SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER I

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Invertebrate: Structure and Function, Minor Phyla	20	80	100
2.	Animal Behaviour	20	80	100
3.	Quantitative Biology	20	80	100
4.	Ecology and Environmental Physiology	20	80	100
LAB I	Practical/Lab Course - I	-	-	100
LAB II	Practical/Lab Course - II	-	-	100
			TOTAL	**600**

SEMESTER II

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	General & Comparative Endocrinology of Vertebrates	20	80	100
2.	Gamete Biology and Reproductive Physiology In Human Beings	20	80	100
3.	Molecular Cell Biology	20	80	100
4.	Tools and Techniques For Biology	20	80	100
LAB I	Practical/Lab Course - I	-	-	100
LAB II	Practical/Lab Course - II	-	-	100
			TOTAL	**600**

SEMESTER III

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	Comparative Anatomy Of Vertebrates	20	80	100
2.	Biosystematics, Taxonomy & Biodiversity	20	80	100
3.	Immunology and Developmental Biology	20	80	100
4.	Population Genetics & Evolution	20	80	100
LAB I	Practical/Lab Course - I	-	-	100
LAB II	Practical/Lab Course - II	-	-	100
			TOTAL	**600**

SEMESTER IV

Student has choice to opt for any 01 group out of 04 optional groups. (Paper III and IV in semester IV)

Paper No.	Title of the Paper	Internal Assessment	Term End Exam	Total Marks
1.	General Physiology and Neurophysiology (*Compulsory)*	20	80	100
2.	Biochemistry , Metabolic Regulation and Cell Function (*Compulsory)*	20	80	100
LAB I	Practical/Lab Course - I	-	-	100
Optional Group-I ICTHYOLOGY				
3.	Fish-Structure and Function	20	80	100
4.	Applied Fisheries	20	80	100
Optional Group-II CYTOLOGY				
3.	Cell Biology	20	80	100
4.	Cellular Organization and Molecular Organization	20	80	100
Optional Group-III ENTOMOLOGY				
3.	Entomology	20	80	100
4.	Applied Entomology	20	80	100
Optional Group-IV WILD LIFE & ENVIRONMENT				
3.	Wildlife Conservation	20	80	100
4.	Environment and Biodiversity Conservation	20	80	100
LAB II	Practical/Lab Course - II (From any One Group)	-	-	100
			TOTAL	**600**
			GRAND TOTAL	**2400**

Internal Assessment shall comprise of 02 parts- 10 marks for test and 10 marks for seminar/ assignment /presentation.

SEMESTER-I
PAPER-I
INVERTEBRATE STRUCTURE and FUNCTION, MINOR PHYLA

UNIT 1

Origin of life unicellular and multi-cellular 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, Coaxalgland ,malphigian tubes, organs of Bojanus and green gland**,** Mechanism of excretion**,** Nervous system. Primitive nervous system.- Coelenterata and Echinodermata, Advanced Nervous system-Annelida, Anthropoda (Crustacea and Insecta) and Mollusca (Cephalopodan) 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
2. Invertebrate Zoology, Robert Barnes IVth edition
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

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**,** Anti-predator 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- Aggregations

Schooling in Fishes, Flocking in Birds, Herding in Animals

Group selection-Kin selection, Altruism

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 Socio-biology : The new synthesis Harvard University Press, Cambridge

SMESTER-I
PAPER-III
QUANTITATIVE BIOLOGY

UNIT 1

Basic mathematics for biologists-Matrices and vectors, Exponential functions.
Biostatistics-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, chi-square 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

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 effect, 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

SEMESTER-I
LAB-COURSE I

Invertebrates

Study of non-chordates through museum specimen

Study of permanent slides of non-chordates

Dissection of representative types (invertebrates) (any available animal)/study through alternative methods of dissection virtual or model any other method virtual/demonstration *Squilla, Mytilus, Sepia, Aplysia, Echinus*

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)

