Biology eds. R.A.Pederson and G.P. Schatten
3. Principles of animal development biology : S.C. Goel, Himalaya Publishing house
4. Developmental biology, S.F Gilbert, 4th edition, Sinauer Assoc. Inc. Publishers
5. An introduction to Developmental biology : D.A. Ede
6. Principles of Developmental Biology : Paul Weiss edited by HafnerPublishngCo.,NY
7. Cells into organs : 2nd edition The forces that shape the embryo John PhillipTrinkaused, Tom Aloisi
8. Principles of development :LewisWolpert et al 1998. Oxford Univ. Press
9. Foundations of embryology ; B.M Pattern & B.M. Carlson, Tata McGraw Hill Publications ,New Delhi
10. An introduction to embryology : Balinsky 1981 5th ed. (CBS College ublishing)
11. Embryonic and foetal development Cambridge Univ press. By Austin and Short 1982,1992 2nd ed.
12. Marshall physiology of reproduction : Longmont Green and Co. London Vol 1 and 2 , lamming 1984,2000
13. Developmental biology; Gudrick
14. Endocrinology : Hardley
15. Endocrinology : Negi.

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SEMESTER-II
PAPER-III
MOLECULAR CELL BIOLOGY

Unit 1

- **Biomembranes**
  Structure,molecular composition and function of plasma membrane
  Specialization pf plasma membrane
  Transport across cell membrane,diffusion, facilitated diffusion, ion channel, active transport and pumps, Uniports, Symports and Antiports

Unit 2

- **Cytoskeleton-**
  Microfilaments and microtubules-structure and dynamics
  Role of microtubules in mitosis
  Cell movements- intracellular transport role of kinesin and dynein
  Signal transduction mechanism
- **Cilia and flagella**

Unit 3

- **Cell cycle and its controlling mechanism check points in cell cycle regulations CDK's and cyclase**
- **Cell-cell Signalling-General idea**
- **Cell-cell adhesion and communication**
  Ca++ dependent homophyllic cell-cell adhesion
  Ca++independent homophyllic cell-cell adhesion
- **Cell matrix and adhesion**
  Integrins
  Collagens
- **Cell organelles**
  Structure and function of mitochondria, ribosomes, golgi bodies, endoplasmic reticulum

Unit 4

- **Genome organization**
  Morphological and functional elements of Eukaryotic chromosome
  Morphology of giant chromosome
  DNA- structure, replication and genetic code, RNA-structure, transcription and transposon
- Intracellular protein traffic
  Protein synthesis on free and bound polysomes
  Uptake into E.R
  Uptake into mitochondria
- Biology of cancer

- Biology of ageing
- Apoptosis-definition, mechanism and significance

Suggested reading materials

1. Molecular cell biology : J.H Darnell, H. Lodish and D. Baltimore Scientific American book Inc USA
2. Molecular biology of the cell, : B.Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, and J.D. Watson, Garland Publishing Inc NY
3. Molecular cell biology : P.K Gupta
4. Molecular cell biology : D Robertis

SEMESTER-II
PAPER-IV
TOOLS AND TECHNIQUES FOR BIOLOGY

Unit 1

- **Principal and use of analytic instruments**
  Balances, pH meter, colorimeter, spectrophotometer, ultra centrifuge
- **Microscopy**
  Principle of light transmission, Electron (SEM, TEM)phase contrast, Fluorescence,

Unit 2 (*15 Lectures*)

- **Microbiological techniques**
  Media preparation and sterilization
  Inoculation and growth monitoring
- **Cell structure techniques**
  Design and function of tissue culture laboratory
  Culture media preparation
  Cell harvesting method
  Cell viability testing
  Cell proliferation measurements

Unit 3 (*15 Lectures*)

- **Cryotechniques**
  Cryopreservation for cells tissues and organisms
  Cryotechniques for light microscopy
  Cryotechniques for electron microscopy
- **Immunological techniques based on antigen antibody interactions**

Agglutination and precipitation

- **Biosensors**

Unit 4 (*15 Lectures*)

- **Separation techniques in Biology**
  Molecular separations by chromatography and its different types
  Electrophoresis- paper and gel
  Organelle separation by centrifugation
  Cell preparation by density gradient, centrifugation affinity adsorption

Suggested Reading materials

1. Introduction to instrumental analysis-Robert Braun , McGraw Hill Publication
2. A biologist guide to principles and techniques of practical biochemistry-K, Wilson and K;HGoulding EBS Edn.
3. Clark and Swizer, Experimental Biochemistry, Freeman, 2000
4. Locquin and Langeron, Handbook of Microscopy, Butterwaths, 1983
5. Boyer, Modern Experimental Biochemistry, Benjamin, 1993

SEMESTER-II

LAB-COURSE I

General & comparative endocrinology of vertebrates

1. **Dissection of various endocrine glands of vertebrates (Fishes, Amphibians, Reptiles, Birds, Mammals, any available animals/ Virtual)**
2. **Dissection of various endocrine glands of insects (Cockroach/any other insect, any available animals/ Virtual)**
3. **Study of microscopic slides of endocrine and related structures**
   - **T.S. Pituitary,T.S. of Thyroid,T.S. of Parathyroid,T.S. of Adrenal,T.S. of Testes,T.S. of Ovary, T.S. Thymus,T.S. of Kidney, T.S. og Heart, T.S. of Stomach,T.S. of Intestine**
4. **Effect of epinephrine on chromatophores of fishes**
5. **Biochemical estimation of cholesterol content in adrenal tissue, glycogen in uterine tissue**
6. **Microtomy-block preparation, section cutting, stretching and straining Gamete biology and reproductive physiology in human beings**
7. **Study of Estrous cycle in mouse or rat**
8. **Preparation on Blastodisc of hen's egg**
9. **Formation of egg window in chicken egg**
10. **Collection of developmental stages of eggs of Lymnea or any gastropod**
11. **Collection of developmental stages of insects/ fishes**
12. **Study of development stages of frog through slides and whole mounts.**
13. **Study of development stages of chick through slides and whole mounts.**
14. **Slide preparation (earthworm ovary, amphibian, reptiles, birds and mammals testes & ovary.)**

Note-

1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act
2. External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or culturable species without paining them

अटल बिहारी वाजपेयी विश्वविद्यालय बिलासपुर

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M.Sc. ZOOLOGY

अटल बिहारी वाजपेयी विश्वविद्यालय बिलासपुर

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M.Sc. ZOOLOGY

SEMESTER-II
LAB-COURSE I

Time-06 Hours
Max. Marks-100

Distribution of marks in practical exam.

