

**COURSE SCHEME AND SCHEME OF EXAMINATIONS**  
**M.Sc. DEGREE COURSE IN ZOOLOGY**  
**CHOICE BASED CREDIT SYSTEM (OBE PATTERN)**  
(For those admitted in June 2020 and later)

Sem	Subject Code	Core/ Elective	Title of the paper	HRS/ Week	Credit	Exam (Hours)	Int. Mark	Ext. Mark	Mark
<i>I</i>	20P1ZO01	Core-I	Taxonomy and Biosystematics	5	4	3	25	75	100
	20P1ZO02	Core-II	Cell and Molecular Biology	5	4	3	25	75	100
	20P1ZO03	Core-III	Biochemistry and Biophysics	5	4	3	25	75	100
	20P1ZO04	Core -IV	Microbiology and Immunology	5	4	3	25	75	100
	20P1ZOP01	Core Practical	Core Practical-I	5	4	4	40	60	100
	20P1ZOE01	Elective- I	Economic Zoology / Apiculture	5	4	3	25	75	100
<b>Total</b>				<b>30</b>	<b>24</b>		<b>165</b>	<b>435</b>	<b>600</b>
<i>II</i>	20P2ZO05	Core-V	Developmental Biology	5	4	3	25	75	100
	20P2ZO06	Core-VI	Animal Physiology & Endocrinology	5	4	3	25	75	100
	20P2ZO07	Core-VII	Molecular Genetics	5	4	3	25	75	100
	20P2ZOP02	Core Practical	Core Practical-II	5	4	4	40	60	100
	20P2ZOE02	Elective- II	Medical Laboratory Techniques / Radiation Biology	4	3	3	25	75	100
	20P2ZOE03	Elective- III	Ichthyology / Biodiversity and conservation Biology	5	4	3	25	75	100
<b>Total</b>				<b>30</b>	<b>24</b>		<b>165</b>	<b>435</b>	<b>600</b>
<i>III</i>	20P3ZO08	Core- VIII	Animal Biotechnology	6	5	3	25	75	100
	20P3ZO09	Core- IX	General and Applied Entomology	6	5	3	25	75	100
	20P3ZO10	Core- X	Environmental Biology	6	5	3	25	75	100
	20P3ZOP03	Core Practical	Core Practical – III	6	4	4	40	60	100
	20P3HR01	-	Human Rights	2	1	3	25	75	100
	20P3ZOED01	EDC	Sericulture	4	4	3	25	75	100
<b>Total</b>				<b>30</b>	<b>24</b>		<b>165</b>	<b>435</b>	<b>600</b>
<i>IV</i>	20P4ZO11	Core- XI	Biostatistics and Research Methodology	6	5	3	25	75	100
	20P4ZO12	Core- XII	Evolution	6	5	3	25	75	100
	20P4ZOE04	Elective- IV	First Aid and Home Nursing / Histology	6	4	3	25	75	100
	20P4ZOPR01	Core- PRI	Project and Viva Voce	12	5	-	-	80+20	100
<b>Total</b>				<b>30</b>	<b>19</b>	<b>-</b>	<b>75</b>	<b>325</b>	<b>400</b>
<b>Grand Total</b>				<b>120</b>	<b>91</b>	<b>-</b>	<b>570</b>	<b>1630</b>	<b>2200</b>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)**

**DEPARTMENT OF ZOOLOGY**

**M.Sc. DEGREE COURSE IN ZOOLOGY**

SEMESTER-I (For those admitted in June 2020 and later) CORE PAPER - I

**TAXONOMY AND BIOSYSTEMATICS -20P1ZO01**

Contact hours per week - 05

Contact hours per semester: 75

4 CREDITS

SYLLABUS

**Course Objectives:**

- ❖ To acquire knowledge on the animal classification based on characters
- ❖ To study the fundamentals knowledge on feeding and locomotion of invertebrates
- ❖ To study the comparative anatomy of vertebrates and invertebrates

**UNIT I CLASSIFICATION**

Importance of taxonomy- Identification using taxonomic keys, General characteristics of animal phyla- Organization of coelom: Acoelomates, Pseudocoelomates and Coelomate groups. Classification of animal phyla upto orders in invertebrates & Vertebrates

**UNIT II NOMENCLATURE**

Zoological Nomenclature- History, Monomial, Binomial, Trinomial nomenclature. Homonymy and Synonymy. International Code of Zoological Nomenclature (ICZN) and its rules. Types of Nomenclature: Holotype, Allotype Paratype, Lectotype, Syntype, Neotype and Allotype. Three domains of life.

**UNIT III LOCOMOTION& NUTRITION IN INVERTEBRATES**

Locomotion and adaptive mechanism of Invertebrates- flagellar- ciliary movement in protozoa, hydrostatic movement in Coelenterates, Annelida and Echinodermata. Nutrition and feeding mechanism in Invertebrates- Nutrition in Protozoa- Types and mode of feeding. Feeding diversity in Insects, Metazoan, Crustaceans, Mollusca and Echinodermata.

**UNIT IV COMPARATIVE ANATOMY OF INVERTEBRATES**

Comparative study of circulatory system, excretory systems, Nervous systems of invertebrates. Types of reproduction in Invertebrates

**UNIT V COMPARATIVE ANATOMY OF VERTEBRATES**

Comparative study on the structure and functions of alimentary canal and associated glands. Respiratory system of Fishes and Birds.. Excretory system of reptiles and mammals; Nervous system: Brain of Amphibia and Mammals, Reproductive system of Reptiles and Mammals. Circulatory system of Aortic arch.

**REFERENCE BOOKS**

1. R.L. Kotpal, (2016). Invertebrates, 11<sup>th</sup> Edition, Rastogi Publications.
2. R.L. Kotpal, (2016). Modern Text Book of Zoology Vertebrates, Rastogi Publications.
3. Anne EM (2003) Measuring Biological Diversity, Blackwell Publications, UK

4. Hosetti BB (2002) Biodiversity, Daya Books, New Delhi.
5. Colbert H and Edwin ((1989) Evolution of the Vertebrates. 2nd Edition, Wiley Eastern Limited, New Delhi.
6. Barnes RD (1982) Invertebrate Zoology.4th Edition, Holt Saunders International Edition.
7. Barrington EJW (1979) Invertebrate Structure and Functions.2nd Edition, ELBS and Nelson.
8. Waterman AJ (1971) Chordate Structure and Function. The Macmillan Company.

**WEB SOURCES:**

- <https://www.itis.gov/>
- <https://lib2.colostate.edu/wildlife/taxonomy.html>
- <https://en.wikipedia.org/wiki/Invertebrate>
- <https://en.wikipedia.org/wiki/Vertebrate>
- [https://www.diffen.com/difference/Invertebrate\\_vs\\_Vertebrate](https://www.diffen.com/difference/Invertebrate_vs_Vertebrate)

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Describe the level of organization in Invertebrate and Chordates	<b>K1</b>
<b>CO2</b>	Bring out the locomotion and adaptive characters of Invertebrates.	<b>K1</b>
<b>CO3</b>	Summarize the feeding behavior of invertebrates and Chordates	<b>K2</b>
<b>CO4</b>	Compare the functional morphology of vertebrates and invertebrates.	<b>K1 &amp; K2</b>
<b>CO5</b>	Discuss the Comparative study on the structure and functions of vertebrate	<b>K1</b>

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SEMESTER-I

CORE PAPER - II

**CELL AND MOLECULAR BIOLOGY – 20P1Z002**

(For those admitted in June 2020 and later)

Contact hours per week: 05

Contact hours per semester: 75

4 CREDITS / SYLLABUS

**Course Objectives:**

- ❖ To study the structure and functional characters of biomolecules
- ❖ To understand the classification of biomolecules
- ❖ To gain knowledge on nucleic acids and enzymes
- ❖ To acquire knowledge about various biophysical techniques

**UNIT I: INSTRUMENTATION & BASIC TECHNIQUE (15 Hours)**

Microtome- Tissue Preparation, Sectioning, Mounting and Staining Techniques, Micrometry, Principles of Phase contrast Microscope, SEM, TEM, Electrophoresis Analysis.

