

SEMESTER I

Course No. **PSZOTC 101**Course Title: **Ecology & Environmental
Biology**

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

Plants, animals and the microbes are part of a well orchestrated life. They interact with one another and with their abiotic environment to produce the symphony of the biosphere of which man is only a small part. Yet, this exquisite harmony is threatened by man through his limitless greed and unwise exploitations of the natural resources. This course has been designed to make a student appreciate in general and broad terms related to ecosystem.

UNIT I

- 1.1 Concept of eco-system, ecological niche, habitat and ecological equivalents.
- 1.2 Hydrological cycle:
 - 1.2.1 Impact on Environment
 - 1.2.2 Impact on biota.
 - 1.2.3 Man's Impact on Hydrological cycle
- 1.3 Generalized model of energy flow through an ecosystem, laws of thermodynamics
- 1.4 Primary productivity: methods of its determining primary production.
- 1.5 Secondary productivity
- 1.6 Limiting factors, Law of minimum and law of tolerance.

UNIT II

- 2.1 Organization of communities: The biotic community concept and Intra-community classification
- 2.2 Patterns in communities.
- 2.3 Ecological dominance, Species diversity in communities, Ecotones and Edge effect
- 2.4 Succession: Concept and types of pioneer species and climax communities, climax concept and mechanism of succession
- 2.5 Vegetation Structure, classification units and systems; classifying vegetation by using differential – species and association concept.
- 2.6 The terrestrial biota, Permeants .
- 2.7 Soil sub-system

UNIT III

- 3.1 Attribution of population, natality and mortality
- 3.2 Age distribution, biotic potential, population growth forms, carrying capacity concept, life tables and survival-ship curves
- 3.3 Population structure, Aggregation and Allee's principle, Isolation and territoriality, dispersal and dispersion
- 3.4 Biological invasion (Ecesis)

- 3.5 Negative interaction: Competition, Predation and Parasitism and Social behaviour.
- 3.6 Positive Interaction : Commensalisms, Cooperation and Proto-cooperation and Mutualism

UNIT IV

- 4.1 Sources and Uses of Non-conventional energy
- 4.2 Causes and Conservation of Dwindling Freshwater Resources
- 4.3 Remote sensing: Definition, Importance and application
- 4.4 Causes, types, effects and control measures of:
 - 4.4.1 Soil Pollution
 - 4.4.2 Water Pollution
 - 4.4.3 Air Pollution
- 4.5 Bio-indicators of Pollution
- 4.6 Bio-remediation

UNIT V

- 5.1 Biodiversity –assessment, conservation and management
- 5.2 Biodiversity act and related International Conventions
- 5.3 Sustainable development, natural resources management in changing environment
- 5.4 Forests as a Natural Resources
- 5.5 Fisheries as a Natural Resources
- 5.6 Wildlife
- 5.7 Minerals

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Phillipson, J. 1966. Ecological Energetic, Edward Arnold Ltd. London.
2. Odum, E.P. 1970 : Ecology, Amerind Publ. Co. New Delhi.
3. Odum, E.P. 1971. Fundamentals of Ecology, W.B. Saunders, USA.
4. Kormondy, E.T. 1971. Concept of Ecology. Prentice Hall of India, New Delhi.
5. Ricklefs, R.E. 1973. Ecology. Thomes Nelson and sons Ltd.
6. Colinbaux, P.A. 1985 Introduction to ecology. John Wiley & Sons.
7. Wiegert, R.G. 1976. Ecological Energetic Dowden, Hutchinson & Ross. Inc. Pennsylvania.
8. Scuthwick, C.H. 1976. Ecology and the quality of our environment. D. Van Nestrand
9. Fahey, J.J, and Knapp, A.K. 2007. Principles and Standards for measuring primary production. Oxford Univ. Press. UK.
10. Grant, W.E. and Swanmack, T.M. 2008. Ecological Modeling. Blackwell Publ. House.

- 11 Wilkinson, D.M. 2007. Fundamental Resources in Ecology: An Earth System Approach. Oxford Univ. Press. UK.
- 12 M.P. Sinha, Soma Dey, Bijaj. S. Singh. 2004. Conservation of biodiversity and Natural Resources. Dya Publ. House Delhi.

COURSE NO. PSZOTC 102

Course title:

Semester I
Ichthyology

CREDITS: 4

MAXIMUM MARKS:

100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test	I :	20
b) Minor Test	II :	20
c) Major Test	:	60

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

The course has been designed to provide the students with sufficient information regarding fish classification, structure and adaptation to various ecological conditions alongwith feeding, nutrition and reproduction so that they may appreciate better the biology of this fascinating and useful group of aquatic animals.

UNIT I

Morphology and classification

1.1 Morphological studies

1.1.1 Distinctive characteristics of fishes

1.1.2 Body form and its diversity

1.1.3 Fins

1.1.3.1 Theories of origin of fins

1.1.4 Structure skeletal support, modification and functions of paired fins

1.1.5 Structure skeletal support, modification and functions of un-paired fins

1.2. Outline classification of fishes with special reference to distinctive features, geographical distributions, classification and typical examples of the following sub-divisions:

1.2.1 Chondrichthyes

1.2.2 Actinopterygi

1.2.3 Crossopterygi

1.2.4 Dipnoi

UNIT II

Sense organs and some special features

2.1 Scales: types, structure and functions of scales

2.2 Coloration: chromatophores, pigments and biological significance of coloration in fishes

2.3 Bioluminescence in fishes and its significance

2.4 Electric organs: their structure and use in fishes.

2.5 Venomous and poisonous fishes

2.6 Sense organs

2.6.1 Eye

2.6.2 Lateral line

2.6.3 Internal ear

UNIT III

Feeding and Respiration

3.1 Alimentary canal and its diversity in fishes

3.2 Food, feeding habits and feeding adaptations

3.3 Respiratory organs

3.3.1 Structure, modifications and functions of gills

3.3.2 Structure and development of air breathing organs in fishes

3.3.3 Structure and function of swim bladder

UNIT IV

Reproduction and Development

- 4.1 Reproductive organs and Accessory sex organs
- 4.2 Secondary sexual characters
- 4.3 Oviparity, vivparity (Aplacental and Placental)
- 4.4 Nest building and parental Care
- 4.5 Types of eggs
- 4.6 Hatching
- 4.7 Metamorphosis

UNIT V

Adaptations to special conditions of life

- 5.1 Deep sea fishes
- 5.2 Hill stream fishes
- 5.3 Cave dwelling fishes
- 5.4 Arctic and Antarctic fishes (avoidance of freezing)
- 5.5 Migration in fishes
- 5.6 Osmoregulation in fishes

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Major Test	41% to 100%	2Hrs.& 30 mins.	60

- iv) Major test will have seven questions each of 15 marks
- v) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- vi) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Vasanth Kumar, Daya Publ. House, New Delhi. 2013. Advancers in Aquatic Ecology
2. Lynwood, S. Smith. Narendra Publ. House, Delhi. 2003. Introduction to the fish physiology.
3. Arvind Kumar and Pushaplata Dubey. Daya Publ. House, Delhi. 2006. Fish Management and Aquatic Environment
4. Lagler, Bardock, Miller & Possino, John Wiley & Sons, N.Y., London: 2012. Ichthyology, 2nd Ed.
5. Halver and Hardy. Acad. Press. 2002: Ash Nutrition . An Imprint

COURSE NO. PSZOTC 103

Course Title: Fundamentals of
Bio-chemistry

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

**Syllabus for the examination to be held in
December, 2014, December, 2015 and December, 2016.**

OBJECTIVES

The course has been designed to expose the students of Zoology to modern functional approach with prime object to understand the biochemical basis explaining the basic functioning of various body mechanisms. The attempt is to arrive at an approach that would necessarily involve biochemistry and help to solve mysteries of cellular activities.

UNIT I **Proteins : Structure, Function & Metabolism**

- 1.1 General features and classification
 - 1.1.1 General Features
 - 1.1.2 Classification
- 1.2 Levels of organization
 - 1.2.1 Primary
 - 1.2.2 Secondary
 - 1.2.3 Tertiary
 - 1.2.3.1 Globular protein (Specialized proteins)
 - 1.2.4 Quaternary.
 - 1.2.4.1 Fibrous protein (Specialized proteins)
- 1.3 Protein metabolism
 - 1.3.1 Catabolism of Amino Acid Nitrogen.
 - 1.3.2 Transamination & Deamination.
 - 1.3.3. Formation of Ammonia and its transport.
 - 1.3.4 Biosynthesis of Urea, Uric Acid & Creatinin.
- 1.4. Denaturation.