Porifera-spicule sand gemmules of fresh water sponges

Crustaceans and rotifers

Larval forms of the free living invertebrates

Animal behaviour-

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

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 studied it should be either pest or culturable species without paining them

Distribution of marks in practical exam

1.	Spotting (1-10)-invertebrates	(20)
2.	Mounting	(10)
3.	Dissection (through alternative methods)	(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

1. Study of animals showing adaptation to different environments
2. Soil analysis physical and chemical composition of soil
3. Effect of physical exercise on blood pressure
4. Exercise based on blood glucose level
5. Carbonates and nitrates from soil sample
6. 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 studied it should be either pest or culturable species without paining them

M.SC. SEMESTER I
LAB-COURSE II

Distribution of marks in practical exam

1.	Exercises based on biostatistics (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

SEMESTER-II
PAPER-I
GENERAL and COMPARATIVE ENDOCRINOLOGY OF VERTEBRATES

Unit 1

AIMS and scope of endocrinology-Types of chemical messengers, Discovery of hormones, Classification of endocrine glands and hormones, Experimental methods of hormones research

Comparative morphology of Endocrine tissue-Hypothalamus, Pituitary gland Thyroid, parathyroid, Adrenal, Gastrointestinal tract, Juxta-glomerular apparatus (kidney), Heart

Unit 2

Life history of hormones--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**,** Systolic hormone receptor and its action

Termination of hormone action and metabolism of hormone

Unit 3

Neuroendocrine system-types of neurohormones, synthesis and function of endorphins, encephalin etc.

Synthesis, function and disorder of following endocrine gland hormones- Pituitary hormones, Adrenal hormones, Thyroid and parathyroid hormones, Gastro-intestinal hormones, Juxta-glomerular hormones, Hormones of heart, Synthesis and function of ecosanoid specially Prostaglandin and Luketerineand its hormonal role

Unit 4

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 : Hadley
13. Endocrinology : Negi

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 differentiation of the internal and external genitalia**,** Brain sex differentiation

Reproductive cycle-Adrenarche**,** Pubarche and puberty**,** ovarian cycle**,** Formation of ova**,** Luteal cycle**,** Uterine cycle**,** Menstruation cycle**,** Menopause**,** Estrous cycle

UNIT 2

Male reproductive system-Anatomy, physiology and morphology of male reproductive system**,** Spermatogenesis and development of spermatozoa**,** Biochemistry of semen**,** Phallus erection**,** Ejaculation**,** Y-specific probes

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**,** Nervous system**,** Secondary sex characteristics**,** Anabolic function**,** Aging**,** Physiological roles of estrogens in male**,** Fertility**,** Male behaviour**,** Epiphyseal fusion**,** Cardio vascular function**,** Mechanism of androgen action and Pathophysiology

UNIT 3

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

Fertilization-Pre-fertilization event**,** Biochemistry of fertilization**,** Post-fertilization event

Collection and cryopreservation of gametes and embryo

Formation and development of placenta and its endocrine function

Role of hormone in Parturition 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 publishing)
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 Vol1 and 2, lamming 1984,2000
13. Developmental biology; Gudrick
14. Endocrinology: Hadley
15. Endocrinology: Negi

SEMESTER-II
PAPER-III
MOLECULAR CELL BIOLOGY

Unit 1

Bio-membranes-Structure, molecular composition and function of plasma membrane**,** Specialization of 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, ribosome, 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, repetitive data**,** RNA-structure, transcription and Transposons**,** 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, Microphotography, Camera Lucida

Unit 2

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

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

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/study through alternative methods of dissection virtual or methods any other method)
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 studied it should be either pest or culturable species without paining them

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

1. Use of balance Ph meter, colorimeter, centrifuge spectrophotometer, camera Lucida etc.
2. Molecular separation by Chromatography, Electrophoresis
3. Media preparation
4. Cell culture
5. Colorimetric estimation of glucose, protein, RNA, DNA
6. Absorption spectrum of any coloured solution
7. 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

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

Respiratory system: Comparative account of respiratory Organs. Skeletal system: Comparative account of Jaw Suspensorium, Vertebral column- Development of vertebra and vertebral column, types of vertebra, Limbs and Girdles.