**UNIT –II: CELL MEMBRANE AND CELL SIGNALLING (15 Hours)**

Plasma membrane: Structure and modifications. Functions of plasma membrane. Introduction of Cell signaling: Intercellular signaling – Autocrine, Paracrine, Endocrine and Juxtacrine signaling. Intracellular signaling. Cell coat and cell recognition- functions of cell coat. Microtubules and microfilaments

– structure, functions, role in cancer formation

**UNIT-III COMPONENTS OF CELLS (15 Hours)**

Endoplasmic reticulum – special functions of Rough Endoplasmic Reticulum and synthesis of exportable proteins. Golgi complex – Synthesis of sphingolipids, glycoproteins, secretory process in pancreas, insulin secretion. Lysosome - cell digestive system – functions. Mitochondria – Structure and Function, Respiratory chain and Ribosome.

**UNIT-IV CHROMOSOMES & CELL CYCLE (15 Hours)**

Chromosomes – Eu chromatin and Hetero chromatin chromosome, giant chromosome. DNA – Structure, Replication and DNA repair. RNA – types and their role in cellular activities. Cell division- Cell Cycle– Mitosis – Amitosis – Meiosis –significance. Cell aging.

**UNIT-V PROTEIN SYNTHESIS (15 Hours)**

Protein synthesis – Transcription in Prokaryotes and Eukaryotes. RNA processing – Capping, polyadenylation, introns, exons. Translation– initiation, elongation and termination of polypeptide chain synthesis. Post translational modifications in Prokaryotes and Eukaryotes.

**REFERENCE BOOKS:**

1. P.S. Verma & V.K. Agarwal, (2015), Cytology, S.Chand & Co
2. Satyesh Chandra Roy, (2011), Cell Biology, New Central Books
3. Gupta, P.K. (2007) Cell and Molecular Biology, Rastogi Publications, Meerut.

4. DeRobertis, E.D.P. and E.M.F.D. DeRobertis (2007) Cell and Molecuar Biology, Lea and Fabiger International Edition, Philadelphia.
5. Watson, J.D, Basker, T.A., Bell, S.P., Gann, A., Levine, M and Losick, R (2004) "Molecular biology of the gene", Pearson Education Pvt. Ltd., Singapore.
6. Bruce, A, Alexander, J, Julian, L, Martin, R, Keith R, and Peter, W, (2002) Molecular Biology of the Cell, Garland Science, Taylor Francis Group, New York.
7. Cooper, G.M. (2001) The cell- A Molecular Biological Approach, ASM Press, Washington.
8. Karp, G. (1985) Cell Biology, Mc Graw Hill Book Company, New York.

**WEB SOURCES:**

- [https://www.cs.helsinki.fi/bioinformatiikka/mbi/courses/09-10/itb/Lectures\\_1509\\_and\\_1709.pdf](https://www.cs.helsinki.fi/bioinformatiikka/mbi/courses/09-10/itb/Lectures_1509_and_1709.pdf)
- [https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental\\_molecular\\_biology](https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental_molecular_biology)
- <https://www.studocu.com/en/document/murdoch-university/foundations-of-cell-and-molecular-biology/lecture-notes/lecture-notes-all-lectures-comprehensive-study-notes-for-final-exam/314293/view>.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Understand the basic instrumentation process and its technique	<b>K1</b>
<b>CO2</b>	Compare the cell signaling process between the cells and cell organization	<b>K1</b>
<b>CO3</b>	Explain the ultra-structure and functions of Cytoskeletons and Plasma membrane	<b>K2</b>
<b>CO4</b>	Assess the events of cell cycle, cell death and cancer	<b>K1 &amp; K2</b>
<b>CO5</b>	Illustrate the process of transcription and post transcriptional amendment in Eukaryotes	<b>K1</b>

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SEMESTER-I CORE PAPER - III

**BIOCHEMISTRY AND BIOPHYSICS - 20P1Z003**

(For those admitted in June 2020 and later)

Contact hours per week - 05

Contact hours per semester: 75

4 CREDITS/SYLLABUS

**Course Objectives:**

- ❖ To provide students with relevant knowledge and skills on instrumentation techniques
- ❖ To study principles and types of cell communication and adhesion
- ❖ To acquire advanced knowledge of molecular biology of prokaryotes, and eukaryotes.

**UNIT -I BIOCHEMICAL COMPOUNDS (15 Hours)**

Structure of Atoms, Molecules and chemical bonds, stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, Electrostatic Force). Biological Importance of Water, pH and Buffers.

**UNIT II CARBOHYDRATES AND PROTEINS (15 Hours)**

Carbohydrates - Classification, structure, function and properties. Metabolism of carbohydrates, TCA Cycle, Glycolysis, HMP Shunt.

Proteins–Classification, Structural organization of proteins (Primary, secondary, tertiary and quaternary structures). Amino acids- Definition, Classification and properties,

**UNIT -III LIPIDS (15 Hours)**

Lipids –Classification, structure, function and properties of simple and compound Lipids. Biological importance of sterols, cholesterol, Bile acids. Fatty acid Biosynthesis and Beta oxidation of fatty acids.

**UNIT -IV NUCLEIC ACIDS & ENZYMES (15 Hours)**

Nucleic acids: Composition and Properties of nucleic acids. Enzymes- Definition, Classification and functions of enzymes – Co-enzymes, Iso-enzymes, Allosteric enzymes, Abzymes – Bioenergetics, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.

**UNIT – V: BIOPHYSICAL TECHNIQUES (15 Hours)**

Separation Techniques – Sedimentation – Chromatography methods. Spectroscopes. Introduction and applications of FTIR and Mass spectroscopy. Nuclear Magnetic Resonance (NMR); Radiation – Introduction and medical applications.

**REFERENCE BOOKS:**

1. Satyanarayana,U, (2015), Essentials of Biochemistry, Books and Allied (P) Limited, Kolkata.
2. Avinash Upadhyay, Kakoli Upadhyay and Nirmalendu Nath, (2019), Biophysical Chemistry, Himalya Publications
3. Satyanarayana, U and Chakrapani, U (2009), Essentials of Biochemistry, Books and Allied (P) Limited, Kolkata.

4. Jain, J.L. (2007), Fundamentals of Biochemistry, S. Chand & Co. Ltd., New Delhi.
5. Stryer, L. (2006), Biochemistry, W.H. Freeman and Co., New York.
6. Chatterjee, H.N. and Spindle, R. (2005), Text Book of Medical Biochemistry, Jaypee Brothers, New Delhi.
7. Nelson, D.I. and Cox, M.M. (2004), Lehninger Principles of Biochemistry, III Edition, Mac Millon Worth Publishers, New York.
8. Devlin, T.M. (2003), Biochemistry, Wiley-Liss, New York.

**WEB SOURCES:**

- <http://www.agrimoon.com/wp-content/uploads/Fundamentals-of-Biochemistry.pdf>
- [https://www.researchgate.net/publication/221657258\\_Fundamental\\_Concepts\\_in\\_Biophysics](https://www.researchgate.net/publication/221657258_Fundamental_Concepts_in_Biophysics)
- [http://www.himpub.com/BookDetail.aspx?BookId=1117&NB=&Book\\_TitleM=Biochemical%20Chemistry%20\(Principles%20and%20Techniques\)](http://www.himpub.com/BookDetail.aspx?BookId=1117&NB=&Book_TitleM=Biochemical%20Chemistry%20(Principles%20and%20Techniques))
- <https://www.britannica.com/science/nucleic-acid>

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Classify the chemical bonds and forces interacting between molecules	<b>K1</b>
<b>CO2</b>	Summarize the structure, classification and- metabolic pathways of carbohydrates	<b>K1</b>
<b>CO3</b>	Understand the Structure, Classification and Metabolism of Proteins & Lipids.	<b>K2</b>
<b>CO4</b>	Illustrate the metabolic pathway of nucleic acid and enzymes.	<b>K1 &amp; K2</b>

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SEMESTER-I

CORE PAPER - IV

**MICROBIOLOGY AND IMMUNOLOGY- 20P1ZO04**

(For those admitted in June 2020 and later)

Contact hours per week: 05

Contact hours per semester: 75

4 CREDITS/ SYLLABUS

Course Objectives:

- ❖ Acquire knowledge on the culture, isolation and control of microorganisms
- ❖ Learn the food preservation techniques and study microbes in food and water
- ❖ Study the organs of immune system and the innate and adaptive immunity
- ❖ To gain knowledge on antigens, antibodies and their production mechanism
- ❖ To study the antigen antibody reactions and immunological disorders

**UNIT – I Microorganism Classification & Culture (15 Hours)**

Bacteria : Characteristics, Classification and Structure. Bacterial Culture techniques: Culture media, sterilization techniques and culture methods. Economic importance of Bacteria.