UNIT II

Enzymes : Structure & Function

- 2.1 General properties and classification.
- 2.2 Coenzymes and their types, Isoenzymes
- 2.3 Kinetic properties of enzymes.
- 2.4 Mechanism of enzyme activity.
- 2.5 Inhibition of enzyme activity.
 - 2.5.1 Irreversible inhibition.
 - 2.5.2 Reversible inhibition.
 - 2.5.2.1 Competitive
 - 2.5.2.2 Non-competitive
 - 2.5.2.3 Uncompetitive
- 2.7 Feed back inhibition: Allosteric site – a concept, Allosteric inhibition

UNIT III

Carbohydrates : Structure and Function

- 3.1 General features and classification.
 - 3.1.1 General features

- 3.1.2 Classification
- 3.2 Isomerism in Glucose
 - 3.2.1 Optical isomerism
 - 3.2.2 Ring structure.
 - 3.2.3 Anomers & Epimers.
 - 3.2.4 Aldose & Ketose Isomerism.
- 3.3 Glucosids, Hexosamines, Glycoprotein and Glycophorins.

UNIT IV

Lipids : Structure & Function

- 4.1 Definition and classification.
- 4.2 Nomenclature and forms of fatty acids..
- 4.3 Saturated & Unsaturated fatty acids
- 4.4 Simple lipids : Triacylglycerols, waxes
- 4.5 Complex Lipids : Phospholipids, Glycolipids
- 4.6 Derived Lipids : Steroids, Lipoprotien, Prostaglandins

UNIT V

Metabolism of Carbohydrates & Lipids

- 5.1 Fatty acid oxidation.
- 5.2 Biosynthesis of saturated fatty acids.
- 5.3 Hormonal control of Adipose tissue.
- 5.4 Lipolysis and Ketosis.
- 5.5 Carbohydrates:.
 - 5.5.1 Biological oxidation.
 - 5.5.2 Oxidoreductases and their function.
 - 5.5.3 Respiratory chain.
 - 5.5.4 Mechanism of oxidative phosphorylation.
 - 5.5.5 Transport of substances in and out of mitochondria.
 - 5.5.6 Glycolysis, Glycogenesis, Glycogenolysis & Gluconeogenesis.
 - 5.5.7 Oxidation of pyruvate to acetyl Co A.
 - 5.5.8 Citric acid cycle.

Note for Paper Setting

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Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Sturkei, J.W. : Introduction to biochemistry, H it, Richart and Winasarton, Tokyo.
2. Prosser & Brown : Comparative animal physiology.
3. Prosser, C.L. : Text Book of animal physiology.
4. Marshall : Introduction to animal physiology.
5. Bell, Smith & Paterson: Text book of physiology and biochemistry.

6. Eckert and Randall : Animal physiology.
7. Hoar : Animal physiology.
8. Nagabhushanam : Text book Animal Physiology.
9. R. Hannah Sulochana, 2010. Principles of Biochemistry
10. Donald Voet, Judith, G. Voet, Wiley Plus Charlotte, W. Pratt. 2008. Principles of Biochemistry
11. Lehninger, Michael M. Cox and David L. Nelson. W.H. Freeman & Co. N.Y. 2010. Principles of Biochemistry
12. R.I. Gumpert, Frank, H. Deis, Nancy Counts Gerber & Rager. W.H. Freeman Co. N.Y. 2002. Biochemistry 5th Ed.
13. John, L. Tymoczko, Jeremy M, Berg & Lubert Stryer 2013. Biochemistry 2nd Ed.
14. Murray, Bender, Botham, Kennelly Rodwell, Mc. Graw Hill Publ. House. 2009. Harper's Illustrated Biochemistry

COURSE NO . PSZOTC 104

Course Title: **Genetics and Cytogenetics**

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

**Syllabus for the examination to be held in
December, 2014, December, 2015 and December, 2016.**

OBJECTIVES

Genetics and Cytogenetics provide scientific basis to the art of plant and animal breeding. Genetic improvement of crop plants and farm animals cannot be perfect and have lasting effect, unless their genetic architecture has been fully understood. This course aims at educating the student with upto date knowledge of the nature and structure of genetic material and principles of heredity in diploid, polyploid and aneuploid organisms.

SYLLABUS

Unit I Structure and organization of chromosome

- 1.1 Chromosome structure in pro-and eukaryotes, nucleosome model, telomere structure.
- 1.2 Specialized chromosome types-Lampbrush and Polytene chromosomes.
- 1.3 Accessory chromosomes, occurrence, behaviour, transmission and origin.
- 1.4 Organization of chloroplast and mitochondrial genomes.

UNIT II Numerical Chromosome Variation

- 2.1 Polyploidy-induction and types. Autopolyploids meiotic behaviour, Segregation. Effect of autopolyploidy.
- 2.2 Allopolyploids – classification, meiotic behaviour, Role of allopolyploidy in evolution of wheat, potato, tobacco and cotton.
- 2.3 Aneuploidy: types of aneuploids; induction of trisomics, monosomics and nullisomes-their role in chromosome mapping.
- 2.4 Alien addition and substitution- Their role in gene transfer.

UNIT III Structural chromosome alterations

- 3.1 Types of structural chromosome alterations- deletion, duplication, meiotic behaviour and utility
- 3.2 Identification, meiotic behaviour and induction of inversions.
- 3.3 Identification, meiotic behaviour and induction of translocations.
- 3.4 Significance of structure alterations of chromosomes in evolution.

UNIT IV Gene Structure and Function

- 4.1 Concept of gene; dis-trans test. rII Locus of T4 phages; complex loci in eukaryotes,
- 4.2 Gene function; transcription and translation in pro and eukaryotes.
- 4.3 Regulation of gene expression in pro and eukaryotes.
- 4.4 Gene controlled biosynthetic pathway: Antho-cyanin, Phenylalanine-tyrosine, Haemoglobin biosynthesis.

UNIT V Genome influx

- 5.1 Gene mutations-molecular basis of mutations, mechanism of DNA repair. Evolutionary significance.
- 5.2 Gene amplification; mechanism and significance; C-value paradox; evolutionary significance.
- 5.3 Mobile genetic elements in prokaryotes; insertion elements and transposons in bacteria.
- 5.4 Mobile genetic elements in eukaryotes, Ty elements in yeast; P and Copia in Drosophila; Ac-Ds, SPM (En) and Mu elements in maize; molecular characteristics and their significance.

Note for Paper Setting

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Books recommended

- 1. Burnham, C.R. (1962) : Discussions in Cytogenetics Burgess Publ. Co. Minneapolis.
- 2. Garber, G.B. (1972): Cytogenetics. McGraw Hill. Pub. Co. Ltd.
- 3. Hexter, W. and Yost: The science of Genetics. Prentice Hall Inc.
- 4. Srb. A.M. Owen, R.D. and Edgar, R.S. General genetics, W.H. Freeman and Co., San Fransisco.
- 5. Sinnett, E.W., Dunn, L.C. and Debzhanski, Th (1958): Principles of genetics. Kugakusha. Co. Inc. Ltd. Japan.
- 6. Strickbarger, M.W. (1976): Genetics. Mc. Millan Publ. Co. Inc. New York.
- 7. Swanson, R.C.P. Mertz, T. and Young, W.J. (1967): Cytogenetics, Prentice Hall of India, Pvt. Ltd.
- 8. Terry Brown, Taylor and Francis Group. USA. 2012. Introduction to Genetics: A Molecular Approach
- 9. E.J. Gardner, M.J. Simmons and D.P. Srustad. J.W. Sons Publ. Singapore. 2012. Principles of Genetics 8th Ed.
- 10. Miglani. Narosa Publ. House . New Delhi. 2011. Fundamentals of Genetics
- 11. Gardner and Snustad. J.W. & Sons. 1981. Principles of Genetics
- 12. A.G. Atherly, J.R. Girton & J.F. McDonald. Saunders College Publ. USA. 1999. The Science of Genetics.