1. Dissection of Endocrine glands /virtual	(10)
2. Spotting (Endocrine glands& Embryology)	(20)
3. Cytological preparation/preparation of estrogen cycle	(10)
4. Microtomy	(20)
5. Preparation of egg window and Blastodisc	(10)
6. Viva	(10)
7. Sessional	(20)

Total = 100

SEMESTER-II
Lab-course II

Molecular cell biology

1. Study of Prokaryotic and Eukaryotic cells
2. Study of permanent slides -Mitosis, Meiosis and cell organelles
3. Temporary squash preparation to show mitosis and meiosis
4. Preparation of giant chromosomes, barr bodies
5. Histological study of cancer cells

Tools and techniques for biology

6. Use of balance Ph meter, colorimeter, centrifuge spectrophotometer, camera Lucida etc.
7. Molecular separation by Chromatography, Electrophoresis
8. Media preparation
9. Cell culture
10. Colorimetric estimation of glucose, protein, RNA, DNA
11. Absorption spectrum of any coloured solution
12. Histochemical techniques

Note-

1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act

2. External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or culturable species without paining them

SEMESTER-II
LAB-COURSE II

Time-06 Hours
Max. Marks-100

Distribution of marks in practical exam.

1. Spotting (mitosis and meiosis, Tools & Techniques)	(20)
2. Exercise based on cell Biology	(10)
3. Chromatography	(20)
4. Colorimetric estimation	(10)
5. Application of different instruments	(10)
6. Viva	(10)
7. Sessional	(20)
Total =	100

SEMESTER-III
PAPER-I
COMPARATIVE ANATOMY OF VERTEBRATES

Unit I

- Origin of Chordates- Amphibians, Reptiles , Birds and Mammals
- Classification of vertebrates up to orders with examples.

Unit II

Vertebrate integument and its derivatives. Development and general structure and function of skin and its derivatives. Glands, Scales, Horns, Claws, Nails, Hoofs, Feathers and Hairs.

- Evolution of Heart, Evolution of aortic arches.

Unit III

1. Digestive system comparative account of digestive organ
2. Respiratory system : Comparative account of respiratory organs.
3. Skeletal system : Comparative account of Jaw Suspensorium, Vertebral column- Development of vertebra and vertebral column, types of vertebra, Limbs and Girdles.

Unit IV (15 Lectures)

- Comparative account of Urinogenital system in vertebrate series.
- Comparative account of Brain and Spinal cord in vertebrate series.
- Sensory receptors

Suggested Reading Material

1. Alexander, R.M. The Chordata. Cambridge University Press, London
2. Bourne,, G.H. The structure and functions of nervous tissue. Academic Press, NY
3. Carter, G.S. Structure and habit in vertebrate evolution - Sedgwick & Jackson, London
4. Kingsley, J.S. Outlines of Comparative Autonomy of Vertebrates, Central Book Depot, Allahabad.
5. Malcom Jollie, Chordata morphology, East-West Press Pvt., New Delhi.
6. Milton Hilderbrand. Analysis of vertebrate structure. IV Ed. John Wiley, NY
7. Tansley, K. Vision in Vertebrate. Chapman and Hall Ltd., London.
8. Walters, H.E. and Sayles, L.D. Biology of Vertebrates. Macmillan & Co., NY
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia.
10. Young, J.Z. Life of Vertebrates. Oxford University Press, London.
11. Montagna, W. Comparative anatomy. John Wiley & Sons Inc.

12. Andrews, S.M. Problems in Vertebrate Evolution. Academic Press, NY
13. Waterman, A.J. Chordata structure and function. Macmillan Co., New York
14. Lovtrup, S. The Phylogeny of Vertebrate, John Wiley & Sons, London.

SEMESTER-III
PAPER-II
Biosystematics and Taxonomy

Unit 1

- **Definition and basic concepts of biosystematics and taxonomy.**
  Historical resume of systematics
  Importance and applications of biosystematics in biology
- **Trends in biosystematics concepts of different conventional and newer aspects**
  Chemotaxonomy
  Cytotaxonomy
  Molecular taxonomy

Unit 2

- **Dimensions of speciation and taxonomic characters**
  Mechanisms of speciation in panmctic and apomictic species
  Species concepts and species category
  Theories of biological classification
  Taxonomic characters and different kinds

Unit 3

Procedure keys in taxonomy
Taxonomic procedures-taxonomic collections, preservation, curetting
Taxonomic keys-different kinds of taxonomic keys, their merits and demerits
Process of typification and different Zoological types
International code of Zoological Nomenclature (ICZN)

Unit 4

- **Biodiversity**
  Types of Biodiversity
  Hot spots of Biodiversity
  Threats to Biodiversity
  Conservation of Biodiversity
- **Evaluation of biodiversity indices**
  Shannon-Weiner index

Suggested reading materials-

1. Biosystematics & Taxonomy Dr.R.C. Tripathi, University Book House JAIPUR

2. Theory & Practice of Animal Taxonomy V.C. Kapoor, 5th Edition Oxford & IBH Publishing Co.
3. Principle of Animal Taxonomy G.G. Simpson, Oxford & IBH Publishing Co
4. Elements of axonomy Earnst Mayer
5. Biodiversity E.O. Vilson, Acadmic Press Washington
6. The Biology of Biodiversity M. Kato, Springer
7. Molecular Markers - Natural History & Evolution J.C. Avise