Virus : Classification- DNA and RNA Virus. Bacteriophages – Multiplication and Life cycle.

**UNIT – II Microbial diseases: (15 Hours)**

Food Microbiology-Preservation of Food, Contamination, Food Borne diseases- Salmonella, Amoebiasis, Botulism and Aspergillus, Causes, Sources, Mode of Transmission, Symptoms and Control measures. Water Microbiology- Microbes in Water, Water borne diseases - Microbial analysis in potable water and membrane filter techniques. Methods of sewage treatment and disposal.

**UNIT - III Immune System (15 Hours)**

Humoral immunity-Cells involved in the immune system, innate immunity- factors involved in innate immunity, active and passive acquired immunity. Lymphoid organs: Thymus, Bursa of Fabricius and bone marrow, lymph node, spleen, MALT, GALT, Payer's patches, Tonsils.

**UNIT IV Humoral and Cell mediated Immunity (15 Hours)**

Primary and secondary immune response; Mechanism of antibody production, cell mediated immunity, MHC Classes and Structure. General Structure and Function of Immunoglobulin.

**UNIT – V Immunopathology (15 Hours)**

Antigen- antibody reaction; immune complex, specificity, binding sites, binding forces, Bonus effect and cross reaction. Hypersensitivity: Factors, types and classification. Transplantation Immunology- Auto immune diseases – Myasthenia gravis, Pernicious anemia, Rheumatoid arthritis, Systemic lupus erythematosus (SLE), Vaccines- principles & types of vaccine. History of Covid Vaccine development.

**REFERENCE BOOKS:**

1. Venkateshwar Reddy .A & Jayaveera K.N, (2014), Pharmaceutical Microbiology, S.Chand & Co Publications.



2. Purohit, S.S., (2006) Microbiology, V Edition, Agrobios (India) Publishers, Jodhpur.
3. David, Brostoff and Roitt (2006) Immunology, 7th Edn., Mosby & Elsevier Publishing, USA.
4. Dubay, R. C. and Maheshwari D. K. (2005) Text Book of Microbiology, S. Chand & Co. Ltd., New Delhi.
5. Prescott, L.M., Harley, J.P. and Ulein, B.A. (2004) Microbiology (IV Edi). WMC, Broun Publisher, USA.
6. Pelczar, M.J. (2002) Microbiology, McGraw-Hill Education India Ltd., New Delhi.
7. Kuby, J. (1997) Immunology, W.H. Freeman &Co., New York.

**WEB SOURCES:**

- <http://microbiologyonline.org/>
- <http://periobasics.com/basic-microbiology.html>
- <https://en.wikipedia.org/wiki/Immunology>
- [http://www.dphu.org/uploads/attachements/books/books\\_5451\\_0.pdf](http://www.dphu.org/uploads/attachements/books/books_5451_0.pdf)
- [http://missinglink.ucsf.edu/lm/immunology\\_module/prologue/prologue\\_syllabus\\_2008.PDF](http://missinglink.ucsf.edu/lm/immunology_module/prologue/prologue_syllabus_2008.PDF)

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Determine the culture of microorganisms and its culture methods	<b>K1</b>
<b>CO2</b>	Summarize the beneficial characters of microbes in industries	<b>K1</b>
<b>CO3</b>	Describe the structure and functions of immune cells and lymphoid organs	<b>K2</b>
<b>CO4</b>	Discuss the structure, types and properties of various Immunoglobulin	<b>K1 &amp; K2</b>
<b>CO5</b>	List the properties of antigen-antibody reaction, B and T cell	<b>K3</b>

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SEMESTER-I

ELECTIVE – 1a

**APICULTURE - 20P1ZOE01**

(For those admitted in June 2020 and later)

Contact hours per week: 05

Contact hours per semester: 75

4 CREDITS/ SYLLABUS

**Course Objectives:**

- ❖ To study the economic importance of apiculture
- ❖ To study the importance of honey bees and its byproducts

**UNIT – I: SCOPE AND HISTORY**

Introduction to Apiculture - Scope, importance and History of bee keeping. Systematic position with reasons for honey bee. Apiculture development in India. Role of Honey Bee Research & Training Institutes.

**UNIT – II: MORPHOLOGY AND ANATOMY OF BEE**

Honey Bee: Morphology, anatomy and life cycle. Honey bee species and identification. Social behavior and different castes of honey bee.

**UNIT – III BEE HIVE**

Honey bee hive - Types of bee keeping: Traditional and modern bee keeping, structure and location of bee hive. Swarming and pheromone in honey bee hive.

**UNIT – IV CARE and MANGEMENT**

Apiary care and management – Materials used in apiary. Harvesting and extraction of honey. Honey bee enemies (Wax Moth, Ants, Wasps, Microorganisms & Pests) and disease ( Bacterial, viral and fungal ).

**UNIT – V ECONOMICS**

Apiculture as self-Honey - its properties and application in various fields - Types of value-added honey products. Economics of bee keeping -Preparing bankable bee keeping project: Steps involved in starting a beekeeping project, Funding sources for beekeeping projects.

**REFERENCE BOOKS:**

1. Cherian R, & K.R. Ramanathan, 1992 – Bee keeping in India,
2. Mishra, R.C., 1985 – Honey bees and their Management in India, ICAR.
3. Singh, S.1982-Bee keeping – ICAR
4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Chandigarh
5. Rare, S. 1998-Introduction. to bee keeping, Vikas publishing house.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Elucidate the role of honey bee in diverse applications.	<b>K1</b>
<b>CO2</b>	Acquired knowledge about Anatomical characters of honey bees	<b>K1</b>
<b>CO3</b>	Identify the economically important of honey and bee hive	<b>K2</b>
<b>CO4</b>	Understand the Apiary care and management	<b>K1 &amp; K2</b>
<b>CO5</b>	Illustrate properties and application of honey bee in various fields	<b>K3</b>

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SEMESTER-I

ELECTIVE – I

**ECONOMIC ZOOLOGY - 20P1ZOE01**

(For those admitted in June 2020 and later)

Contact hours per week: 05    Contact hours per semester: 75

4 CREDITS - SYLLABUS

**UNIT I: APICULTURE**

Lac Culture: Types of Lac insect, Harvesting and Extraction of Uses of Lac. Economic Importance - Honey bee

**UNIT II: POULTRY**

Types of birds for poultry – Bio-security measures followed in Poultry farms, Diseases and pests – Egg and meat production – Types of breeds rearing in animal husbandry (Cow, Sheep and Goats, Pigs) – Disease and parasites of animal husbandry. Economic importance.

**UNIT III: AQUACULTURE**

Aqua culture- Site selection and Construction, Pre stocking and post stocking management of Nursery, rearing and stocking ponds, Fish byproducts. Prawn culture - Methods of prawn fishing, Preservation and marketing - Fish and Prawn.

**UNIT IV: VERMICULTURE**

Species of earthworm used in vermiculture- Raw materials for vermiculture- Compost Production. Natural enemies and their control measures- Harvesting of vermicompost and worms - Role of vermicompost in agriculture.

**UNIT V: SERICULTURE**

Sericulture – Types of Silk worms, Rearing techniques, Diseases – Bacterial, Fungal and Protozoan - their managements, reeling and Byproducts.