SEMESTER II

COURSE NO. PSZOTC-201

CREDITS : 4

Time Duration: 2 Hrs and 30 Mins.

TITLE: **Basic Endocrinology**

Maximum marks : 100

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015 and May 2016**OBJECTIVES**

The course is designed to offer the students a broad understanding of Endocrinology as an important branch of Animal Physiology. A comparative approach is useful in that it highlights the basic morphology, anatomy, histology of endocrine glands/ neurosecretions and their activity in response to particular physiological situation, irrespective of diversity of the organisms involved.

SYLLABUS**Unit I**

- 1.1 Neurochemical coordination and role of hormones
 - 1.1.1 Types of Chemical messengers
 - 1.1.2 Neural versus hormonal coordination
 - 1.1.3 Homeostasis
- 1.2 Feed back mechanism
- 1.3 Pheromones: Types, Structure and Functions
- 1.4 Hormone Assays Techniques
 - 1.4.1 Ablation
 - 1.4.2. Bio-assays
 - 1.4.3 Radio-immuno Assays.

Unit II

- 2.1 Morphology and Physiology of Neuroendocrine system in Crustacea
 - 2.1.1 Neurosecretory cells: X and Y Organs.
 - 2.1.2 Role of Neuroendocrine Secretions on growth, reproduction and metabolism
- 2.2 Morphology and Physiology of Neuroendocrine system in Insecta
 - 2.2.1 Neuro secretory cells, Corpora cardiac, Corpora allatum and Prothoracic gland
 - 2.2.2 Neuroendocrine control of growth reproduction and metabolism
 - 2.2.3 Neuroendocrine system in fish: Morphology and physiology of Urophysis and Corpuscle of Stannius

Unit III

- Comparative Vertebrate Endocrinology:
- 3.1 Hypothalamo-hypophysial System
 - 3.1.1 General organization of Hypothalamus: Localization, chemistry and action of hypophysiotropic hormones.
 - 3.1.2 Pituitary gland

- 3.1.2.1 Localization, Chemistry and physiological roles of Adenohypophysial hormones and Neurohypophysial hormones.
- 3.1.2.2 Neural and vascular supply of hypophysis
- 3.2 Thyroid Gland: Comparative morphology, anatomy and histology of the gland
 - 3.2.1. Biosynthesis of Thyroid hormones
 - 3.2.2. Physiologic roles
 - 3.2.3 Pathophysiology
- 3.3 Parathyroid Gland: Comparative morphology, anatomy and histology of the gland
 - 3.3.1 Role of Calcitonin, PTH and Vit. D in calcium homeostasis.
 - 3.3.2 Pathophysiology
- 3.4 Gastro-intestinal hormones

UNIT IV

Steroid hormones of Gonads and Adrenal cortex:

- 4.1 Gonads: Comparative Morphology, anatomy, functions, deficiency diseases and chemical structure of hormones released
 - 4.1.1 Biosynthesis and Role of Male and Female sex hormones.
- 4.2 Adrenal Gland: Comparative Morphology, anatomy, functions, deficiency diseases and chemical structure of hormones released
 - 4.2.1 Morphology and Histology of the Adrenal cortex
 - 4.2.2 Biosynthesis and role of corticosteroids
 - 4.2.3 Biosynthesis and role of Adrenal medullary hormones (Catecholamine)
 - 4.2.4 Renin angiotensin system
- 4.3 Pancreatic Islets: Structure, Role and Regulation of Insulin and Glucagon
 - 4.3.1 Pathophysiology
- 4.4 Structure and functions of putative endocrine glands.
 - 4.4.1 Pineal Gland
 - 4.4.2 Thymus gland

Unit V

- 5. Life history of Hormones
 - 5.1 Formation of hormones
 - 5.2 Release of hormones from endocrine glands
 - 5.3 Transport of hormones in the blood and their peripheral activation.
 - 5.4 Termination of hormone action.
 - 5.5 Mechanism of hormone action

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
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Major Test	41% to 100%	2Hrs.& 30 mins.	60

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- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books recommended

1. Bantley, P.J. (1976) : Comparative vertebrate Endocrinology, Cambridge Univ. Press, U.K.
2. Norris, O Davia: Vertebrate Endocrinology
3. Williams Text book of Endocrinology (1998). W.B. Saunders Company.
4. Larsen, K. Ronenberg, Melmed and Polonsky
5. Hadley MaE and Levine, J.E. (2006): Endocrinology by Addison-Wesley
6. Barrington, E.E.W. : An introduction to comparative endocrinology, Willey Eastern Pvt. Ltd. USA.
7. Tombs, A.S. (1970)Introduction to invertebrates Endocrinology
8. Norman, Anthony, Litwack (1997): Hormones. Acad. Press
9. Brook, Chales and Marshall (2000) Essential Endocrinology
10. Chandler and Gulbert (1962) Hormones and Neurosecretions. State Univ. of New York,

Semester II

COURSE NO. PSZOTC-202

Maximum Credits: 4

Time Duration: 2 Hrs and 30 Mins.

Title: **Cell and Molecular Biology**

Max. Marks: 100

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015 and May 2016

Objectives

Molecular biology is relative a very recent field of biological Studies which emerged a couple of decades back, essentially as a consequence of enormous research work that followed the successful cracking of the genetic codes. Much of the knowledge generated on molecular aspects of life at cellular level is fascinating and worth of knowing by all students of biology. The course is designed to present an essential but simplified account of the current situation of the cell and the molecular biology for the students of Zoology of Master Degree Programme.

SYLLABUS

Unit I

- 1.1 Tools and methods
 - 1.1.1 Optical microscopy, Stereomicroscopy and Confocal microscopy
 - 1.1.2 Electron microscopy, Transmission electron microscopy, Scanning electron microscopy
 - 1.1.3 Fluorescence microscopy
 - 1.1.4 Flow cytometry
 - 1.1.5 Cell fractionation
 - 1.1.5.1 Centrifugation
 - 1.1.5.2 Ultracentrifugation
- 1.2 Sequencing proteins and nucleic acids: Principal and Application
 - 1.2.1 Southern, Northern blotting techniques
 - 1.2.2 South-western blotting techniques
 - 1.2.3 Dots blots and slot blots
 - 1.2.4 Polymerase chain reaction

UNIT II

- 2.1 Cell Membrane
 - 2.1.1 Structure and models of membrane organization
 - 2.1.2 Composition of cell membrane
 - 2.1.3 Function of cell membrane
- 2.2 Transport across membranes
 - 2.2.1 Active and Passive transport
 - 2.2.2 Endocytosis and Exocytosis
 - 2.2.3 Membrane transport proteins
- 2.3 Transport of macromolecules: Semi permeability; Osmosis
- 2.4 Modification of cell membrane

- 2.4.1 Microvilli
- 2.4.2 Cilia
- 2.4.3 Flagella

UNIT III

Cellular basis of immunity

- 3.1 Human Immune system : with trillions of lymphocytes
 - 3.1.1 Humoral antibody responses
 - 3.1.1.1 Lymphocyte development and reaction
 - 3.1.1.2 Distinguishing T and B cells
 - 3.1.1.3 Working of immune system
 - 3.1.1.4 Immunological memory
 - 3.1.1.5 Antigen specific receptors on B-cells
 - 3.1.1.6 B-cells stimulation to make antibodies
 - 3.1.1.7 Antibody genes and B cell development
 - 3.1.2 T-Lymphocyte and cell mediated immunity
 - 3.1.2.1 T cell receptors and classes of T-cells
 - 3.1.2.2 Cytotoxic T cells and virus infected T cells.
 - 3.1.2.3 MHC molecules and their role in tissue graft rejection, classification of MHC molecules
 - 3.1.2.4 Cytotoxic T cell recognition
 - 3.1.2.5 Helper T cells and their role in B cell activation.