SEMESTER-III
PAPER-III
IMMUNOLOGY AND DEVELOPMENTAL BIOLOGY

UNIT- I

- Innate and Acquired immunity
- Cell and Organs of Immune System

  Organization and Structure of Lymphoid organs

  Cells of the immune system & their differentiation

  Lymphocyte traffic
- Nature of Immune response
- Nature of Antigens

  Antigenicity and Immunogenicity

  Factor influencing immunogenicity

  Antigenic determinates/epitopes andheptens

UNIT- II

- Antibodies (Immunoglobulins)

  Structure & Function of antibodies

  Immunoglobulin Classes & Subclasses
- Antigen- Antibody interaction
- B Cell Maturation, Activation and Differentiation

  B- Cell Receptors

  B- Cell Activation and Proliferation

  Humoral Immune Response Kinetics
- T- Cell maturation activation and differentiation

T- Cell Receptors

T- Cell Activation and Proliferation

T- Cellular Immune Response

UNIT- III

- Compliment System & it regulation

  Consequence of Compliment Activation

- Major and Minor Histo- compatibility Complex

  Structure of MHC molecule

  Peptide interaction with MHC molecule

  Cellular distribution and regulation of MHC expression

  MHC & Susceptibility to infections disease

  MHC & Susceptibility to infections disease

- Hyper sensitivity and immune responses to infection agents especially intra cellular parasites

UNIT- IV

Cleavage (Segmentation) and its Significance

Gastrulation

Tubulation and extension of the Major Organ- forming Areas: Development of Primitive body form

Basic Feature of Vertebrate Morphogenesis

- Histogenesis and Morphogenesis of the Organ System

  The Cardio Vascular Specjallr System

  The Nervous System

Suggested Reading Materials –

Immunology by Kuby, W. H. Froeman USA
Fundamental of Immunology by W. Paul
Essential Immunology by M. Rohit, ELBs Edition
Immunology by Richard M. Hyde, Robert A. Patnode, A Wiley Medical Publications
Reproductive Physiology by Guyton

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M.Sc. ZOOLOGY

BILASPUR UNIVERSITY, BILASPUR

M.Sc. Semester III

Zoology

M.Marks= 100
Theory = 80
Internal = 20

Paper IV Population Genetics and Evolution (60 Periods)

Unit I

Concept of Evolution and theories of Organic Evolution with an emphasis on Darwinism, Neutral Theory of Evolution

- Neo-Darwinism -
  - Hardy-Weinberg Law of genetic equilibrium.
  - A detailed account of destabilizing forces –

(i) Natural Selection (ii) Mutation (iii) Genetic drift (iv) Migration (v) Meiotic drive.

Unit II

- Genetics of speciation.
  - Models of speciation (Allopatric, Sympatric and Parapatric).
  - Patterns and mechanisms of reproductive isolation.
- Genetics of Quantitative traits in population.
  - Analysis of quantitative traits.
  - Inbreeding depression and heterosis.

Unit III

- Molecular Evolution
  - Gene Evolution
  - Origin of Higher categories
  - Major trends in origin of higher categories.
  - Macro and micro Evolution
- Molecular phylogenetics.
  - How to construct Phylogenetic trees ?
  - Amino acid sequence and phylogeny
  - Molecular Clock.

Unit IV

- Quantifying genetic variability
  - Genetic structures of natural population
  - Phenotypic variation
- Molecular population Genetics
  - Patterns of change in nucleotide and amino acid sequence
  - Emergence of non Darwinism- Neutral theory
  - Genotype environment interaction
- Population Genetics and ecology
  - Metapopulations

- **Why small populations become extinct**
- **Conservation of genetic resources in diverse texa**

Suggested Reading Material

1. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press.
2. Dobzhansky, Th., F.J.Ayala, G.L.Stebbines and J.M.Valentine. Evolution. Surjeet Publication, Delhi.
3. Futuyama, D.J. Evolutionary Biology, Suinaer Associates, INC Publishers, Dunderland.
4. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates Inc., Massachusetts.
5. Jha, A.P. Genes and Evolution, John Publication, New Delhi.
6. King, M. Species Evolution - The role of chromosomal change. Cambridge University Press, Cambridge.
7. Merrel, D.J. Evolution and Genetics. Holt, Rinchart and Winston Inc.
8. Smith, J.M. Evolutionary Genetics. Oxford University Press, New York.
9. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston, London

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M.Sc. ZOOLOGY

M.Sc. Semester III

Zoology Practical

Lab-course I

(Comparative Anatomy)

1. Dissection of animals :- Amphioxus, Scoliodon, Electric ray, Sting ray, Calotis, Bird head, Rat (Subject to availability of material) / study through alternative methods of dissection.
2. Micro preparation of suitable and available material.
3. Study of the representative examples of different classes of Chordates.
4. Study of permanent slides showing whole mount or section as per Theory syllabus, including embryological slides of Frog and Chick.
5. Osteology of Amphibia, Reptile, Bird, Mammal.
6. Study of animal diversity by field trip and excursion, Extension activity to spread health awareness. Students have to submit project report.

Biosystematics, taxonomy & Biodiversity

1. Study of biodiversity among various invertebrates and vertebrates (Listing of all the animals found in and around your house and also try to find out their Zoological names)
2. Collection of various insect species
3. Visits to a local animal park or zoo to identify and study the captive fauna and preparation of report
4. Study of adaptive characteristics of various invertebrates and vertebrates in different climate
5. Taxonomic key formation and conversion
6. Study of biodiversity in grassland and pond water by using Shannon - Weiner index .

M.Sc. Semester III

Zoology Practical

Lab-course I

Time-06 Hours

Max. Marks-100

Distribution of marks in practical exam.