**REFERENCE BOOKS:**

1. Banerjee, G.C. (2015), Animal Husbandry, Navyug Book International Publications
2. Jawaid, A. and Sinha, S. P. (2008) A Handbook of Economic Zoology. S. Chand Group Publishers, New Delhi.
3. Khan, A. A. (2007) Encyclopedia of Economic Zoology. 2 vols. Anmol Publications Pvt. Ltd., New Delhi.
4. Upadhyay, V.B. (2006) Economic Zoology. Rastogi Publications, Meerut, India.
5. Nigam, H.C. (2006) Modern Trends in Biology & Economic Zoology, Vishal Publishing. Co., Jalandhar.
6. Jabde and Pradip V (2005) Text Book of Applied Zoology, Discovery Publishing House, New Delhi.

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DEPARTMENT OF ZOOLOGY  
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SEMESTER-II

CORE PAPER –V

DEVELOPMENTAL BIOLOGY – 20P2ZO05  
(For those admitted in June 2020 and later)

Contact hours per week: 05

Contact hours per semester: 75

4 CREDITS  
SYLLABUS

Course Objectives:

- To understand the structure of gametes and the events of gametogenesis
- Acquire knowledge on the fertilization and morphogenetic movements in the developing embryo

**UNIT– I: GAMETES (15 Hours)**

Gametogenesis: Spermatogenesis- Types of Sperm, Ultra structure of Human sperm, Sperm motility and role of sperm in egg activation. Oogenesis- Types of Eggs and egg membranes, Ultra structure of Mammalian egg.

**UNIT– II: FERTILIZATION (15 Hours)**

Fertilization– Process and significance – Post – fertilization changes. Parthenogenesis (Natural and Artificial). Cleavage – Chemical changes during cleavage – Pattern and plane of cleavage –Fate map.

**UNIT – III: ORGANOGENESIS (15 Hours)**

Morphogenetic movements – Nucleocytoplasmic interactions in morphogenesis – Gastrulation in Frog and Mammal- (Mouse). Organogenesis – Eye, heart, kidney and brain in Frog, Foetal membranes – Types of placenta in mammals.

**UNIT – IV: METAMORPHOSIS & REGENERATION (15 Hours)**

Morphological and biological changes associated with metamorphosis – Hormonal control of amphibian metamorphosis – Neuro-endocrine control of insect metamorphosis. Regeneration –Types of regeneration - Experimental evidence for Regeneration.

**UNIT – V: DIFFERENTIATION (15 Hours)**

Embryonic fields and embryonic induction, Types of Differentiation – Genes in differentiation – Inductors and organizers.

REFERENCE BOOKS:

1. Lewis Wolpert (2007) Principles of Development (III edition) Oxford University Press, UK.
2. Gilbert, S.F. (2006) Developmental Biology, 8th edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
3. Gilbert, F.S. (2003) Developmental Biology, 7<sup>th</sup> Edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.

4. Balinsky, B.I. (2004) An Introduction to Embryology, 5th edition, Thomas Asia Pvt. Ltd, Chennai.

**WEB SOURCES:**

- <https://study.com/academy/topic/basics-of-developmental-biology.html>
- [https://gurukpo.com/Content/Bsc-biotech/Development\\_Biology.pdf](https://gurukpo.com/Content/Bsc-biotech/Development_Biology.pdf)
- <https://www.khanacademy.org/science/biology/developmental-biology/development-and-differentiation/a/introduction-to-development>
- <https://www2.bc.edu/christopher-kenaley/bio3030/Wolpert.Ch1.pdf>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)**

**DEPARTMENT OF ZOOLOGY  
M.Sc., DEGREE COURSE IN ZOOLOGY  
(For those admitted in June 2020 and later)**

**SEMESTER – II  
Contact hour per week: 05**

**CORE PAPER – VI  
Contact hour per semester : 75**

**ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY – 20P2ZO06**

**Unit – I : Digestion and Respiration**

Physiology of Carbohydrate, Protein and lipid digestion. Physiology of digestion and assimilation. Balanced diet. Nutrient requirement for pregnant women and infants.

Types of respiration. Physiology of respiration and Excretion– Gaseous exchange. Respiratory pigments. Transport of oxygen and carbon-dioxide.

**Unit – II : Circulation and Excretion**

Types of hearts, neurogenesis mechanisms of heart – Origin and conduction of heart beat. Cardiac cycle and ECG. Blood coagulation factors and mechanism.

- Nature and types of excretory products - Ammonotelism, Ureotelism and Uricotelism. Excretory organs in invertebrates and vertebrates. Structure of nephron, Physiology of urine formation.

**Unit – III: Nervous and Muscular system**

Types of neurons (Brain and Spinal cord). Transmission of nerve impulse – Axonomic, synaptic transmission and neuromuscular junction. Reflex action.

Types of muscles. Ultra structure of striated muscle. Mechanism and theories of muscle contraction. Thermoregulation in animals – Aestivation and Hibernation.

**Unit – IV: Sense organs and Pituitary gland**

Chronobiology – Biological clock and Photoperiodism. Physiology of Photoreceptor. Phonoreceptor – Human ear.

Pituitary Hormones of Hypothalamus and its significance. Biological importance of Pituitary gland and its hormones.

**Unit – V : Endocrine glands and Hormones**

Hormones and significance of Thyroid gland, Parathyroid gland, Adrenal gland, Pancreas, Gastrointestinal hormones, Testis and ovary.

**REFERENCE BOOKS:**

1. Moyes, C.D. and Schulte, P. M. (2006) Principles of Animal Physiology, Pearson Education Inc. Chennai.
2. Tortora, G. J. and Derrickson, B. (2006) Principles of Anatomy and Physiology, 11th edition, John Wiley and Sons Inc. USA.
3. Richard W. Hill, Gordon A. Wyse (2004) Animal Physiology, Second Edition, Sinauer Associate, Inc Publishers, USA.

4. Guyton, A.C. (2001) Text book of Medical Physiology 10th edition W. B. Saunders Company, Philadelphia.
5. Prosser, C.L. (1973) Comparative Animal Physiology, 3<sup>rd</sup> Edition, W.B. Saunders & Co. Philadelphia.



**M.Sc. DEGREE COURSE IN ZOOLOGY**  
**SEMESTER-II** **CORE PAPER –VII**  
**MOLECULAR GENETICS -20P2ZO07**

(For those admitted in June 2020 and later)

Contact hours per week: 05

Contact hours per semester: 75

**4 CREDITS – SYLLABUS**

**UNIT – I: GENES & GENE REGULATIONS**

Eukaryotic genome - Structure of Gene - One Gene One Polypeptide Concept, GAL & LAC operon system, Karyotype, Gene Regulations in Prokaryotic & Eukaryotic.

**UNIT – II: MICROBIAL & HUMAN GENETICS (20 Hours)**

Methods and evidence of Genetics transfer in bacteria- conjugation, transformation and transduction, Viral genetics – bacteriophage; Gene and genetic pathways-Inborn errors of metabolism- Sickle cell anemia - Phenylketonuria and Alcaptonuria.

**UNIT - III: MUTATION**

Chromosomal and point mutation, Spontaneous and Induced mutation, mutagens: physical, chemical and biological – Genetic changes in Neoplasia in man.

**UNIT - IV: CLASSICAL CONCEPT**

Genetic Interactions - Types & Classification - Dosage Composition - X inactivation - genomic imprinting; Genetic and Physical Mapping Concept, Genetic Mapping & Physical Mapping

**UNIT V: APPLIED GENETICS**

Application of genetics in animal breeding – application of genetics in crime and law – DNA finger printing, Cloning and Genetics basis of twins.

**REFERENCE BOOKS:**

1. L.M.Narayanaa& A. Mani, 2014. Genetics and Genetic Engineering, Saras Publications
2. B.D. Pandey, 2012. Cytology, Genetics and Molecular Genetics, Mcgraw Hill
3. Klug, W.S., Cummings, M.R., Spencer, C and Palladino, M.A. (2008) Concepts of Genetics, 9th edition (2008), Benjamin Cummings, Canada.
4. Benjamin Lewin (2008) Genes IX, 9th edition, Jones and Barlett Publishers Inc. London.
5. Snustad D. Peter and Simmons J. Micheal, (2006) Principles of Genetics, 4th edition, John Wiley and Sons. Inc., USA.
6. Daniel J. Fairbanks, W. Ralph Andersen (1999) Genetics, Brooks/Cole Pub Co., USA.
7. Eldon J. Gardner, D.P. Snustad, M.J. Simmons, and D. Peter Snustad (1991) Principles of Genetics, 8th edition, John Wiley and Sons. Inc., USA.
8. David Freifelder (1987) Microbial Genetics, Jones & Bartlett Co., USA.
9. Leon A. Snyder, David Freifelder, Daniel L. Hartl (1985) General Genetics, Jones and Bartlett., London.