Unit IV

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. MalcomJollie, 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 axonomyEarnst 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 and heptens.

UNIT- II

Antibodies (Immunoglobulin's), 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, Complement Component, Regulation of Compliment System, Consequence of Compliment Activation, Major and Minor Histocompatibility Complex Inheritance of HLA System, Location and Function, Structure of MHC molecule, Peptide interaction with MHC molecule, Cellular distribution and regulation of MHC expression, MHC & Susceptibility to infectious disease, Hyper sensitivity and immune responses to infectious agents especially intra cellular parasites

UNIT- IV

The development of Primitive Embryonic form, Cleavage (Segmentation) and Blastulation, Chordate Blastula and its Significance, The late Blastula in relation to Certain Innate Physiological Conditions: Twinning Gastrulation, Tabulation 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 System, The Nervous System.

Suggested Reading Materials –

1. Immuniology by Kuby, W. H. Froeman USA
2. Fundamental of Immunology by W. Paul
3. Essential Immunology by M. Rohit, ELBs Edition
4. Immunology by Richard M. Hyde, Robert A. Patnode, A Wiley Medical Publications
5. Reproductiove Physiology by Guyton

SEMESTER-III
PAPER-IV
POPULATION GENETICS and EVOLUTION

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, Meta-populations, Why small populations become extinct? Conservation of genetic resources in diverse taxa

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. SurjeetPublication, 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

SEMESTER-III
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 dissection or virtual or another method.
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/ college premises 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.

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

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

SEMESTER-III
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 viability testing of the spleenocytes prepared
2. Preparation and study of phagocytosis by splenetic peritoneal macrophage.
3. Raising polyclonal antibody in mice, serum collection 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. Induced Breeding in Frog
7. Culture of chick Embryo in Vitro
8. Study of chick embryos by vital staining
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 Grasshopper testis (c) Auto Radiography

Population Genetics and Evolution

1. (a) An experiment related to quantitative genetics, genotypic frequencies in light of hardy Weinberg law
   (b) ABO blood group data
2. Numeric exercise related to Natural selection
3. Changing gene frequency (a) Chromosomal Polymorphism

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

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

SEMESTER-IV
PAPER-I
NEURO PHYSIOLOGY & GENERAL PHYSIOLOGY

UNIT – I

Central Nervous System Gross Anatomy of Brain & Spinal Cord. Histological structure and Origin of Nervous tissue Neurons and Neuroglia & its function. The Meninges, Neurotrophins & Cerebrospinal Fluid (CSF) and its function. Physiological Properties of nerve fibres and mechanism of conduction of Nerve Impulse in Non-medulated and medulated Nerve fibre. Nerve endings (Bio-Analyzers) Electrical activity of Brain, EEG-Electroencephalography and its Physiological basis.

UNIT – II

Synapse – structure, Properties and its reuptake mechanism. Neurotransmitters: Classification, structure, receptors, function and metabolism. Spinal cord and the ascending descending tracks. The Cranial and spinal Nerves. Autonomic Nervous system: Sympathetic and parasympathetic system with special comparison to hormonal mechanism of transmission through autonomic nervous system. Reflex action and sensation.

UNIT – III

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 of Heart. Structure, function, synthesis & composition of Blood & lymph. Blood group system. Blood Coagulation & Defibrinisation. Cardiac cycle and pressure and volume changes in heart and blood vessels during Cardiac Cycle. Heart sound and ECG. Respiratory system and Physiology of Respiration . Structure of respiratory track. Breathing Physiology. Transport of Gases, carriage of Oxygen & Carbon di-oxide. Tissue Respiration. Respiratory diseases: Asphyxia, Hyperpnea, Anoxia etc.