UNIT IV

- 4. Birth, Growth and Death of Neurons
 - 4.1 Generations of neurons, migration of new born neurons
 - 4.2 Connection of neurons
 - 4.3 Cell death in neurons
 - 4.4 Growth care in neurons
 - 4.5 Patterns of nerve connection

UNIT V

- 5. Cell Death : Apoptosis
 - 5.1 Cell deaths in *Coenorhabditis elegans*
 - 5.2 Cell deaths in mammals
 - 5.3 Cell deaths in *Drosophila*
 - 5.4 Apoptosis targeted therapies

Note for Paper Setting

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Books Recommended:

1. De Robertis, E.D.F. and De Robertis, E.M.F. 1981. Cell and Molecular Biology. Saunders International Edition.
2. De Robertis, E.D.F. and De Rebertis, E.M.F. Essential of Cell and Molecular Biology. Saunders International Edition.
3. De witt 1977. Biology of the cell- an Evolutionary Approach. Saunders Co.
4. Avers, C.J. 1976. Cell Biology. D. Van Nostrand, Co. New York.
5. Korenberg, 1974 DNA Replication W.H. / Freeman and Co. San Francisco
6. Graland, A. 1983. Molecular Biology of the cell A, Bestrisetical, Garland Pub. Inc. New York.
7. Watson *et al.* 1987 Molecular Biology of Genes Vol I and II.
8. Jones and Bartlett, 1980. Cells : Principle of Molecular Structure and function, Prescott.
9. Gene- Watson 1987. Molecular biology
10. Karenbeg, 1980. Replication/
11. Alberts, 1983. Molecular Biology of the Cell.
12. Maniatis 1983. Molecular cloning
13. Watson, 1983. Recombinant DNA. A short course.
14. Bruce Alberts, Bray, Johnson, Lewis, Raff, Roberts, Walter 1997. Essential Cell Biology
15. Mousami Debnath, Shashi Jain Publ. Jaipur. 2008 Cell and Molecular Biology,
16. Melacinki & Freifelder, John and Bartlett Publ. Boston. 1998. Essentials of Molecular Biology.
17. Smith and E.J. Wood, Chapman & Hall., HongKong. 1992. Cell Biology
18. P.K. Gupta, Rastogi Publ. Merrut. 1994. Cytogenetics, Genetics and Evolution.

DETAILED SYLLABUS**Course No. PSZOTC-203****TITLE: Functional
of Animals Anatomy****Credits: 4****Maximum Marks: 100****Time Duration: 2 Hrs and 30 Mins.**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60****Syllabus for the examinations to be held in May. 2014, May 2015, and May 2016**

The course is designed with the main objective of conveying to the students of Zoology the co-ordination within animal organization, between the structure and functioning of the various organs and organ systems. The course highlights a streak of commonness in apparently highly diversified animal world and highlights many anatomical features which during the course of evaluation have, as a consequence of loss of their functioning, undergoing marked reduction or even complete exclusion.

SYLLABUS**UNIT I Movement and Locomotion_**

- 1.1 Principles of hydrostatic skeleton
 - 1.1.1 Locomotion based on hydrostatic skeleton, with special reference to Coelenterate, Planaria and Nemertina.
 - 1.1.2 Functional significance of coelom in locomotion in Echinodermata and Mollusca
- 1.2 Comparative account of skeletal system in vertebrates
 - 1.2.1 Axial Skelton
 - 1.2.1.1 Skull
 - 1.2.1.2 Vertebral Column
 - 1.2.2 Appendicular skeleton
 - 1.2.2.1 Limbs
 - 1.2.2.2 Girdles

UNIT II Food and Feeding_

- 2.1 Mechanism of food intake .
 - 2.1.1 Fluid/liquid feeding
 - 2.1.2 Particulate solid feeding mechanism
- 2.2 Basic digestive mechanisms
 - 2.2.1 Inter-Cellular digestion
 - 2.2.2 Extra-Cellular digestion
- 2.3 Filter Feeding mechanism in:
 - 2.3.1 Polychaetes
 - 2.3.2 Crustaceans
 - 2.2.3 Mollusca

UNIT III Functional aspects of basic physiological activities

- 3.1 Respiration
 - 3.1.1 Branchial
 - 3.1.2 Tracheal
 - 3.1.3 Pulmonary
 - 3.1.4 Cutaneous
- 3.2 Excretion: Comparative study of excretory organs in
 - 3.2.1 Invertebrates
 - 3:2.2 Vertebrates

- 3.3 Thermoregulation in vertebrates
- 3.4 Osmoregulation in marine, freshwater and land animals

UNIT IV Co-ordination in body functioning

- 4.1 Primitive nervous system
 - 4.1.1 Nerve net in coelenterata
 - 4.1.2 Nervous system in Echinodermata
 - 4.1.3 Nervous system in Hemichordata
- 4.2 Advanced nervous system
 - 4.2.1 Metameric Nervous system in Annelids
 - 4.2.2 Nervous system in Arthropods
 - 4.2.3 Nervous system in Mollusca
 - 4.2.4 Comparative central Nervous system in vertebrates (through fish to mammals) with special reference to brain.

UNIT V Development and Adaptation

- 5.1 Larval forms and their functioning in:
 - 5.2.1 Crustacean
 - 5.2.2 Insecta
 - 5.2.3 Echinodermata
- 5.2 Metamerism and its significance in movement
- 5.3 Principles of flight in:
 - 5.3.1 Insects
 - 5.3.2 Birds
 - 5.3.3 Mammals

Note for paper setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. William O. Recce (2009). Functional Anatomy and Physiology of domestic animals
2. Karelilium, William Bemis, Wallen F. Walker and Lancer (2000). Functional anatomy of vertebrates: An Evolutionary Perspectives.
3. Gunther Von Hagens and Angelina Whalley (2011) Body Worlds: The anatomy of animal-catalog.
4. Gerald, J, tertora, Sandra, R. And Bonnie (2000) Principles of Anatomy and Physiology.
5. R. Mc Neill Alexender (2006) Principles of Animal Locomotion

COURSE NO. PSZOTC-204

Course title: Insect diversity and
Physiology

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: 2 Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015 and May 2016.**OBJECTIVES**

The course has been designed to provide the students with sufficient information about the morphology, diversity and physiology of insects which form the basis for any type of entomological studies which would be undertaken by the students subsequently

UNIT I Insects General Organization and Classification

- 1.1 Bionomics of insect orders of economic importance
 - 1.1.1 Subclass Apterygota, Thysanura, Collembola
 - 1.1.2 Subclass Pterygota:
 - 1.1.2.1 Exopterygota: Odonata, Orthoptera, Dictyoptera, Dermaptera, Hemiptera, Homoptera
 - 1.1.2.2 Endopterygota: Lepidoptera, Diptera, Coleoptera, Hymenoptera

UNIT II Structure and physiology of the following systems in Insects

- 2.1 Digestive system
- 2.2 Reproductive system
- 2.3 Nervous system
- 2.4 Excretory system
- 2.5 Respiratory system

UNIT III Adaptive Modifications in the body Parts

- 3.1 The mouth parts and their diversity
- 3.2 Types of Antennae in insects
- 3.3 Types of leg modifications in insects
- 3.4 Wings and wing coupling mechanism
- 3.5 Male and female external genitalia

UNIT IV Growth and Development

- 4.1 Types of larvae and pupae
- 4.2 Diapause
- 4.3 Stridulation and tridulatory organs
- 4.4 Metamorphosis and Moulting

UNIT V Sensory System

- 5.1 Compound Eye
- 5.2 Chemoreception and Chemotaxis
- 5.3 Mechanoreceptors
- 5.4 Defence Mechanisms in Insects

Note for paper setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test I	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Timothy, 2007. *Marc, Insect Ecology*. Marc J. Klowden Elsevier Inc.
2. Marc J. Klowden Elsevier Inc. 2007. *Physiological Systems in Insects*.
3. Waldbauer, 2007. *The Handy Insect G.K. Book*. Jaico Publ. House.
4. Pedigo and Rice, 2009. *Entomology and Pest Management*. Publ. PHI Learning, Pvt. Ltd.
5. R.F. Chapman, 2013 2nd Ed. *The Insect; Structure and Function*

Semester III

Course No. PSZOTC-301

Credits: 4

Time Duration: 2Hrs and 30 Mins.

Title: Animal Physiology

Maximum Marks: 100

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May, 2014; May, 2015 and May, 2016.