10. Monroe W. Strickberger, (1968), Genetics, 3rd edition, Macmillan Publishing Co. Bangalore.

**WEB SOURCES:**

- <https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/lecture-notes/>
- [http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl\\_Jones\\_Genetics.pdf](http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl_Jones_Genetics.pdf)
- [http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl\\_Jones\\_Genetics.pdf](http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl_Jones_Genetics.pdf)
- [https://www.bio.bg.ac.rs/materijali\\_predmeta/med-eng-griffiths-an-introduction-to-genetic-analysis.pdf](https://www.bio.bg.ac.rs/materijali_predmeta/med-eng-griffiths-an-introduction-to-genetic-analysis.pdf)
- [http://gsi.semmelweis.hu/files/ebook/Genetics%20genomics\\_en.pdf](http://gsi.semmelweis.hu/files/ebook/Genetics%20genomics_en.pdf)
- <https://www.thesisscientist.com/docs/Study%20Notes/12a79a12-7a79-4d08-8f16-a84e0d70b65d>.

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M.Sc. DEGREE COURSE IN ZOOLOGY**

**SEMESTER-II**

**ELECTIVE –II**

**MEDICAL LABORATORY TECHNIQUES -20P2ZOE02**

**(For those admitted in June 2020 and later)**

**Contact hours per week: 05**

**Contact hours per semester: 75**

**4 CREDITS**

**SYLLABUS**

**UNIT – I LABORATORY & SAFETY (15 Hours)**

The laboratory: Safety, Contaminants- Physical, Chemical, Biological Contaminants. – Universal work precautions (NWP) for laboratory personnel. Disposing of Biomedical waste.

**UNIT – II PARAMETERS (15 Hours)**

RBC, WBC, Differential Count, packed cell volume, MCH, MCHC, MCV, Haemoglobin content, Haematocrit, Erythrocyte sedimentation rate, Reticulocytocrit, RBC fragility test, platelet count. haemorrhagic disorders, clotting time, Bleeding time.

**UNIT – III URINE TEST (15 Hours)**

Analysis of urine, Physical parameter, - Colour, odor, p<sup>H</sup>, Density, Chemical parameters – Albumin, Ketone bodies and their clinical significances- Pregnancy tests.

**UNIT – IV MICROBIAL AND PARASITIC ANALYSIS (15 Hours)**

Microbial analysis of Blood, Urine, Faeces, Sputum. Parasitic analysis in Blood and Faeces, Analysis of semen, and cerebrospinal fluid for clinical investigation.

**UNIT – V RECENT ANALYTIC TECHNIQUES (15 Hours)**

Molecular diagnostic techniques – RIA, ELISA, WESTERN BLOT, WIDEL TEST and rtPCR.

**REFERENCE BOOKS:**

1. Sood and Ramnik (2009) Medical Laboratory Techniques, Jaypee Brothers, New Delhi.
2. Kanai L. Mukherjee and Swarajit Ghosh (2009) Medical Laboratory Techniques, , Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
3. B. S. Chauhan (2009) Principles of Biochemistry and Biophysics, first edition, Luxmi publishers, New Delhi.
4. Garrod, L.P. (2008) Medical Laboratory Techniques, BMJ publishers, USA.
5. Estridge, B.H., Reynolds, A.P. and Walters N.J. (2007) Basic Clinical Laboratory Techniques, Cengage Learning, Hyderabad.

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M.Sc. DEGREE COURSE IN ZOOLOGY  
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**SEMESTER-II**

**ELECTIVE –III**

**ICHTHYOLOGY- 19P2ZOE03**

**Contact hours per week: 05**

**Contact hours per semester: 75**

**4 CREDITS  
SYLLABUS**

Course Objectives:

- To study the types of fish culture and the techniques involved in rearing
- To study the recent techniques of fish rearing under controlled conditions
- To learn recent trends in harvesting and marketing of fishes.

**UNIT I: FIN FISH AND SHELL FISH ANATOMY & BEHAVIOUR**

Morphology of skin, colouration, scales, mouth, jaws, teeth, fin and fin rays and their taxonomic importance. Internal anatomy (Fish & Prawn) of alimentary canal and associated structure, Respiratory and accessory respiratory organs, circulatory system, Reproductive system. External Character of Prawn, Crab, Lobster, Bivalves, Gastropods and Cephalopod.

Fish behavior: Parental care of fishes. Fish Migration.

**UNIT II: FISH GROWTH**

Isometric and allometric growth, the cube law, analysis of growth check on hardparts (Scale, otolith,), Marking and tagging of fish for growth studies, length-weight relationship. **UNIT**

**III: FISH CULTURE & FARMING**

Importance of fisheries-Aim and qualities of culturable fishes. Types of fish culture: Monoculture – composite culture- Integrated fish culture. Construction and maintenance of fish farm- Types of fish pond- Induced breeding Techniques.

**UNIT IV: FISHING METHODS & BY PRODUCTS**

Harvesting-Methods of fishing. Gears and Crafts. Fish market-Fish Copied, Benfish, Sangams. Fish handling, quality and processing. Preservation and processing methods, Fishery byproducts. Fish spoilage – Rigor mortis. Post-harvest technology.

**UNIT V: FISH NUTRITION & DISEASE MANAGEMENT**

Food and feeding habit of fish, prawn, crab, bivalves and cephalopod. Fish diseases- Parasitic and Non- Parasitic diseases, Protozoan disease, and Nutritional disorder. Symptoms and Treatment methods.

**REFERENCE BOOKS:**

1. Jawaid, A. and Sinha, S. P. (2008) A Handbook of Economic Zoology. S. Chand Group Publishers, New Delhi.

2. Shukla, G.S. and upadhya, V.B. (2005) Economic Zoology, Rastogi Publications, Meerut, India.
3. Kamaleswarpandey and Shukla, J.P. (2005) Fish and Fisheries, Rastogi Publications, Meerut.
4. Yadav, M (2003) Economic Zoology. Discovery Publishing House, Rastogi Publications, Meerut.
5. Shanmugam, K. (1992) Fishery Biology and Aquaculture, Leo Pathippagam, Chennai.
6. Jingran, V.G. (1983) Fish and Fisheries of India, 2<sup>nd</sup> Edition, Hindusthan Publications, New Delhi.

**WEB SOURCES:**

- [http://himachal.nic.in/WriteReadData/l892s/4\\_l892s/1402134883.pdf](http://himachal.nic.in/WriteReadData/l892s/4_l892s/1402134883.pdf)
- [https://www.aquariumconnection.com/pdf/fw\\_disease\\_rx.pdf](https://www.aquariumconnection.com/pdf/fw_disease_rx.pdf)
- <http://www.guammarinelab.org/publications/uogmltechrep104.pdf>

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DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-III

CORE PAPER: VIII

**ANIMAL BIOTECHNOLOGY - 20P3ZO08**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90

5 CREDITS - SYLLABUS

**Course Objectives**

1. To acquire knowledge on technology used in living organisms
2. To learn the techniques in animal Cell cultures
3. To acquire knowledge about different animal breeding
4. To diagnose different diseases and their rectification techniques by using vaccines & drugs
5. To learn the ethics related to animal biotechnology

**UNIT I: GENETIC ENGINEERING**

Tools in Genetic Engineering-Enzymes, and Vectors- Plasmids, Cosmids and Phagemids. Methods of gene isolation, DNA sequencing Techniques, PCR – Types and applications, Gene transfer methods.