1. Dissection of Vertebrate (virtual/other method) (10)
2. Spotting 1 to 10 (20)
3. Micro preparation (10)

4. Exercises related to Taxonomy. (Three) (30)

5. Viva (10)
6. Sessional (20)

Total = 100

M.Sc. Semester III

Zoology Practical
Lab-course II

Immunology and developmental Biology

1. Dissection of Primary and secondary immune organ from mice
a. Preparation of single suspension from bone marrow
b. Cell counting and vigbility testing of the spleenocytes prepared
2. Preparation and study of phagocytosis by spleenic peritoneal macrophase.
3. Raising polyclonal antibody in mice, serum collecton and estimating antibody titre in serum by following method-
a. Ouchterlony (double diffusion) assay for antigen-antibody specificity and titre.
b. ELISA
4. Antibody purification from the serum collected from immunized mice, affinity purification chromatography
5. Blood group testing A, B ,O ,AB AND Rh factor
6. Indused Breeding in Frog
7. Culture of chick Embryo in Vitro
8. Study of chick embryos by vital staiting
9. The Technique for the whole mount preparation of chick embryo
10. Demonstration of Cell death
11. Study of Mitosis (a) Techniques for chromosomes preparation (b) Preparation of Meiotic chromosomes for Grosshopper testies (c) Auto Rediography

Population Genetics and Evolution

a. i. An experiment related to quantitative genetics, genotypic frequencies in light of hardy weinberg law

ii. ABO blood group data

b. Numeric exercise related to-

i. Natural selection

ii. Changing gene frequency
Chromosomal Polymorphism

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M.Sc. Semester III
Zoology Practical

Lab-course II
Time-06 **Hours**
Max. Marks-100

Distribution of marks in practical exam.

1. Dissection showing primary and secondary immune organ of mice virtual / other method	**(10)**
2. Exercise related to immune response	(20)
3. Exercise related to developmental biology/ Preparation of egg window and Blastodisc	**(10)**
4. Exercises related to quantitative genetics / hardy Weinberg law	**(20)**
5. Exercise related to natural selection	**(10)**
6. Viva	**(10)**
7. Sessional	**(20)**
Total =	**100**

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M.Sc. ZOOLOGY

M.Sc. Semester IV
Zoology

M.Marks= 100
Theory = 80
Internal = 20

Paper- I Neuro Physiology & General Physiology

UNIT – I (*15 Lectures*)

- Central Nervous System Gross Anatomy of Spinal Cord.
- Histological structure of Nervous tissue Neurons and Neurogalia & its function.
- The Meninges, Neurotrophins & Cerebro spinal Fluid (CSF) and its function.
- Physiological Properties of nerve fibres and mechanism of conduction of Nerve Impules in Non-medullated and medullated Nerve fibre.
- Nerve endings (Bio-Analyzers)

UNIT – II (*15 Lectures*)

- Synapse – structure, Properties and its reuptake mechanism.
- Neuro transmitters : Classification, structure, recepters, function and metabolism.
- The Cranial and spinal Nerves.
- Autonomic Nervous system: Sympathetic and parasympathetic system with special comparison to hormonal mechanism of transmission through autonomic nerves system .

UNIT – III (*15 Lectures*)

- Feeding Mechanism and comparative Physiology of Digestion.
  - Various digestive juices, its composition, function and mechanism of secretion.
  - Physiology of digestion for carbohydrate, Protein, fat & Nucleic acid and its absorption.
- Circulation of Body Fluid and its regulation.
  - Structure, function of Heart, synthesis & composition of Blood, Blood group system.
  - Blood Cougulation & De-fibrinisation.

- Cardiac cycle Heart sound and ECG.
- Respiratory system and Physiology of Respiration .
- Structure of respiratory track.
- Breathing Physiology.
- Transport of Gases
- Oxygen carriage
- Carriage of Carbon di-oxide.
- Tissue Respiration .

UNIT – IV (*15 Lectures*)

- Contractile elements and its Physiology .
- Properties of Skeletal, Smooth & Cardiac Muscle.
- Structure of Muscle.
- Ultra & Molecular of Structure of Muscle.
- Structure of Sarcoplasmic reticulum & its role in Muscle Contraction.
- Theories and Physiology of muscle contraction.
- Changes during muscle contraction.
- Enzyme used in muscle contraction.
- Pattern of Nitrogen Excretion and its Physiology.
- Excretory Substance .
- Physiology of liver for excretion.
- Structure of kidney and its Excretory Physiology.
- Fromation of Urine.
- Regulation of body temperature.
- Pyraxia
- Hypothermia.

Suggested Reading Materials

1. The Brain : Our Nervous System by Seymour Simon
2. Mass Action in the Nervous system by Walter J. Freeman
3. Human Anatomy and Physiology with Interactive physiology 10-system Suite, 8th Edition by Elaine N. Marieb and Katja N. Hoehn (jan 10, 2010)
4. Neuroanatomy by H. G. Snell
5. Clinical Neurophysiology- Guide for Auther- Slsevier
6. Foundations of cellular Neurophysiology (Bradford Books) Daniel Johnston
7. Medical physiology by Ganong
8. Medical physiology by Gyaton
9. Human Anatomy and Physiology by Tor Tora
10. Human Physiology by G. C. Chatterji

M.Sc. Semester IV
Paper II Biochemistry ,
Metabolic Regulation and Cell Function (60 Periods)

M.Marks= 100
Theory = 80
Internal = 20

UNIT- I (*15 Lectures*)

- Water the solvent of life
  - Chemistry of water
  - Function and regulation of water balance
- General Structure of Monosaccharide
  - Nomenclature, Definition and Classification
  - Formation of Monosaccharide – Formation of glucose
    - Linear form
    - Ring form
    - Hawarth perspective formate
- Occurrence, Chemistry, Properties & hydrolysis of Oligosaccharides (Sucrose, Lactose, Maltose, Cellobiose, Isomaltose & Trehalose)
- Structure of Polysaccharides (Starch, Glycogen, Cellulose, Hyaluronic acid, Chondroitin and Heparin)
- Metabolism of Carbohydrate
- General Structure, Classification and function of Lipids
- Lipid Metabolism.