OBJECTIVES

The course has been designed to supplement the understanding of the functioning of organ systems of animals, after having exposure to students to the understanding of the structural organization and Bio-chemistry of cellular activities of the systems.

SYLLABUS

Unit-I Animal food and its composition

- 1.1 Modes of animal nutrition
- 1.2 Digestion and its control
 - 1.2.1 Salivary digestion
 - 1.2.2 Gastric digestion
 - 1.2.3 Intestinal digestion and digestion enzymes
- 1.3 Absorption in GIT
 - 1.3.1 Carbohydrates
 - 1.3.2 Amino acids
 - 1.3.3 Lipids and other substances

Unit-II Blood

- 2.1 Composition and Functions
 - 2.1.1 Blood coagulation
 - 2.1.2 Blood groups and transfusion
 - 2.1.3 Buffer system
- 2.2 Heart and its working
- 2.3 Heart Beats (in mammals)
 - 2.3.1 Origin, rhythmicity and conduction
 - 2.3.2 Nervous regulation
 - 2.3.3 Chemical regulation
 - 2.3.4 Electro-cardiogram
 - 2.3.5 Cardiac cycle in man
 - 2.3.6 The exchange vessels

UNIT III Respiratory Physiology

- 3.1 Nervous regulation of respiration (in mammals)
- 3.2 Physiological adaptations to different environments
 - 3.2.1 Environmental influences over respiratory process (in mammals)
 - 3.2.2 Extreme temperature & limits to life
 - 3.2.2.1 Tolerance to cold and freezing
 - 3.2.2.2 Tolerance to high temperature

UNIT IV Excretory and Neurophysiology

- 4.1 Excretory physiology (in mammals)
 - 4.1.1 Detailed structure of nephron

- 4.1.2. Glomerular functions
- 4.1.3. Tubular functions
- 4.1.4. The rennin angiotensins
- 4.1.5. Aldosterone system
- 4.2 Neurophysiology
 - 4.2.1 Nerve cell organization
 - 4.2.2 Nerve impulse origin and propagation
 - 4.2.3 Synapsis and transmitters

UNIT V Structural basis of contraction

- 5.1 Muscle: Types, their gross structure
 - 5.1.1 Hierarchy and skeletal muscle organization (vertebrates)
 - 5.1.2 Myofibrils: Ultra- structure
 - 5.1.3 Chemical composition of myofibril
- 5.2 Muscle contraction-striated muscles
 - 5.2.1 Sliding, filament theory and cross bridge activity
 - 5.2.2 Cross-bridge attachment and muscle contraction
 - 5.2.3 Energy cycle, role of ATP and phosphogen

Note for paper setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test I	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Malcolin & Gorden. 1977. Animal Physiology: Principles and Adaptation. Macmillan Publ. Co. New York.
2. Nagabhushnam. 1993, Textbook of Animal Physiology. Oxford & IBH Publ. Co. Pvt. Ltd.
3. Randall, Burggren and French. 2000. Eckert Animal Physiology Mechanisms and Adaptations. W.H. Freeman and Co. New York.
4. Louw. 1993. Physiological Animal Ecology. Langman House, Burnt Mill, Harlow, England.
5. Dennis, W. Wood . 1970. Principles of Animal Physiology. Arnold, Publ. Ltd. , London.

COURSE NO. PSZOTC-302

Title: **Biotechnology & Microbiology**

Credits: 4

Maximum Marks: **100**Time Duration: **2Hrs and 30 Mins.**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60**

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

The integrated course aims to acquaint the students with underlying principles of Biotechnology on one hand and significance clubbed with Microbiology on animal life on the other. Progress in understanding biology until middle of the current century was restricted to pherminological studies. The discovery of the molecule DNA and its contribution to the organization, maintenance and perpetuation of the species, ushered in a phenomenal change in the kingdom of biological science. Molecular studies of the biological structure led to the rise of specialized branches of the studies like Molecular biology and more recently to development of techniques based on the ignious mental concepts of immense importance to mankind. Role of micro-organisms in health and diseases of plants, animals and man needs emphasis. The course has been designed to expose the students to the present state of our knowledge of the characterization, application and ecology of micro-organisms

SYLLABUS

UNIT I

- 1.1 Origin, history and scope of Biotechnology
- 1.2 Recombinant DNA & Gene cloning
 - 1.2.1 Cloning and expression vectors
 - 1.2.2 Plasmids, bacteriophage, phagemids, cosmids, transposons, artificial chromosomes (YAC and MAC)
- 1.3 Chimeric DNA, Molecular probes and gene libraries
- 1.4 Restriction enzymes, types, classifications and examples.
- 1.5 Isolation of DNA, ligation of insert vectors, ligation of recombinant DNA into host cells.
- 1.6 Screening of recombinant DNA, restriction mapping, Nick translation, DNA sequencing.

UNIT II Animal and cell tissue culture

- 2.1 Primary culture, cell line and cloning
 - 2.1.1 Disaggregation of tissue and primary culture.
 - 2.1.2 Cultured cell and evolution of cell lines.
 - 2.1.3 Maintenance of cultured-cell lines
 - 2.1.4 Cloning of cell lines
 - 2.1.5 Large scale cell culture

- 2.1.6 Somatic cell fusion
- 2.2 Tissue and organ culture
 - 2.2.1 Tissue culture: Slides, flasks, test tube culture
 - 2.2.2 Organ culture
 - 2.2.3 Whole embryo culture
 - 2.2.4 Tissue engineering: Artificial skin and artificial cartilage

UNIT III Application of Biotechnology

- 3.1 Biotechnology in Environment
 - 3.1.1. Sewage treatment
 - 3.1.1.1 Aerobic process trickling/ percolating filters and activated sludge
 - 3.1.1.2. Anaerobic digestion process
 - 3.1.1.3 Biological processing of Industrial waste, waste from dairy industry
 - 3.1.1.4 Removal of spilled oil and grease deposits
- 3.2 Biotechnology in Industry
 - 3.2.1 Enzyme Biotechnology: Uses of enzymes, isolation and purification of enzymes.
 - 3.2.2 Single cell proteins from microorganisms

UNIT IV Medical Microbiology: Etiology, Pathogenicity, Symptoms, Treatment and Prophylaxis

- 4.1 Air borne or water borne diseases
 - 4.1.1 Tuberculosis
 - 4.1.2 Pneumonia
 - 4.1.3 Tetanus
 - 4.1.4 Cholera
 - 4.1.5 Salmonella
 - 4.1.6 Streptococcal diseases
 - 4.1.7 Diptheria
- 4.2 Viral diseases
 - 4.2.1 Hepatitis
 - 4.2.2 AIDS
 - 4.2.3 Rabies
 - 4.2.4 Polio

UNIT V Industrial and Agricultural Biotechnology

- 5.1 Fermentation products, Bioconversions and bioremediation
- 5.2 Products of Industrial microbiology:

- 5.2.1 Penicillin
- 5.2.2 Ethanol
- 5.2.3 Vinegar
- 5.2.4 Citric acid
- 5.3 Food and Dairy microbiology
 - 5.3.1 Role of microbes in food production
 - 5.3.2 Fermented food
 - 5.3.3 Alcoholic beverages
- 5.4 Agricultural biotechnology: Role of microbes in agriculture with special reference to biological nitrogen fixation.
- 5.5 Pharmaceuticals: Antibiotics, vaccines

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Pelczar MJ, Chan ECS & Kreig NR. 1997. *Microbiology: Concepts and Application*. Tata McGraw Hill.
2. Tauro P, Kapoor KK & Yadav KS. 1996. *Introduction to Microbiology*. Wiley Eastern.
3. Mitchell R. 1992. *Environmental Microbiology*. John Wiley & Sons.
4. Levine MM, Kaper JB, Rappuoli R, Liu MA & Good MF. 2004. *New Generation Vaccines*. 3rd Ed. Informa Healthcare.
5. Male D, Brostoff J, Roth DB & Roitt 1.2006. *Immunology*. Elsevier.
6. Wood, J. B. 1985. *Microbiology of fermented foods*. Volumes I and II. Elsevier
7. Applied Science Publishers. London, England
8. Joshi, V.K. and Pandey, A. Ed. 1999. *Biotechnology. Food Fermentation*, (2 Vol. set). Education Publ. New Delhi
9. Jay, J.M. (2008) *Modern Food Microbiology* (Sixth Edition). Aspen Publishers, Inc, Gaithersburg, Maryland.
10. Rajeshwari, S. Sethi and Sreekrishna, V. 2004. *Biotechnology-2* New Age International Publ. Delhi.
11. Ananthanaryan & Paniker's. 2009. *Textbook of Microbiology*. Univ. Press Pvt. Ltd. Himayatnagar, Hyderabad.
12. Gerard, J. Tortora, Berdell R. Funke & Christine L. Case. 2011. *Microbiology: An Introduction 9th Ed*, Pearson Education.
13. M.P. Arora. 2005. *Microbiology*. Himalaya Publ. House. Mumbai
14. Wulf Crueger and Anneliese Crueger. 2005. *Biotechnology: A text book of Industrial Microbiology 2nd Ed*. Panima Publ. Corporation, New Delhi.