**UNIT II: ANIMAL CELL CULTURE**

Tissue culture, Requirements in tissue culture laboratory instruments and media., Organ culture techniques, Advantages and applications, Preservation and storage of cells, Animal tissue culture, Safety consideration in laboratory.

**UNIT III: ARTIFICIAL ANIMAL BREEDING**

Artificial insemination, Transplantation, in-vitro fertilization (IVF), ICSI and embryo transfer. Production and use of transgenic animals, Biotechnology in Aquaculture- Gynogenesis, androgenesis, Transgenic in fishes, Ethics of Animal breeding.

**UNIT IV: ANIMAL HEALTH AND BIOTECHNOLOGY**

Animal health - disease diagnosis, Monoclonal Antibodies - Prophylaxis - vaccines and its types, Antibiotic drugs and their sensitivity tests – Gene therapy.

**UNIT V: APPLICATIONS OF BIOTECHNOLOGY IN SOCIETY**

Bio fertilizers, Enzymes in detergents and dying industries, Biofuel- Biogas, bio ethanol, safety measures in biotechnology, Bioethics, Intellectual Property Rights and Patent.

**REFERENCE BOOKS:**

1. Satyanarayana, U. (2010) Biotechnology, Books and Allied Pvt Ltd. Kolkata.
2. Dubey, R.C. (2006) A textbook of Biotechnology, S. Chand Company Ltd. New Delhi.
3. Kumar, H.D. (2008) Modern concepts of Biotechnology, Vikas Publishing House Pvt Ltd., New Delhi.
4. Ranga, M.M. (2003) Animal Biotechnology, Agrobios Publishers, India,
5. Pradeep Parihar, (2004) A textbook of Biotechnology, Student Edition. Jodhpur.
6. Sasidhara, R. (2006) Animal Biotechnology, MJP Publishers. Chennai.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Define the tools and its uses in genetic engineering	<b>K1</b>
<b>CO2</b>	Compare the type of cell and its culture technique	<b>K1</b>
<b>CO3</b>	Analyze the technique of artificial insemination	<b>K2</b>
<b>CO4</b>	Understand the disease diagnosis process in animals	<b>K1 &amp; K2</b>
<b>CO5</b>	Elucidate the Enzymes in detergents and leather industries	<b>K1</b>

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DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-III

CORE PAPER: IX

**GENERAL AND APPLIED ENTOMOLOGY - 20P3ZO09**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**Course Objectives**

- 1 To learn the taxonomical importance and classification of insects
- 2 To acquire knowledge about agricultural importance of insect pest
- 3 To identify the pests of stored products and medical importance of vectors
- 4 To learn different pest control measures

**UNIT I TAXONOMY OF INSECTS**

General characters of insects, Classification of Insects, Economic importance of insects Orders - Orthoptera, Hemiptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. Reasons for insects attaining pest status.

**UNIT II INJURIES INSECTS OF PLANTS AND ANIMALS**

Life cycles of any four pests of Paddy, Sugarcane, Cotton and Stored products –Nature of Damage and control measures, Life cycle of any two ticks and mites of cattle and poultry- control measures.

**UNIT III INSECT PEST OF STORED PRODUCTS**

Household insects and their control- Cockroach, Lepisma and carpet beetle- Insect vectors,vector biology- pathogens. Disease transmitted by mosquito, housefly, flea and control measure. Insect vectors of plant diseases- white fly and leaf hoppers.

**UNIT IV BENEFICIAL INSECTS**

Insect galls- NPV. Insects in medicine- Beneficial insects: predators- parasites- weed killers- soil builders- scavengers.

**UNIT V PEST MANAGEMENT**

Classification of insecticides, mode of action and chemical nature- merits and demerits of chemical methods of pest control, Pest resurgence. - Biological method of pest control, Integrated pest management (IPM)- precautions in handling pesticides- pesticide poisoning, first aid.

**REFERENCE BOOKS:**

1. Rajendra Singh, 2016. Elements of Entomology. 2<sup>nd</sup> Edition: Rastogi publications, New Delhi.
2. Nalina Sundari, M.S. and Santhi, R. (2006) Entomology, MJP Publishers, Chennai.
3. David, B.V. (2001) Elements of Economic Entomology, Popular Book Depot, Chennai.
4. Dunston, P. Ambrose (2004) The insects: Structure, Function and Biodiversity, Kalyani Publications, New Delhi.
5. Srivastava, K.P. (1993) Text Book of Applied Entomology, Vol. I & II, Kalyani Publications, New Delhi.



6. Nayar, K.K., Anandakrishnan, T.N. and David, B.V. (1982) General and Applied Entomology, Tata Mc Graw Hill, New Delhi.
7. Ayyar, T.V.R. (1984) Handbook of Economic Entomology for South India, Books and Periodicals, Supply Service, New Delhi.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Describe the classification of insects	<b>K1</b>
<b>CO2</b>	Elucidate the control methods of pest in the different field of agriculture	<b>K1</b>
<b>CO3</b>	Classify the Households insects and their control	<b>K2</b>
<b>CO4</b>	Outline the beneficial insects like silkworm and honey bee	<b>K1 &amp; K2</b>
<b>CO5</b>	List the pest of stored products and their controlling mechanisms	<b>K1</b>

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DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-III

CORE PAPER: X

**ENVIRONMENTAL BIOLOGY - 20P3ZO10**  
(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**Course Objectives**

- ❖ To introduce the students to various concerns regarding the environment, regionally and globally including the natural challenges, pollution and their effects in the changing environment.

**UNIT I ECOSYSTEM**

Definition and concepts of ecosystem – Types of ecosystems (Terrestrial and aquatic ecosystem). Energy flow in ecosystem food chains, food webs and ecological pyramids.

**UNIT II BIODIVERSITY**

Definition of biodiversity, value of biodiversity, threats to biodiversity, endemic and endangered species of India. In-situ conservation – protected areas, National parks, wild life sanctuaries, conservation projects – tiger, elephant, Dolphin and Dugong. Ex-situ conservation Zoological parks, Germ plasm banks, Biosphere reserves, National bureau of animal genetic resources.

**UNIT III POLLUTION**

Introduction -Types of pollution- Air, water, soil and Noise Pollution -effects and control measures. Biomagnification - eutrophication – Environmental Impact Assessment (EIA), bio indicators- bioremediation-bio degradation.

**UNIT IV NATURAL RESOURCES**

Types of Resources – water resources management, Forest resources and chipko movement. Energy resources – renewable and non - renewable. Conventional and non – Conventional sources of energy.

**UNIT V ECOLOGICAL HABITATS**

Biomes, Deciduous Forest, Rain Forest, temperate grass land, savanna, tropical forest and desert, estuary, ecological niche, types of ecological succession. Remote Sensing and GIS - introduction and applications

**REFERENCE BOOKS:**

1. Gowrikrishna Dasmohapatra (2009) Environment and Ecology (III Edn) VIKAS Publishing House Pvt Ltd, New Delhi.
2. Ahluswalia, V.K. and Sunita Malhotra (2009) Environmental Sciences, Ane Books Pvt Ltd, New Delhi.
3. Misra, S.P and Pandey, S.N. (2009) Essential Environmental Studies, Ane Books Pvt Ltd, New Delhi.
4. Kormondy, E.J. (2007) Concepts of Ecology, Frenice Hall of India, New Delhi.
5. Agarwal, K.C. (1999) Environmental Biology, Agro Bolanica, Bikaner.