UNIT – IV

Contractile elements and its Physiology. Properties of Skeletal, Smooth & Cardiac Muscle. Structure of Muscle. Ultra & Molecular 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 Substances. Physiology of liver for excretion. Structure of kidney and its Excretory Physiology. Fromation of Urine and Micturition. Regulation of body temperature. Pyrexia 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. Human Anatomy and Physiology by Tor Tora
9. Human Physiology by C. C. Chatterjee

SEMESTER-IV
PAPER-II
BIOCHEMISTRY, METABOLIC REGULATION and CELL FUNCTION

UNIT- I

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 Howarth perspective format, 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

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, 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

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

UNIT- IV

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 Materials-

1. Lehninger Principles of Biochemistry, Fourth Edition
   David L. Nelson, Michael M. Cox Publisher: W. H. Freeman
2. Biochemistry
   Donald Voet, Hard cover: 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. RanalloPublisher : 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 Thomason

SEMESTER-IV
PAPER-III
OPTIONAL GROUP-I ICHTHYOLOGY
FISH: STRUCTURE AND FUNCTION

UNIT 1
1. Origin and evolution of fishes
2. Classification of fishes as proposed by Berg
3. Fish integument
4. Locomotion
5. Alimentary canal and digestion

UNIT 2
1. Accessory respiratory organs
2. Air bladder and its functions
3. Webberian ossicles their homologies and functions
4. Excretion and osmoregulation
5. Acoustic-lateral line system

UNIT 3
1. Luminous organs
2. Colouration in fishes
3. Sound producing organs
4. Deep sea adaptations
5. Hill stream adaptations

UNIT 4
1. Migration in fishes
2. Sexual cycle and fecundity
3. Parental care in fishes
4. Early development and hatching
5. Poisonous fishes.

SEMESTER-IV
PAPER-IV
OPTIONAL GROUP-I ICHTHYOLOGY
APPLIED FISHERIES

UNIT 1

Introduction, Colouration in fishes- Physical colours, chemical colours, mixed colour 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, fish manure, fish glue and isinglass, fish leather

Luminous organs

UNIT 2

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

Reservoir fisheries- Distribution of reservoir fisheries

Lacustrine fisheries- Lake types, principle lake fisheries

Estuarine fisheries

Fish farming

Principal cultivable fishes

UNIT 4

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. Khanna-Introduction to fish
7. Parihar-Fish biology
8. Norman-Introduction to fishes
9. Mishra-Identification of fishes in India

SEMESTER-IV
PAPER-III
OPTIONAL GROUP-II CYTOLOGY
CELL BIOLOGY

Unit-1

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 and DNAase-1 Hypersensitivity in relation to gene activity and chromatin organization. Specialized chromosomes II structural organization and functional significance of lamp brush chromosome. Organisation and significance of heterochromatin.

Unit-2

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 Gene imitation and molecular mechanism of occurrence of mutation repair mechanism Organisation of eukaryotic transcriptional machinery promoters, 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

Eukaryotic transcription of Eukaryotic transcriptional control, Environmental modulation of gene activity (stress response) stress genes and stress proteins, Molecular basis of thalasemia, muscular dystrophy, cystic fibrosis, DNA rearrangement, Amplification during development with special response to (a) Ciliates (b) Chlorine gene (c) 58 RNA genes

Unit-4

Drosophila development
(a) Cleavage (b) Gastrulation Origin of Anterior–Posterior (Maternal effect genes and segmentation genes
Drosophila development II origin of dordal ventral polarity
Basic idea of homoetic selector genes and homeotic mutation
Basic idea of organization of homeoboxes
Evolutionary significance of homeoboxes

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.