Course No. **PSZOTE -303****TITLE : Cell Biology and
Cytogenetics-I**CREDITS: **4**Maximum Marks **100**Time Duration: **2Hrs and 30 Mins.**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60**

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

Cell Biology and Cytogenetics are fascinating branch of biological studies and Genetics in particular is today making roads increasingly into new areas of biology if only to make man understand the mysteries of life and its activities and find answers to questions which have remained unanswered for a long time. The courses prescribed in this syllabus are meant for students with some background of the cell structure and principles of inheritance and designed to help students in acquiring knowledge for further comprehension of the cytological phenomenon and principles of Genetics as understood today and keeping abreast of a rapidly advancing field

SYLLABUS**UNIT I Cell in Multicellular Organisms**

- 1.1 Cell associations
- 1.2 Cell-cell recognition and adhesion
- 1.3 Extra-cellular Matrix
- 1.4 Cell signalling
 - 1.4.1 Remote signalling
 - 1.4.2 Contact signalling by plasma membrane bound molecules
 - 1.4.3 Contact signalling via gap junctions
 - 1.4.4 single transduction
- 1.5 Growth factors

UNIT II: Differentiation

- 2.1. Differentiation of specialized cells-muscles & neurons cells
- 2.2. Epigenetic control of differentiation
- 2.3. Differentiation - mechanism
- 2.4. Molecular basis of differentiation
 - 2.4.1 Nucleo-cytoplasmic interaction
 - 2.4.2 Induction
- 2.5 Role of maternal RNA in early stage of development
- 2.6 Homeoboly-significance in differentiation

UNIT -III Cell cycle and programmed cell death

- 3.1 Cell cycle in eukaryotes
 - 3.1.1. Cell cycle and its components
 - 3.1.2 Spindle organization, Chromosome movements and Synaptonemal complex
 - 3.1.3 Crossing over, Chaisma formation
- 3.2 Cell cycle regulation/control

- 3.3 Programmed cell death
 3.3.1 Mechanism and regulation of Apoptosis

UNIT -IV Cancer cells

- 4.1. Origin
 4.1.1. Transformation of normal cell to cancer cell.
 4.1.2. Immortalization of cancer cell.
 4.2. Difference of normal and cancer cells
 4.2.1. Membrane changes
 4.2.2. Bio-chemical changes
 4.2.3. Nuclear and chromosomal changes
 4.3. Cancer inducing agents
 4.3.1. Tumor viruses
 4.3.2. Oncogenes
 4.3.3. Environmental factors

UNIT V Factors Affecting Mutations

- 5.1. Biological factors that influence Human mutations
 5.1.1. Paternal age
 5.1.2. Sex
 5.1.3. Genotype.
 5.2. Environmental factors that influence Human mutations.
 5.2.1 Radiations
 5.2.2 Chemical mutagens
 5.2.3 Temperature
 5.2.4 Pollutants
 5.3. Somatic mutations and Human health

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
 ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
 iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. De Robertis, E.D.F. and De Robertis, E.M.F. 1981. Cell and Molecular Biology. Saunders International Edition.

2. De Robertis, E.D.F. and De Rebertis, E.M.F. Essential of Cell and Molecular Biology. Saunders International Edition.
3. De Witt 1977. Biology of the cell- an Evolutionary Approach. Saunders Co.
4. Avers, C.J. 1976. Cell Biology. D. Van Nostrand, Co. New York.
5. Korenberg, 1974 DNA Replication W.H. / Freeman and Co. San Francisco
6. Graland, A. 1983. Molecular Biology of the cell A, Bestrisetical, Garland Pub. Inc. New York.
7. Watson *et al.* 1987 Molecular Biology of Genes Vol I and II.
8. Jones and Bartlett, 1980. Cells : Principle of Molecular Structure and function, Prescottt.
9. Gene- Watson 1987. Molecular biology
10. Karenbeg, 1980. Replication/
11. Alberts, 1983. Molecular Biology of the Cell.
12. Maniatis 1983. Molecular cloning
13. Watson, 1983. Recombinant DNA. A short course.
14. Bruce Alberts, Bray, Johnson, Lewis, Raff, Roberts, Walter 1997. Essential Cell Biology
15. Mousami Debnath, Shashi Jain Publ. Jaipur. 2008 Cell and Molecular Biology,
16. Melacinki & Freifelder, John and Bartlett Publ. Boston. 1998. Essentials of Molecular Biology.
17. Smith and E.J. Wood, Chapman & Hall., Hong Kong. 1992. Cell Biology
18. P.K. Gupta, Rastogi Publ. Merrut. 1994. Cytogenetics, Genetics and Evolution.

Semester III

Course No: PSZOTE- 304
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Title: **Fish & Fisheries-I**
MAXIMUM MARKS: **100**
a) Minor Test I : **20**
b) Minor Test II : **20**
c) Major Test : **60**

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

The present course on Fish and Fisheries is designed to acquaint the students with information on different types of water bodies, their changing physico-chemical nature, their influence on inhabiting biota and fish production. This course aims to provide sufficient knowledge regarding life of fishes, their breeding potentials and culturing methods. The course is spread over to the semester program, including a course titled Fish and Fisheries II stated for semester IV.

SYLLABUS

UNIT I Introduction to Fishery Science and Classification of Fishes

- 1.1 Importance of Fishery Science
- 1.2 Fishery Science as an integrated study
- 1.3. Outline classification of fishes-A detailed study of the sub-class Teleostei with special reference to following orders
I) Clupeiformes II) Cyprinodontiformes III) Ophiocephaliformes
IV) Cypriniformes V) Perciformes VI) Syngnathiformes VII) Tetradontiformes

UNIT -II Fish Environment (Abiotic)

- 2.1 Physical:
 - 2.1.1. Bottom : Composition, sources and diversity
 - 2.1.2 Temperature : Effect on vital biological processes and thermal stratification
 - 2.1.3 Light : Sources, factors influencing light penetration, methods of measuring penetration and its relationship with aquatic organisms
 - 2.1.4 Turbidity : Causes and Impact on aquatic organisms
- 2.2. Chemical
 - 2.2.1 pH – Definition, distribution and significance
 - 2.2.2 CO₂ : Sources, methods of determination and significance
 - 2.2.3 DO : Sources, methods of determination and significance
 - 2.2.4 Nitrates, Nitrites and Ammonia: Sources and significance
 - 2.2.5 Silicates : Sources and impact

Unit III Fish Environment (Biotic)

- 3.1. Plankton
 - 3.1.1. Definition, classification and its role in fishery
 - 3.1.2. Diurnal and seasonal variation
- 3.2. Benthos
 - 3:2.1 Definition, classification and its role in fishery
 - 3.2.2 Common benthic organisms

UNIT-IV Fisheries of India

- 4.1 Freshwater fishery
 - 4.1.1. Riverine fishery
- 4.2. Lacustrine fishery
 - 4.2.1 Lakes, Origin, Classification and Diversity
- 4.3 Reservoir Fishery
- 4.4. Marine Fishery

UNIT -V Population Growth and Age_

- 5.1 Population
 - 5.1.1. Population structure (year class recruitment.), its estimation and factors effecting fish population structure.
 - 5.1.2. Fecundity, Types, its estimation and factors effecting fish fecundity
- 5.2. Growth and Age
 - 5.2.1 Methods for measurement of growth, Growth rates, Marking and tagging method, length-weight relations and condition factor
 - 5.2.2 Age determination through hard parts.