UNIT- II (*15 Lectures*)

- Biosynthesis of Amino Acids and Structure & Properties
  - Chemical bond – Peptide Bond
  - Secondary bond – Disulfide ,Hydrogen, Non polar or hydrophobic and Ionic or Electrostatics bond
  - Characteristic of Chemical bond

- Protein Configuration

(a)Primary Structure (b) Secondary Structure (c) Tertiary Structure (d) Quaternary Structure

- Biological function and metabolism of Protein
- Metabolism of Inorganic elements
  - Macro- Minerals
  - Micro – Minerals

UNIT- III (*15 Lectures*)

- Nucleic Acid
  - Chemistry of DNA & RNA
  - Nucleo Proteins
  - Metabolism of Nucleic Acid (Anabolism & Catabolism)
  - Biological importance of Nucleic Acid
- Eicosanoids
- Vitamin
  - Water & Fat Soluble Vitamin
  - Chemistry, Occurrence and Physiological role of Vitamins

UNIT- IV (*15 Lectures*)

- Enzymes
  - Nomenclature and Classification
  - Co- enzyme, Isoenzyme or Isozyme & Lysozyme
  - Biological role of enzyme
  - Properties and Characteristics of enzyme
  - Three Dimensional Structure of enzyme
  - Enzyme Inhibitors and activators
  - Mechanism of enzyme action
- Biological Oxidation
  - Mitochondrial Electron Transport Chain
  - Oxidative Phosphorylation
  - Utilization of Krebs Cycle

- Enzyme & Co – enzyme involved in oxidation & reduction

Suggested Reading Materilas-

1. Lehninger Principles of Biochemistry, Fourth Edition
David L. Nelson, Michael M. Cox Publisher : W. H. Freeman
2. Biochemistry
Donald Voet, Hardcover : 1616 Pages Publisher : Wiley, 3rd Edition
3. Principles of Biochemistry with a Human Focus
Reginald H. Garrett, Charles M. Grisham Publisher : Brooks Cole
4. The Molecular Basis of Cell Cycle and Growth Control
Gray S. Stein (Editor), Renato Baserga, Antonio Giordano, David T. Denhardt, Publisher : Wiley- Liss
5. Experiments in Biochemistry : A Hands – on Approach
Shawn o. Farrell, T. Ranallo Publisher : Brooks Cole
6. Analysis of CD Effect on liver, Stomach and Intestine of Carp Fish by Hundet, A.
7. Histological and Histochemical staining techniques by Homason

M.Sc. Semester IV
Zoology

M.Marks= 100
Theory = 80
Internal = 20

Optional Group I : Paper III Fish (Icthyology) Structure and Function (60 Periods)

Unit 1 (*15 Lectures*)
- Origin and evolution of fishes
- Classification of fishes as proposed by Berg
- Fish integument
- Locomotion
- Alimentary canal and digestion

Unit 2 (*15 Lectures*)
- Accessary respiratory organs
- Air bladder and its functions
- Weberianossicles their homologies and functions
- Excretion and osmoregulation
- Acoustic-lateral line system

Unit 3 (*15 Lectures*)
- Luminous organs
- Colouration in fishes
- Sound producing organs
- Deep sea adaptions
- Hill stream adaptions

Unit 4 (*15 Lectures*)
- Migration in fishes
- Sexual cycle and fecundity
- Parental care in fishes
- Early development and hatching
- Poisonous fishes.

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M.Sc. Semester IV

Zoology

M.Marks= 100

Theory = 80

Internal = 20

Optional Group I : Paper IV Applied Fisheries (60 Periods)

Unit 1 (*15 Lectures*)

- **Introduction**
- **Colouration in fishes**
  - Physical colors,chemicalcolors,mixedcolor factors (temperature stimulation,light adaptive significance)
- **Common diseases of fishes and their care**
  - Skin parasites and diseases, diseases of gills,diseases caused by bacteria and viruses
- **Economic value of fishes**
  - Fishes as human food, fish for cattle,fishmanure, fish glue and insinglass fish leather
- **Luminous organs**

Unit 2 (*15 Lectures*)

- **Fresh water fishes of Chhattisgarh and their culture**
- **Maintenance of nursery rearing and stocking ponds**
- **Marine fisheries**
  - Deep sea, coastal, and off shore fisheries
- **Fishing method in sea coast**
  - Crafts of east and west coast, other methods(Nets and Gears, electric fishing, light fishing)
- **Riverine and cold water fisheries**

Unit 3 (*15 Lectures*)

- **Reservoir fisheries-**
  - Distribution of reservoir fisheries
- **Lacustrine fisheries-**
  - Lake types , principle lake fisheries
- **Estuarine fisheries**
- **Fish farming**
- **Principal cultivable fishes**

Unit 4 (*15 Lectures*)

- **Larvivorious fishes**
- **Exotic and transplanted fishes**
- **Planktons-its role in pollution of water and fisheries**
- **Preparation and maintenance of aquarium**

- **Induced breeding**

Suggested reading materials

1. Zingron-Fish and fisheries in India
2. Gavelander-Fish biology
3. KarkLegler-Fresh water fisheries
4. Nikolaski-Fish biology
5. Identification of fishes-Days fauna
6. E.Khanna-Introduction to fish
7. Parihar-Fish biology
8. Norman-Introduction to fishes
9. Mishra-Identification of fishes in India

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M.Sc. Semester IV
Zoology
Optional Group II : Paper III Cell Biology (60 Periods)

M.Marks= 100
Theory = 80
Internal = 20

Unit-1 (*15 Lectures*)

- Molecular organization of eukaryotic chromosomes
  - structure of nucleosome particles and higher order compaction of mitotic chromosomes, chromatin re-modelling
- specialized chromosomes:
  - structural organization and functional significance of polytene chromosomes
- DNA methylation specialized chromosomes II
  - structural organization and functional significance of lamp brush chromosome.