SEMESTER-IV
PAPER-IV
OPTIONAL GROUP-II CYTOLOGY
CELLULAR and MOLECULAR ORGANISATION

UNIT-1

1. **General organization and characterizes of viruses (Examples SV 40 and HIV)**
2. **Yeast-**Structure, reproduction and chromosome organization**,** Basic ideas of its applications as vectors for gene cloning
3. **Molecular organization of respiratory chain assemblies, ATP / ADP Translocate and F0F1 ATPase**
4. **Cell cycle-**Cell cycle control in mammalian cells and xenopus
5. **Cytochemistry of Golgi complex and its role in cell secretion**

UNIT-2

1. **Peroxisomes and training of paroxysmal proteins**
2. **Nucleolus-**Structure and Biogenesis and functions of Lysosomes
3. **Intracellular digestion-**Ultra structure and function of Lysosomes
4. **Synthesis and targeting of mitochondrial proteins**
5. **Secretary pathways and translocation of secretary proteins across the EPR membrane**

UNIT-3

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

UNIT-4

1. **Chromosomal abnormalities in human cancer**
2. **General idea of oncogenes and proto-oncogenes**
3. **Oncogence and cancer**
4. **Transforming Agents**
5. **Tumour Suppressor genes**
6. **Receptor–Ligand interaction and signal transduction. Cross–talk among various signalling 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.

SEMESTER-IV
PAPER-III
OPTIONAL GROUP-III ENTOMOLOGY
MORPHOLOGY AND PHYSIOLOGY OF INSECTS

Unit I

1. Cephalisation and theories of cephalisation
2. Head capsule, types of antennae and types of mouth parts
3. Thorax, legs in locomotion and functional modification of legs
4. Integument- Sclerotization and moulting
5. Wing venation-General and in the orders- Lepidoptera, Diptera, Hymenoptera, Coleoptera and Hemiptera

Unit II

1. Digestive system and physiology of digestion
2. Excretory organs, excretion and osmoregulation
3. Respiratory structure and respiration
4. Respiratory adaptation in aquatic and endoparasitic insects
5. Circulation, Haemocytes and blood coagulation

Unit III

1. Nervous system- Principle modifications
2. Photoreception, mechanoreception chemoreception
3. Sound producing structure and functions
4. Bioluminiscence, reproduction and metamorphoses and Diapause

Unit IV

1. Internal and external organization of reproductive organs
2. Endocrine control of reproduction and metamorphoses
3. Development- Embryonic and Post embryonic
4. Types of Larvae
5. Types of Pupae
6. Diapause

SEMESTER-IV
PAPER-IV
OPTIONAL GROUP-III ENTOMOLOGY
TAXONOMY, ECONOMIC ENTOMOLOGY AND PEST CONTROL

Unit I

1. History of Insect classification, Basis of classification
2. Brief concept of all insect orders
3. 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
4. Insect classification as per Essigs's College entomology.

Unit II

1. Classification, life cycle, Control measures, and Economic Importance of the following-
   a. Important pests of Paddy
   b. Important pests of Sugarcane
   c. Important pests of Pulses in the field eg Gram, Pea, Arhar,
   d. Important pests of Vegetables- Bringle, Cabbage, Cauliflower, Lady finger and cucumber

Unit III

1. Classification, Life cycle, economic importance and control measures of stored grain pests- namely:
   a. Sitophilousoruzae,
   b. Corcyrecephalonica,
   c. Tregedermagranarium,
   d. Triboliumcasfeneum,
   e. Callosobruchuschinensis,
   f. Stotrogacerellela
2. Life cycle Bionomics, Damage potential and control measures of Aphids and its phases, Phases of Locust- Schistocerca gregarine, Phase theory of locust
3. Social life in Insects
4. Parasitism in Insects

Unit IV

1. Pest Control
2. Physical and cultural control
3. Chemical control
4. Biological control
5. Integrated pest control

SEMESTER-IV
PAPER-III
OPTIONAL GROUP-IV WILD LIFE & ENVIRONMENT
WILDLIFE CONSERVATION

UNIT-1

1. **Wild life** – Values of wild life - positive and negative, our conservation ethics Importance of conservation, Causes of depletion, World conservation strategies.
2. **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.
3. **Management of habitats** –Setting back succession, Grazing logging, Mechanical treatment, advancing the succession process, Cover construction, Preservation of general genetic diversity