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Bagenal, T. 1978 Methods for assessment offish production in fresh water. International Biological Programme Handbook No.3 Blackwell Scientific Publications, Oxford and Edinburg.
2. Berg. L.S. 1947. Classification of fishes. Both recent and fossil, *I.M.* Edwards, Alm, Al-bor, Michigan.
3. Boyd, C.E. 1979, biology of fishes Saunders, Philadelphia.
4. Boyd. C.E. 1982, Water quality management for pond fish culture. Development in aquaculture and fisheries science. G. Elsevier, Amsterdam.
5. Rajiv Tyagi and Arvind, N, Shukla 2002. Adaptation in Fishes
6. W.E. Meehqan . 2002. Fish Culture in Ponds and other Inland waters.
7. H.S. Bhamra and Kavita Juneja. 2001. An Introduction to Fishes
8. C.B.T. Rajagopalsamy and V. Ramdhas. 2002. Nutrient Dynamics in Freshwater Fish Culture System.
9. K.K\ . Balachandran. 2001. Post harvest Technology of Fish and Fish Products.
10. Arvind Kumar. 2004. Fishery Management
11. P.N. Pandey. 2005. Economics of Fisheries
12. Heatranpf. 2002. handbook on Ingredients for Aquaculture feeds.
13. Sugunan, V.V. 1997. Reservoir Fisheries of India.
14. Hameed, M; Shahul and M.R. Boopendra Nath. 2000. Modern Fishing gear Technology

Course No. PSZOTE 305
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

TITLE: Limnology-I
MAXIMUM MARKS: 100
 a) Minor Test I : **20**
 b) Minor Test II : **20**
 c) Major Test : **60**

**Syllabus for the examination to be held in
 December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

Ever increasing demand for food has forced man to explore and harvest aquatic biota to ameliorate food deficiency. This in turn demands a thorough insight into the delicately balanced insipid system of relationships of biotic and abiotic parameters. The present course and its adjunct Limnology – II in semester 1V are, therefore, designed to provide the students, Opting this course, information of different types of Inland waters, their changing physico-chemical profile, biotic characterization and the applicability of the information to provide the commercial exploitation of such water bodies.

SYLLABUS

UNIT I

- 1.1 Limnology, its history and scope.
- 1.2 Limnology in India
- 1.3 Hydrological cycle
- 1.4 Dwindling fresh water resources and their conservation
- 1.5 Freshwater resource management.

UNIT II

- 2.1 Current: Causes, types and significance
- 2.2 Turbidity: Causes and impact on aquatic organisms
- 2.3 Bottom: Composition, sources and diversity
- 2.4 Light Sources, factors affecting light penetration, methods of measuring light penetration and its relationship with aquatic organisms
- 2.5 Temperature: Effect on various biological processes and thermal stratification.

UNIT III

- 3.1 pH- definition, distribution and significance
- 3.2 Dissolved oxygen: Sources, methods of determination, distribution and significance
- 3.3 Carbon dioxide: Sources, different forms, methods of determination, distribution and significance
- 3.4 Nitrate, Nitrite and Ammonia: Sources and significance
- 3.5 Silicates: Sources and impact on aquatic organisms
- 3.6 Calcium and Magnesium: Sources, methods of determination, distribution and significance
- 3.7 Phosphates: Sources, methods of determination and significance

UNIT IV

- 4.1 Wetland-Introduction
- 4.2 Management techniques of wetlands.
- 4.3 Lakes

- 4.3.1 Origin.
- 4.3.2 Classification.
- 4.3.3 Eutrophication and restoration methods.
- 4.4 Ponds:
 - 4.4.1 Origin.
 - 4.4.2 Types.

UNIT V

- 5.1 Rivers:
 - 5.1.1 Origin, Classification, Water flow and Stream channels.
 - 5.1.2 Physico-chemical characteristics of flowing waters.
 - 5.1.3 Biotic characteristics of flowing waters.
- 5.2 Estuaries: Definition, origin and classification.
- 5.3 Bogs: Origin, types, abiotic and biotic characteristics
- 5.4 Marshes: Origin, abiotic and biotic characteristics and their future
- 5.5. Vernal pools: Definition and significance

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

BOOKS RECOMMENDED

1. Cole, A.A. 1974. text book of Limnology. The G.V. Mosby Company Saint Louis.
2. Olepper, H. 1979. Careers in conservation. A Ronaldn Press publication John Wiley and Sons, New York. .
3. Davies, B.R. and Walker, K.F. 1986. The Ecology of River Systems. Dr. W. Junk Publishers, Bostan
4. Goldman, C.R. and Horne, A.J. 1983. Limnology. Mc Graw Hill International Book Company, New Delhi .
5. Hutchinson, G.E. 1977. A treatise on Limnology Vol. I John Willey and Sons, New York
6. Hutchinson, G.E. 1977. A treatise on Limnology Vol. II John Willey and Sons, New York.
7. Hutchinson, G.E. 1975. Limnological Botany John Willey and Sons, New York
8. Hybes, H.B. N. 1979. 'The Ecology of running waters. Liver Pool University Press.
9. Jhingran, V.G. 1982. Fish and Fisheries of India. Hindustan Publishing corporation, India.
10. Hutchinsonl, G.E. 1977. A treatise on Limnology Vol. I John Willey and Sons, New York
11. Jorgenson, S.E., Loffler, H, rast, W and Straskraba, M. 2005. Lakes and Reservoir Management.
12. G.E. Hutchinson. 2004. A Treatise on Limnology. John Willey & Sons, Canada.
13. Arvind Kumar. 2005. Fundamentals of Limnology

14. Welch, P.S. 2011. Limnology. N.H.P.
15. Brian Moss. Blackwell Science. 1998. Ecology of Freshwaters 3rd Ed.

COURSE NO. PSZOTE-306**CREDITS: 4****Time Duration: 2Hrs and 30 Mins.****Course title: Entomology I****MAXIMUM MARKS: 100**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60**

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

This course and its adjunct (Entomology II) in semester IV has been designed to introduce the students to various useful and harmful species of insects found in this area. Topics concerning insect behaviour, insect plant interactions, insect ecology and biology alongwith control measures studies such as chemical, biological etc. have been included in order to make the students aware of the importance of these studies in insect pest management (IPM) which is an area of considerable relevance in an agriculture based, economy like ours.

SYLLABUS

UNIT I Agriculturally important insects. Studies on important Species of insect pests with special reference to J&K State. Emphasis to behold on any two of each of the following categories

- 1.1 Cereal crop pests (Maize, Wheat, Paddy).
- 1.2 Fruit and vegetable pests (apple, cucurbits, mango)
- 1.3 Stored grains and household pests.
- 1.4 Forest pests.
- 1.5 Pests of fibrous crops (cotton).

UNIT II Medically important insects

- 2.1 Insect nuisance phobia
- 2.2 Insect venoms and allergens
- 2.3 Insects as vectors of human diseases
- 2.4 Mode of transmission and epidemiology of major vector borne diseases such as malaria, yellow fever, kalazar, typhus and plague.