Unit-2 (*15 Lectures*)

- Structural organization of Eukaryotic genes, interrupted genes and overlapping genes and their evolution
- Gene families:
  - Organization, evolution and significance
- Transposable genetic elements of prokaryotes and eukaryotes
- Organisation of eukaryotic transcriptional machinery promoter enhancers transcription factors polymerase activators and repressors.
- DNA binding domains of transcription apparatus zinc finger steroid receptors hemeo domains HELIX-loop, Helix and Leucine Zipper

Unit-3 (*15 Lectures*)

- Eukaryotic transcription and Environmental control
- Environmental modulation of gene activity Molecular basis of thalasemias muscular dystrophy cystic fibrosis
  - DNA rearrangement
  - Amplification during development

  - **Unit-4 (*15 Lectures*)**
- Drosophila development

(a) Cleavage (b) Gastrulation Origin of Anterior –Posterior (Maternal effect genes and segmentation genes

- Drosophila development and origin of dordal ventral polarity
- Basic idea of homoetic selector genes Homeotic mutation and its significnce

Suggested Reading Materials:

1. Robertis, De and Robertis Cell and molecular biology Lea and Febiger.

2. Watson Hopkis Roberts Steitz Weiner, Molecular Biology of the Gene the Benjamin, Cummings Publishin Company inc.

3. Bruce A; berts Bray ewis Raff Roberts Watson Molecular Biology of the Cell,Garland Publishing inc.

4. Watson Gilman WitkowskiZoller Recombinant DNA Scientific American Books

a) Karp Gerald Cell Biology

b) LewinB.,Genes VII

c) King Cell Biology

d) Kaniel L. Hartl, Elizabeth W. Jones. Genetics Principals and Analysis, Jones and Bartlett Publishers.

5. Kuby, Immunology, W.H. Freeman and Company

6. Roitt Male Snustad Immunology.

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M.Sc. ZOOLOGY

BILASPUR UNIVERSITY, BILASPUR

M.Sc. Semester IV

Optional Group II : Paper IV Cellular and Molecular Organisation

(60 Periods)

M.Marks= 100
Theory = 80
Internal = 20

Unit-1 (*15 Lectures*)

- **General organization and characterizes of viruses (Examples SV 40 and HIV)**
- **Yeast**
  - Structure, reproduction and chromosome organization
  - Basic ideas of its applications as vectors for gene cloning
- **Molecular organization of reoiratory chain assemblies,**
- **Cell cycle-**Cell cycle control in mammalian cells and xenopus
- **Cytochemistry of Golgin complex and its role in cell secretion**

Unit-2 (*15 Lectures*)

- **Peroxisomes and training of paroxysmal proteins**
- **Nucleolus**
  - Structure and Biogenesis and functions of lysosomes
- **Intracellular digestion**
  - Ultra structure and function of lysosomes
- **Synthesis and targeting of mitochondrial proteins**
- **Secretary pathways and translocation of secretary proteins across the EPR membrane**

Unit-3 (*15 Lectures*)

- **Genome complexity**
  - C- value [paradox and cot value]
- **DNA sequences of different complexity**
- **Difference between normal cells and cancer cells**
  - Biochemical changes
  - Cytoskeleton changes
  - Cell surface changes
- **Genetic basis of human cancer**

Unit-4 (*15 Lectures*)

- **Chromosomal abnormalities in human cancer**
- **General idea of onchogens and proto onchogens**
- **Onchogence and cancer**
- **Transforming Agents**
- **TumorSupressorgeanes**

- **Receptor – Ligand interaction and signal transduction. Cross – talk among various signaling pathways.**

Suggested Reading Materials:

1. DeRobertis and De Robertis Cell and Molecular Biology. Lea and Febiger
2. We Watson Hopkingrebertssteits, Weiner molecular biology of the gene, the Benjamin / Cummings Publishin Company Inc.
3. Bruce alberts, Bray, Lewis, Raff, Roberts, Watson molecular Biology of the cell garland publishing inc.
4. P.K. Gupta, Molecular Cell Biology Rastogi Publication.
5. Watson Gilman Witkowski, Zoller Recombinant D.N.A. scientific American Books
6. Gerald Karp. Cell Biology
7. Lewin B. Genes VII
8. King Cell Biology
9. Baniel L. Hartl Elizabeth W. Jones, Genetics Principles and analysis . Jones and Bartlett Publisher.
10. Lodish, Berk Zipursky, Matsudaira Baltimore Dernell Molecular Cell Biology W.H.Freeman and company
11. J. Travers Immunology current Biology limited
12. Kubey Immunology W.H. Freeman and Company
13. Riott, Male Snustad Principles of genetics John Weley and sons Inc.

BILASPUR UNIVERSITY, BILASPUR
M.Sc. Semester IV
Zoology

M.Marks= 100
Theory = 80
Internal = 20

Optional Group III : Paper III Entomology (Morphology and Physiology of Insects) (60 Periods)

Unit I (***15 Lectures***)

- Cephalisation and theories about cephalisation
- Head capsule, types of antennae and types of mouth parts
- Thorax, legs in locomotion and functional modification of legs
- Integument- Sclerotization and moulting
- Wing vanation- General and in the orders- Lepidoptera, Diptera, Hymenoptera, Coleoptera and Hemiptera

Unit II (***15 Lectures***)

- Digestive system and physiology of digestion
- Excretory organs, excretion and osmoregulation
- Respiratory structure and respiration
- Respiratory adaptation in aquatic and endoparasitic insects
- Circulation, Haemocytes and blood coagulation

Unit III (***15 Lectures***)

- Nervous system- Principle modifications
- Photoreception, mechanoreception chemoreception
- Sound producing structure and functions
- Bioluminiscence, reproduction and metamorphoses and Diapause

Unit IV (***15 Lectures***)

- Internal and external organization of reproductive organs
- Endocrine control of reproduction and metamorphoses
- Dwevelopment- Embryonic and Post embryonic
- Types of Larvae
- Types of Pupae

BILASPUR UNIVERSITY, BILASPUR
M.Sc. Semester IV
Zoology

M.Marks= 100
Theory = 80
Internal = 20

Optional Group III : Paper IV Entomology (Taxonomy, Economic Entomology and Pest Control) (60 Period

UnitI (***15 Lectures***)

- History of Insect classification, Basis of classification
- Brief concept of all insect orders
- Characters and classification upto principal families of following orders-

a. Thysanura b. Collembola c. Orthroptera
d. Hemiptera e. Mallophaga f. Lepidoptera
g. Diptera h. Hymenoptera & i. Coleoptera
(Insect classification as per Essigs's College entomology)

Unit II (***15 Lectures***)