UNIT-2

1. **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.
2. **National Organization:** Indian board of wild life**,** Bombay Natural History Society**,** Voluntary organization involved in wild life conservation
3. **Wild life Legislation-Wild Protection act, 1972, its amendments and implementation.**
4. **Management planning of wild life in protected areas.**
5. **Estimation of carrying capacity**

UNIT-3

1. **Eco tourism / wild life tourism in forests**
2. **Concept of climax persistence**
3. **Ecology of protuberance**
4. **Management of excess population & translocation**
5. **Biotelemetry**
6. **Care of injured and diseased animal**.

UNIT-4

1. **Quarantine**
2. **Common diseases of wild animal**
3. **Protected areas National parks & sanctuaries, Community reserve**
4. **Important features of protected areas in India**
5. **Tiger conservation - Tiger reserve in M.P, in India.**
6. **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)

SEMESTER-IV
PAPER-IV
OPTIONAL GROUP IV (WILD LIFE & ENVIRONMENT)
ENVIRONMENT and BIODIVERSITY CONSERVATION

UNIT 1

1. Basic concept of Environmental Biology Scope and Environmental Science
2. Biosphere and Biogeochemical cycles
3. Environmental monitoring and impact assessment
4. Environmental and sustainable development
5. Water conservation, rain water harvesting, water shed management

UNIT 2

1. Cause, effects and remedial measure of: Air pollution, Water pollution, Noise pollution. Radioactive and thermal pollution
2. Agriculture pollution
3. Basic concepts of Bioaccumulation
4. Solid waste management

UNIT 3

1. Global warming and disaster management
2. Cause of global warming
3. Impact of global warming– acid rains and ozone depletion, green house effect
4. Control **measures of global warming**
5. Afforestation & reduction in the use of CFCS
6. **Disaster management -floods, earthquake, Cyclones landslides**
7. **Environmental legislation**

UNIT 4

Natural Resources:-

1. **Forest -**Use and over exploitation of forests**,** Timber extraction
2. **Land-** Land degradation. Landslides**,** Soil-erosion and desertification
3. **Water-** Use and over utilization of surface and ground water**,** Floods**,** Drought dams- benefits and problems
4. **Mineral -** Use and exploitation**,** Environmental effect of extracting and using mineral resources
5. **Food-** World food problem, Effects of modern agriculture and overgrazing
6. **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
7. **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
8. 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

SEMESTER-IV
LAB-COURSE I
PRACTICAL
BASED ON THEORY PAPER I and PAPER II

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

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

SEMESTER-IV
LAB-COURSE II
GROUP I
FISHES

1. Anatomy of different systems of Fresh water Fishes through dissections or alternative methods.
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

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

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

SEMESTER-IV
LAB COURSE II
GROUP II
CYTOLOGY

1. Examination of different cell types in Vertebrate tissue
2. Contrast Microscopy
3. Photomicrography
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 phospholipids and enzyme
10. Microbial culture media preparation and microbial growth
11. Molecular separation by chromatography and Electrophoresis

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 Electrophoresis	(20)
5.	Exercise based on microbiology/ karyotype study	(10)
6.	Viva	(10)
7.	Sessional	(20)
	Total =	100

SEMESTER-IV
LAB COURSE II
PRACTICAL
GROUP III
ENTOMOLOGY

1. Collection, Preservation and classification of the insects of order :- Thysaneura, Collembola, Orthoptera, Hemiptera, Lepidoptera, Mallophaga, Diptera, Hymenoptera and Coleoptera
2. Dissection or any other alternative methods- 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 e.g. 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

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

Distribution of marks in practical exam

1.	Dissection of Available insect pests /Virtual	(10)
2.	Spotting (1 to 10)	(20)
3.	Micro preparation	(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

SEMESTER-IV
LAB COURSE II
GROUP IV
WILD LIFE & ENVIRONMENT

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