6. Castri, F.D and Younes, T. (1996) "Biodiversity Science And Development" Cab Int., Wallingford, UK.
7. Ananthkrishnan, T.N. (2000) Bioresources Ecology, Oxford and IBH Publishing Co., New Delhi.
8. Odum, E.P., (2003) Fundamentals of Ecology, Holt Saunders, Philadelphia.
9. Odum, E.P., (2000) Basic Ecology, Holt Saunders, Philadelphia.
10. Siddiqui, K.A., (2000) Pollution conservation and forestry, Kitab Mahal, New Delhi.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Recall the basic concepts of ecosystem	<b>K1</b>
<b>CO2</b>	Summarize the biodiversity and Energy flow in ecosystem food chains	<b>K1</b>
<b>CO3</b>	Discuss the forest resource management	<b>K2</b>
<b>CO4</b>	Understand the biodiversity and its conservation process	<b>K1 &amp; K2</b>
<b>CO5</b>	List the type of pollution and its controlling mechanisms	<b>K1</b>

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SEMESTER-III

CORE PAPER: X

**GENERAL AND APPLIED ENTOMOLOGY,  
ENVIRONMENTAL BIOLOGY AND ANIMAL BIOTECHNOLOGY  
(20P3ZOP03)**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**I. GENERAL AND APPLIED ENTOMOLOGY**

1. Preparation of key for the identification of insects using dichotomous Key.
2. Different types of Mouth parts of insects, their feeding habits (Diagram and description).
3. Study of insects: Beneficial and Harmful insects
4. Observation of important pests of paddy, sugar cane, cotton, pulses, vegetables, fruits and stored products to understand the life history of insects in relation to the life history of plants
5. Field study to understand the various methods of pest managements: (Observation in agro ecosystem).

**II. ENVIRONMENTAL BIOLOGY**

6. Estimation of dissolved O<sub>2</sub> in given water sample (Winkler's method). (BOD demonstration only)
7. Estimation of CO<sub>2</sub> content in given water sample.
8. Identification and description of fresh water plankton. (Daphnia, Cyclops, Volvox, Paramecium, Euglena).

**III. ANIMAL BIOTECHNOLOGY**

9. Single cell Protein culture – Demo.
10. Demonstration of southern Blotting and SDS PAGE techniques.
11. Tour reports of the visits to Biotechnological Research Lab / Industries.

**IV. RECORD SUBMISSION**

**REFERENCE BOOKS:**

1. David B.V. (Ed.), (1992) Pest Management and Pesticides: Indian Scenario, Namrutha Publications, Madras.
2. Hill D.S. (1987) Agricultural Insect Pests of Tropics and their Control, Cambridge University Press, UK.
3. Michael P. (1984) Ecological Methods for field and Laboratory Investigations, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
4. Nayar N.K. Ananthakrishnan T.N. and David B.V. (1983) General and Applied Entomology, Tata Mc Graw Hill Publishing Company, New Delhi.
5. Brown, T.A. (2006) Gene cloning -An Introduction, Stanley Thrones (Publishers) Ltd., Cheltenham, U.K.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	List the Preparation of key for the identification of insects	<b>K1</b>
<b>CO2</b>	Observation of important pests of paddy, sugar cane	<b>K1</b>
<b>CO3</b>	Analyses the water quality parameters with O <sub>2</sub> estimations.	<b>K2</b>
<b>CO4</b>	Demonstration of Blotting and SDS PAGE techniques	<b>K1 &amp; K2</b>
<b>CO5</b>	Understand the various methods of pest managements	<b>K1</b>

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SEMESTER-III

CORE PAPER: X

**EDC: SERICULTURE - 20P3ZOED01**  
(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**UNIT I INTRODUCTION TO SERICULTURE**

History of Sericulture: Silk production, Scope and limitations of sericulture Industry- Morphology and life cycle of *Bombyx Mori*, Types of silk, Voltinism.

**UNIT II MULBERRY CULTIVATION**

Bruning Technique, Study of mulberry varieties- Methods of plantation and leaf production- Identification of mulberry diseases, pests and control measures.

**UNIT III SILKWORM REARING TECHNIQUES**

Grainage operations and activities. Silkworm rearing- Rearing environment condition-shoot harvest method of rearing- spacing and leaf requirement in different stages. Disinfection of rearing houses and appliances- handling of eggs- Transporting of eggs- hatching. –Brushing- young age and late age rearing- Spinning and mounting- Harvesting- transportation and marketing.

**UNIT IV DISEASES OF SILKWORM**

Silkworm diseases, symptoms and control measures: Protozoan disease-.Pebrine, Bacterial diseases- Flacherie, Viral diseases- Grasserie, Fungal diseases- Muscardine. Pest of Silkworm.

**UNIT V SILK PRODUCTION & BY PRODUCTS OF SERICULTURE**

Raw silk reeling- raw silk testing -classification of silk -By products of sericulture- Economic importance of silkworm-Economics of sericulture -a Role of women in Indian sericulture. Technique to increase the silk production.

**REFERENCE BOOKS:**

1. Ganga G. and J. Sulochana Chetty (2005) An introduction to sericulture, 2<sup>nd</sup> Edition Vijay Primlani Publ. For Oxford and IBH Publ. Co. New Delhi.
2. Rangasamy, G. (1987) Manual on sericulture FAO, Vol. I-IV, Agriculture service bulletin, CSB, Bangalore, INDIA.
3. Dandin, S.B. (2004), Hand book of new sericulture technologies, Central Silk Board, Board, Bangalore, pp 287.

<b>L No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Recognize the scope of Silkworm production	<b>K1</b>
<b>CO2</b>	Explain the nutritional values of Mulberry plant	<b>K1</b>
<b>CO3</b>	Apply the silk production process	<b>K2</b>
<b>CO4</b>	Identify the diseases and competitors in Sericulture industries	<b>K1 &amp; K2</b>
<b>CO5</b>	List the byproducts from sericulture process	<b>K1</b>

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SEMESTER-IV

CORE PAPER: XI

**BIostatISTICS AND RESEARCH METHODOLOGY - 20P4ZO11**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**Course Objectives**

- ❖ To learn the statistical concepts and uses in Bio / Zoology
- ❖ To identify the problem during the data analysis
- ❖ To provide a foundation and motivation for exposure to statistical ideas
- ❖ To inculcate the certainty that Statistics is important for scientific research
- ❖ To understand the compute and interpret of data

**BIostatISTICS**

**UNIT I IMPORTANCE OF STATISTICS**

Introduction, Concept and importance of statistics in biology: Collection of Data- Classification, Tabulation, Diagrammatic presentation and graphical presentation of Data

**UNIT II DESCRIPTIVE STATISTICS**

Measures of central tendency - Mean, Mode, Median: Measures of Dispersion- Standard Deviation, Standard Error and Coefficient of Variation. Probability and Theoretical Distribution- F-Test. Regression and Correlation analysis.

**UNIT III TEST OF FINDINGS**

T-tests (One sample t-test, Two sample t-test, Paired t-test), Chi-square test and goodness of fit, One-Way and Two Way ANOVA.

**RESEARCH METHODOLOGY**

**UNIT IV FORMAT OF THESIS**

Sources of literature collection. Format of thesis - framing the title. Preparation of the first page. Precautions to be taken while preparing introduction, Historical resume and materials and methods. Format of presenting results, including tables, figures and photographs. The art of writing discussion and summary. Guidelines to be followed while writing bibliography.

**UNIT V PAPER PUBLICATION**

Preparation of Scientific paper for publication in a Journal. Internet and e-journals. Computer aided techniques for data analysis, data presentation.

**REFERENCE BOOKS:**

1. Gurumani, N. (2005) "An Introduction to Biostatistics", II Edition, MJP Publishers, Chennai.
2. Gurumani, N. (2009) "Research Methodology for Biological Sciences", MJP Publishers, Chennai.
3. Gupta, S.P., (2002) Statistical methods, Sultan Chand and Sons, Educational Publishers, New Delhi.
4. Memering, D. (2000) The prentice Hall Guide to research Writing. Prentice Hall International, London.
5. Khan, I.A., and Khanum, A., 2004 Fundamentals of Biostatistics, Ukaaz Publications, London.



6. Mahajan, B.K. (1997) Methods in Biostatistics for medical students and research workers, 6<sup>th</sup> edn. Jaypee Brother's Medical Publications Ltd., New Delhi.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Recall the basic concepts of origin of life on earth	<b>K1</b>
<b>CO2</b>	Summarize the Measures of Central tendency	<b>K1</b>
<b>CO3</b>	Interpret the hypothesis with students t test	<b>K2</b>
<b>CO4</b>	Apply the knowledge of research methodology and frame the hypothesis	<b>K1 &amp; K2</b>
<b>CO5</b>	Understand the Preparation of Scientific paper for publication	<b>K1</b>

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)

DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-IV

CORE PAPER: XII

**EVOLUTION - 20P4ZO12**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**UNIT I EVIDENCES OF EVOLUTION**

Introduction, Origin of life – Abiogenesis, Biogenesis, Biochemical, Urey miller's experiments.