- Classification, life cycle, Control measures, and Economic Importance of the following-
- Important pests of Paddy
- Important pests of Sugarcane
- Important pests of Pulses in the field eg Gram, Pea, Arhar,
- Important pests of Vegetables- Bringel, Cabbage, Cauliflower, Lady finger and cucumber

UnitIII (***15 Lectures***)

- Classification, Life cycle, economic importance and control measures of stored grain pests- namely: Sitophilous oruzae, Corcyre cephalonica, Tregederma granarium, Tribolium casfeneum, Callosobruchus chinensis, Stotroga cerellela
- Life cycle Bionomics, Damage potential and control measures of Aphids and its phases
- Phases of Locust- Schistocerca gregarine, Phase theory of locust
- Social life in Insects
- Parasitism in Insects

Unit IV (***15 Lectures***)

Pest Control

- Physical and cultural control
- Chemical control
- Biological control
- Integrated pest control

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M.Sc. Semester IV
Zoology

M.Marks= 100
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Optional Group IV : Paper III Wildlife Conservation (60 Period)

Unit-1 (*15 Lectures*)

- **Wild life –**
  - Values of wild life - positive and negative
  - Our conservation ethics
  - Importance of conservation
  - Causes of depletion
  - World conservation strategies.
- **Habitat analysis, Evaluation and management of wild life.**
  - Physical parameters - Topography, Geology, Soil and water
  - Biological Parameters - food, cover, forage, browse and cover estimation
  - Standard evaluation procedures - remote sensing and GIS.
- **Management of habitats –**
  - Setting back succession
  - Grazing logging
  - Mechanical treatment
  - Advancing the successional process
  - Cover construction
  - Preservation of general genetic diversity

Unit-2 (*15 Lectures*)

- **Population estimation.**
  - Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation
  - Faecal analysis of ungulates and carnivores - Faecal samples, slide preparation,Hair identification, Pug marks and census method.
- **National Organization**
  - Indian board of wild life
  - Bombay Natural History Society
  - Voluntary organization involved in wild life conservation
- **Wild life Legislation - Wild Protection act - 1972, its amendments and implementation.**
- **Management planning of wild life in protected areas.**

- Estimation of carrying capacity

Unit-3 (*15 Lectures*)

- Eco tourism / wild life tourism in forests
- Concept of climax persistence.
- Ecology of pertuberence.
- Management of excess population & translocation
- Bio- telemetry.
- Care of injured and diseased animal.

Unit-4 (*15 Lectures*)

- Quarantine.
- Common diseases of wild animal
- Protected areas National parks & sanctuaries, Community reserve
- Important features of protected areas in India.
- Tiger conservation - Tiger reserve in M.P, in India.
- Management challenges in Tiger reserve.

Suggested Reading Materials:

1. . Gopal Rajesh : Fundamentals of wild life management
2. Agrawal K.C : Wild life India
3. Dwivedi A.P (2008) : Management wild life in India
4. Asthana D.K : Envionment problem and solution
5. Rodgers N.A &Panwar H.S : Planning of wild life / Protected area Network in India vol. the report, wild life Institute of India Dehradun
6. Odum E.P : Fundamentals of Ecology
7. Saharia V.B : Wild life in India
8. TiwariS.K : Wild life in Central India 9. E.P Gee : Wild life of India
9. Negi S.S : Wild life conservation (Natraj Publishers)

BILASPUR UNIVERSITY, BILASPUR
M.Sc. Semester IV
Zoology

M.Marks= 100
Theory = 80
Internal = 20

Optional Group IV : Paper IV Environment and biodiversity conservation (60 Period)

Unit 1 (*15 Lectures*)

- **Basic concept of Environmental Biology Scope and Environmental Science**
- **Biosphere and Biogeochemical cycles**
- **Environmental monitoring and impact assessment**
- **Environmental and sustainable development**
- **Water conservation, rain water harvesting, water shed management**

Unit 2 (*15 Lectures*)

- **Cause, effects and remedial measure of Air pollution, Water pollution**
- **Noise. radioactive and thermal pollution**
- **Agriculture pollution**
- **Basic concepts of Bioaccumulation**
- **Solid waste management**

Unit 3 (*15 Lectures*)

- **Global warming and disaster management**
- **Cause of global warming**

- **Impact of global warming – acid rains and ozone depletion, green house effect**
- **Control measures of global warming**

1. Afforestation (b) reduction in the use of CFCS

- **Disaster management -floods, earthquake, Cyclones landslides**
- **Environmental legislation**

Unit 4 (*15 Lectures*)

- **Natural Resources:-**
  - **Forest**
    - Use and over exploitation of forests
    - Timber extraction
  - **Land**
    - Land degradation. Landslides
    - Soil-erosion and desertification
  - **Water**
    - Use and over utilization of surface and ground water
    - Floods
    - Drought dams- benefits and problems
  - **Mineral**
    - Use and exploitation
    - Environmental effect of extracting and using mineral resources
  - **Food**
    - World food problem
    - Effects of modern agriculture and overgrazing
  - **Energy**
    - Conventional and nonconventional energy resources
    - Using of alternate energy sources
    - Role of an individual in conservation of natural resources
    - Equitable use of resources for sustainable life
    - Biodiversity crisis – habitat degradation poaching of wild life
    - Socio economic and political causes of loss of biodiversity
    - In situ and ex-situ conservation of biodiversity
    - Value of biodiversity

Suggested Reading Materials:

1. Arora : Fundamentals of environmental biology
2. Anathakrishnan : Bio-resources ecology
3. Bottain : Environmental studies
4. Bouhey : Ecology of populations
5. Clark : Elements of ecology
6. Dowdoswell : An introduction to animal ecology
7. Goldman : Limnology
8. Kormondy : Concepts of ecology

9. May : Model ecosystems
10. Odum : Ecology
11. Perkins : Ecology
12. Simmons : Ecology of estuaries and costal water
13. Pawlosuske : Physico-chemical methods for water
14. South Woods : Ecological methods
15. Trivedi and Goel : Chemical and biological methods for water pollution studies
16. Willington : Fresh water biology
17. Wetzal : Limnology
18. Welch : Limnology Vols. I-II