Evidences of evolution - morphology and comparative anatomy, Embryology, Physiological and Bio – chemical, Paleontological and Genetic Evidences.

**UNIT II PALEONTOLOGY & THEORIES OF EVOLUTION**

Geological time scale, Study of Fossils: Definition, Formation, Types and Determination of Age of Fossils. Evolution of Vertebrate groups, Ostracoderms- characteristics features and classification. Primitive jawed vertebrates- origin of jaws, amphibian, Reptiles, Birds and Mammals. Lamarckism - Neo Lamarckism, Darwinism – Neo Darwinism,

**UNIT III PROCESS OF EVOLUTION**

Mutation and their role in Evolution, Types of variation, Elemental forces of Evolution – mutation, Natural selection, Genetic drift, Recombination, gene frequency, Hardy Weinberg law.

**UNIT IV SPECIATION AND ADAPTIVE RADIATION**

Speciation, isolating mechanism, Neoteny, mimicry, coloration and its types, Adaptive radiation– Darwin's finches. Cultural evolution of man.

**UNIT V ANIMAL DISTRIBUTION**

Zoogeography distribution of Fauna and Flora – Oriental region, Australian region, Neotropical region, Ethiopian region, Neo arctic region and Paleoartic region. Insular fauna- Continental Island and Oceanic Islands.

**REFERENCE BOOKS:**

1. Richa Arora (2009) Patterns of Evolution, Anmol Publishers, New Delhi.
2. Richa Arora (2004) Elements of Evolution, Anmol Publishers, New Delhi.
3. Rastogi, V.B. (2003) Organic Evolution, Kedar Nath, Ram Nath.
4. Strickberger, M.W. (2000) Evolution. Jones & Bartlett Publications.
5. Dodson, E.V. (1960) Evolution process and product. East West Press, New Delhi.
6. Paulamos Moody (1978) Introduction to evolution. Kalyani Publishers, Ludhiana, New Delhi.
7. Kapoor, V.C. (1986). Theory and practice of animal taxonomy. Oxford & IBH Publishers Co., New Delhi.
8. Stebbins, G.L. (1969) The basis of Progressive Evolution, University of North Carolina Press,
9. Dobzhansky, T. (1955) Evolution, Genetics & Man. Wiley Eastern Pvt. Ltd.

<b>SL No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Recall the basic concepts of origin of life on earth	<b>K1</b>
<b>CO2</b>	Relate the evidences of Geological time scale and fossils	<b>K1</b>
<b>CO3</b>	Summarize the theories of evolution	<b>K2</b>
<b>CO4</b>	Discuss the role of speciation	<b>K1 &amp; K2</b>
<b>CO5</b>	Explain the Zoogeography distribution of Fauna and Flora	<b>K1</b>

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DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-IV

Elective Paper: IV

**FIRST AID AND HOME NURSING - 20P3ZOE04**

(For those admitted in June 2020 and later)

Contact hours per week: 06

Contact hours per semester: 90 hrs

5 CREDITS/ SYLLABUS

**UNIT I FIRST AID TREATMENTS**

Principles of first aid – Insect bite, Dog bite and Snake bite. Medical emergency. 108 and 112 service, First aid box and Laboratory first aid – Fire accidents, Corrosive chemicals.

**UNIT II BONE AND HEAT**

Fracture - Causes, Types, Signs and Symptoms. First aid – Treatment. Effect of heat, heatstroke, signs and symptoms and first aid. First aid for wounds and burns.

**UNIT III HOME REMEDIES**

Home nursing – Definition, observation of patients, Conditions. Importance of habit and observation. Clinical thermometer and its uses. Counting of pulse, Respiration, respiratory rate.

**UNIT IV STRESS MANAGEMENT**

Normal and abnormal blood pressure, Specific infectious diseases. Method of Nursing the patients suffering from illness.

**UNIT V HOSPITAL NURSING**

Care of sick – Routine nursing care of sick. General application of heat – Hot baths and hot sponging, warm baths and medicated baths. General application of cold bath and sponging.

**REFERENCE BOOKS:**

1. Park. K. (2011) Text book of preventive and social medicine (21<sup>st</sup> edn.). M/s Banarsidas Bhanot Publishers, Jabalpur.
2. Indrani., T.K. (2006) First Aid for Nurses (1<sup>st</sup> edn.), Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi.
3. Shukla, G.S. and Upadhyay, V.B. (2005) Economic Zoology, Rastogi Publication, Meerut.
4. Park. K (2004) Essentials of community health nursing (4<sup>th</sup> edn.) M/s Banarsidas Bhanot Publishers, Jabalpur.

SL No	Course Outcome	Knowledge Level
CO1	Recall the basic steps for the first aid process	K1
CO2	Understand Fracture - Causes, Types, Signs and Symptoms.	K1
CO3	Summarize the home nursing procedure	K2
CO4	Discuss the blood pressure	K1 & K2
CO5	Explain the Routine nursing care of sick	K1

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DEPARTMENT OF ZOOLOGY/M.Sc. DEGREE COURSE IN ZOOLOGY

SEMESTER-IV

**PROJECT AND VIVA VOCE - 20P4ZOPR01**

**(For those admitted in June 2020 and later)**

Contact hours per week: 12

Contact hours per semester: 180 hrs

5 CREDITS/ SYLLABUS

Governing the Evaluation of Project and Viva-Voce

1. Each student shall select a topic for his/her Project work in consultation with his/her guide and the Head of the department.
2. The Project report should be submitted to the Controller of Examinations (PG Courses) through the Head of the Department one week prior to the commencement of the terminal Examinations. If a candidate fails to submit the project report within the stipulated time, he/she may be permitted to submit the same one day prior to date of *viva voce* examinations with late fee prescribed by the Principal. If the candidate fails to submit the project report one day prior to the date of *viva voce* examination, he/she may be permitted to submit the Project report within a period of one month from the date of conduct of *viva voce*, with extension fee prescribed by the Principal. If the candidate fails to submit the project report even after that extension period, he/she will be treated with on par with failures and he/she has to do another project and to submit the report after six months by paying fee prescribed by the Principal.
3. Each student shall submit 2 copies of his/her Project report for valuation.
4. The Project report shall contain a minimum of 25 pages excluding bibliography and appendices.
5. The Project report shall be valued for a total of 80 marks out of which the external examiner and the Guide share 20 marks each. The sum of marks awarded by both the examiners shall be considered to be the final mark. For a pass in the Project report, the student should secure a minimum of 36 marks. If a student fails to get the minimum pass mark in the Project report, he/she shall be permitted to resubmit his / her Project report once again within a period of 6 months from the date of publication of the result.
6. For those candidates who have passed in the evaluation of Project report, there will be a *viva voce* examination on the above. The *viva voce* carries a maximum of 20 marks and the guide and the external examiner will conduct it jointly. The student should secure a minimum of 10 marks for a pass in the *viva voce* examination, failing which he/she shall be required to reappear for the *viva voce* after a month from the date of *viva voce* already conducted but within a period of 3 months for which he/she will have to pay a fee as prescribed by the Principal.
7. For a pass in this paper as a whole, a student should secure a minimum of 50 marks in Project report and *viva voce* put together.

QUESTION PAPER PATTERN FOR THEORY

Time: 3 Hours

Maximum Marks: 75

Each question paper consists of 3 parts – A, B & C

**PART - A (20 x 1 = 20 Marks)**

Choose the Best Answer

Four Questions from each Unit

**Part - B (5 X 5 = 25 Marks)**

Answer All questions (Either or type)

Two questions from each unit.

**PART - C (3 x 10 = 30 Marks)**

Answer any three questions (Open Choice)

One questions from each unit.

QUESTION PAPER PATTERN FOR PRACTICALS

Time: 4 hours

Maximum Marks: 60

- I. Major practical      -20 Marks
- II. Minor practical     -10 Marks
- III. Spotters      (4 X 5)- 20 Marks
- IV. Record               - 10 Marks