अटल बिहारी वाजपेयी विश्वविद्यालय बिलासपुर

(छत्तीसगढ़)

सेमेस्टर पाठ्यक्रम

M.Sc. ZOOLOGY

BILASPUR UNIVERSITY, BILASPUR

M.Sc. Semester IV

Zoology Practical
Lab-course I

A. Practical based on Paper I and Paper II as per Theory

1. Estimation of Protein by the Biuret, Lowry, Brad ford and Eosine-a comparasion
2. Determination of N-terminal Amino acids by the Sangers reagent (FDND)
3. Paper chromatographic separation of Amino acids
4. Quantitative estimation of Protein, carbohydrate, Mucosaccharide, Lipids and Enzyme (Bromphenol blue, PAS, Alcian blue, aldehyde fucsin, Acetylcholinestrase technique)
5. Identification of hypothalamic nuclei histological, hystochemical and Immunocytochemical method
6. Isolation and characterization of Pituitary cell
7. Estimation of MAC, MCH and MCHC
8. Total count of WBC and RBC
9. Differetial count of WBC
10. Haemoglobin estimation and PCV estimation or ESR estimation
11. Quantitative estimation of blood serum by Colorimetry (I) Blood Urea (II) Blood glucose (III) Blood Calcium (IV) Blood Creatine (V) Blood cholesterol (VI) Blood Protein (VII) Blood Albumin
12. Blood clotting time
13. ECG Recording
14. Blood Pressure estimation
15. EEG

M.Sc. Semester IV

Zoology Practical

Lab-course I

Time-06 Hours

Max. Marks-100

Distribution of marks in practical exam.

1. Estimation of Protein	(10)
2. estimations of, carbohydrate, Mucosaccharide, Lipids and Enzyme (two exercises)	(20)
3. Exercise based on histochemical and Immuno-cytochemical method	(10)
Exercises based on haematology. (two exercises)	(20)

Exercise based on ECG/EEG	(10)
4. Viva	(10)
5. Sessional	(20)

Total = 100

BILASPUR UNIVERSITY, BILASPUR

M.Sc. Semester IV

Zoology Practical
Lab-course II

Practical (Special Paper Fishes)

1. Anatomy of different systems of Fresh water Fishes through dissections
2. Osteology of Fishes
3. Microscopic Preparation
4. Taxonomic study of Fishes through Museum specimen and collection
5. Identification of Fresh water Fishes of Chhattisgarh up to species level
6. Field work/ Industry visit and preparation of Record

M.Sc. Semester IV

Zoology Practical

Lab-course II

Time-06 Hours

Max. Marks-100

Distribution of marks in practical exam.

1. Dissection of fresh water fish /Virtual		(10)
2. Spotting (1 to 10)	(20)	
3. Slide preparation	(10)	
4. Identification of fresh water fishes		(20)
5. Project Report and field visit		(10)
6. Viva	(10)	
7. Sessional	(20)	

Total = 100

BILASPUR UNIVERSITY, BILASPUR

M.Sc. Semester IV

Zoology Practical
Lab-course II

Practical (Special Paper – Group II Cytology)

1. **Examination of different cell types in Vertebrate tissue**
2. **Contrast Microscopy**
3. **Photomichrography**
4. **Study of permanent cytological preparation**
5. **Squash preparation of chromosomes and preparing karyotype**
6. **Preparation of Giant Chromosomes and demonstration of puffs**
7. **Golgi material and Mitochondrial preparation**
8. **Demonstration of Barr body and drum stick**
9. **Histochemical demonstration of RNA DNA phospholipid and enzyme**
10. **Microbial culture media preparation and microbial growth**
11. **Molecular separation by chromatography and Electrophorasis**

M.Sc. Semester IV

Zoology Practical

Lab-course II
Time-06 **Hours**
Max. Marks-100

Distribution of marks in practical exam.

1. **Spotting (1to 10)** **(20)**
2. **Exercise based on cytological preparation** (10)
3. **Exercise based on histochemical preparation** (10)
4. **Molecular separation by chromatography and Electrophorasis** (20)
5. **Exercise based on microbiology/ karyotype study** (10)

6. Viva	(10)
7. Sessional	(20)

Total = 100

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M.Sc. Semester IV

Zoology Practical
Lab-course II

Practical (Special Paper – Group III Entomology)

1. Collection, Preservationand classification of the insects of order :- Thysaneura, Collembola, Orthoptera, Hemiptera, Lepidoptera, Mallophaga, Diptera, Hymenoptera and Coleoptera
2. Dissectionof Grasshopper, Cockroach, Cricket, wasp, and honey bee, with special reference to their Nervous system, Salivary gland, Endocrine gland, Sting apparatus, of honey bee, reproductive organs of Grasshopper and cockroach.
3. Whole mounts of small insects eg Collembola, Thysaneura, bedbug, louse, stored grain pests
4. Whole mount of different types of legs, antennae, wings, mouth parts, salivary glands and scales
5. Microtomy of Insect materials
6. Simple experiment on Insect Physiology
7. Identification of common insect pests
8. Collection of life cycle of the pest of any economic crop

M.Sc. Semester IV

Zoology Practical

Lab-course II

Time-06 **Hours**

Max. Marks-100

Distribution of marks in practical exam.

1. Dissection of Available insect pests /Virtual		**(10)**
2. Spotting (1 to 10)	(20)	
3. Micropreparation	**(10)**	
4. Experiment based on insect physiology (10)		
5. Identification of common insect pests		**(10)**
6. Project Report and field visit		**(10)**
7. Viva	**(10)**	
8. Sessional	**(20)**	

Total = 100

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M.Sc. Semester IV

Zoology Practical
Lab-course II

Exercises based on paper III – Wild life conservation
Exercises based on paper IV - **Environment and biodiversity conservation**

M.Sc. Semester IV

Zoology Practical

Lab-course II

Time-06 **Hours**

Max. Marks-100

Distribution of marks in practical exam.

1. paper III – Wild life conservation		**(35)**
2. Environment and biodiversity conservation		**(35)**
3. Viva	**(10)**	

4. Sessional	(20)

Total = 100