UNIT III Insects of commercial importance and their culture

- 3.1 Honey bees
 - 3.1.1 Different species of honey bees
 - 3.1.2. Castes of honey bees and their morphology and biology
 - 3.1.3 Honey formation and types of honey.
 - 3.1.4 Chemical composition and economic value of honey
 - 3.1.5 Apitoxin (bee venom), its composition, secretion and importance.
 - 3.1.6 Other important products of honey bees: Bee wax, Glue, Royal jelly and their uses.
- 3.2 Silk and Tassar worms
 - 3.2.1. Kinds of silk and their producer insects
 - 3.2.2 Bionomics and morphology of mulberry silk worm at different stages
 - 3.2.3 Silk gland and its importance
 - 3.2.4 Silkworm rearing techniques including equipment and other infrastructure
 - 3.2.5 Silkworm diseases, pests and their management
 - 3.2.6 Bionomics and rearing of tassar silk moth.
- 3.3 Lac insect
 - 3.3.1 Distribution, morphology, biology and life cycle of lac insects

3.3.2 Host plants and lac culture techniques

3.3.3 Composition, properties

UNIT IV Insect Pest Control and Management

4.1 Culture control

4.2 Chemical control

4.2.1 Insecticides of plant origin

4.2.2 Inorganic insecticides

4.2.3 Organic insecticides

4.2.3.1 Organochlorine compounds

4.2.3.2 Organophosphorus compounds

4.2.3.3 Carbonate compounds

4.2.3.4 Fumigants

4.3 Hazards of Insecticides

UNIT V Newer methods of insect control

Chemical modifiers of development and behaviour in insects

5.1.1 Disrupting normal growth and Development

5.1.1.1 Hormonal Control

5.1.2 Modifying behaviour patterns

5.1.2.1 Tactics Involving insect attraction

5.1.2.2 Insect Repellents

5.2 Sterile insects and other genetic tactics in insect control

5.3 Plant resistance to insects

5.3.1 Mechanism of resistance (non-preference antibiosis tolerance)

5.3.2 Use of plant resistance in pest management

5.4 Biological Control of Insect Pests

5.4.1 Agents of Biological Control (Predators, Parasitoids and Pathogens)

5.4.2 Practice of Biological Control (Introduction, Augmentation and Conservation of natural enemies)

5.5 Pest management: Theory and Practice

5.5.1 Concept of Insect Pest management

5.5.2 Tools of Pest management

5.6 Biotechnological approach in pest management

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Wigglesworth, V.B. 1976. Insect and the life of Man. London Chapman & Hall.
2. Hermann, H.R. 1982. Social Insects (Vol-III). Academic Press, London.
3. Fryer, J.C.F. 2008. Insect Pests of Fruit Crops. Biotech Books, Delhi.

4. Pedigo, L.P. and Rics, M.E. 2009. Entomology and Pest Management (VI Edi.) PHI Learning Private Limited.
5. Bhargava, M.C. and Kumawat, K.C. 2010. Pests of Stored Grains and their Management. New India Publishing Agency.
6. Cotton, R.T. 2011. Insect Pests of Stored Grains and Grains Products: Identification, Habits and Methods of Control Biotech Books, Delhi.

COURSE NO. PSZOTE-307

Course title: **Wildlife Biology,
Conservation & Management-I**

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: **2Hrs and 30 Mins.**

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

There is a growing need for knowing what wildlife means and what's its importance in the balance of nature. The designed course is intended to convey the desirous students information regarding wildlife in India, its management along biological lines and the techniques associated with it. The course highlights major approaches to solve problem and solutions and the ways of implementing those solutions, with ever-ridding goal of giving students a scientific point of view in understanding management of wildlife resources and its importance in India

UNIT I Introduction of Wildlife and Wildlife Habitats

- 1.1 Definition of Wildlife and importance of its study
- 1.2 Wildlife Habitats
 - 1.2.1 Definition, types and importance of Habitats
 - 1.2.2 Plant succession
 - 1.2.3 Climax vegetation
- 1.3 Forest as major habitats
 - 1.3.1 Forests types of India
 - 1.3.2 Distribution pattern of forests in India
 - 1.3.3 Their ecological characteristics
- 1.4 Wildlife in Aquatic habitat

UNIT II Habitat analysis and evaluation

- 2.1 Forest range evaluation
- 2.2 Wetland: Evaluation, Significance and Management
- 2.3 Wildlife management principles
- 2.4 Management problems in tropics
- 2.5 Procedure for food habit analysis
- 2.6 Methods of Environmental Impact Assessment

UNIT III Importance of Wildlife and Forests

- 3.1 Natural resources and their conservation
- 3.2 Conflict between man and wildlife
- 3.3 Influence of Human activities on sedimentary and non-sedimentary nutrient cycles.
- 3.4 Industrialization and its consequences on wildlife ecology
- 3.5 Impact of environmental pollutants on wildlife

UNIT IV Habitat improvement

- 4.1 Food production
 - 4.1.1 Water development
 - 4.1.2 Cover and structural improvement
 - 4.1.3 Wetland improvement
 - 4.1.4 Structural improvement
- 4.2 Impact of changed Land Use pattern on wildlife
- 4.3 New tools and techniques in wildlife research
- 4.4 Important Wildlife diseases: Viral, Bacterial, Parasitic and Helminthes diseases of mammals and birds

UNIT V Techniques in wildlife study

- 5.1. Capturing techniques
 - 5.1.1. Bait and Scents
 - 5.1.2 Trapping: Killed and Live mammals and birds
- 5.2 Handling and Marking techniques
 - 5.2.1 Handling of live trapped animals
 - 5.2.2 Marking of captured birds and mammals
 - 5.2.3 Marking of birds and mammals without capturing
- 5.3 Preservative techniques
 - 5.3.1 Common preservatives and their efficacy
 - 5.3.2 Preservation of game trophies and their meat.

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Bolton, M. 1997. Conservation and the use of Wildlife Recourses
2. Chaudhuri, A.B. and Sarkar, D.D, 2003. Wildlife and Ground Flora. Arunima Printing Wo4rks, Kolkota
3. Singh, M.P. Dey, S and Singh, B.S. 2004. Conservation of Biodiversity and Natural Resources
4. S.K. Singh. 2009. Textbook of Wildlife Management. 2nd Ed. Int. Book. Distributing Co.
5. M.V. Reddy. 2009. Wildlife Biodiversity Conservation. Daya Publ. New Delhi.
6. M.G. Chitkara. 2012. Wildlife. APH Publ. Co. New Delhi.

COURSE NO. PSZOTE- 308

Title: **Economic Zoology**

CREDITS: 4

MAXIMUM MARKS: 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

**Syllabus for the examination to be held in
December, 2014; December, 2015 and December, 2016.**

OBJECTIVES

Economic Zoology deals with the application of zoological knowledge for the benefit of mankind. It includes culturing animals for mass production for the human use and to control or eradicate such animals that are injurious to man directly or indirectly. Economic Zoology is an application for our knowledge of animals which affect human interests. The subject is based on knowledge regarding structure, relations, habits, activities of animals particularly for game, food, fodder, clothing and also which are deterrent to attack our crops, cattle or directly attack human beings. The understanding of the interrelationship of animal life with special reference to human life in scientific language refers to applied Zoology. Applied Zoology has its aim to manipulate animals for man's advantage by increasing production and boost the nation's economy.

SYLLABUS

Unit-I Economic Entomology

- 1.1 Habit, habitat, life cycle, colony, organization and economic products of :
 - 1.1.1 *Apis* sps.
 - 1.1.2 *Bombyx mori*
 - 1.1.3 Lac insect
- 1.2 Biological notes and control of some harmful insects:
 - 1.2.1 Housefly, Cockroach, Mosquitoes and Ticks and Mites
- 1.3 Field Insects
 - 1.3.1 Stem borer, Cotton bug, Aphids, Rice weevil, Pulse beetle

UNIT II Economic Fishery and Aquaculture

- 2.1 Aquaculture: its aim, purpose and status
 - 2.1.1 Type of culture: Open Water Culture, Semi closed and Closed
 - 2.1.2 Some important culturable fishes
- 2.2 Carp culture
- 2.3 Trout culture
- 2.4 Prawn culture
- 2.5 Pearl culture

UNIT III Animal farming: Types, Habitat and Economic Importance

- 3.1 Dairy farming: Types, Habit, Habitat and Economic Importance of some Important breeds of milk producing animals:
 - 3.1.1 Cow
 - 3.1.2 Buffalo
 - 3.1.3 Goat

- 3.2 Dairy feed: Ingredients, Formulation, and Feeding techniques
- 3.3 Poultry farming: Types, Habit, Habitat and Economic Importance of some important breeds of poultry birds

UNIT IV Diseases causing parasites:

- 4.1 Some important human parasites:
 - 4.1.1 Protozoan, Helminthes, Nematodes
- 4.2 Structure, Life cycle, Pathology, Damage Caused, Prevention and Control of:
 - 4.2.1 *Leishmania*
 - 4.2.2 *Giardia*
 - 4.2.3 *Entamoeba*
 - 4.2.4 *Ascaris, Enterobius, Taenia*

UNIT V Modern Biological Techniques for Human Welfare: An Over view

- 5.1 Transgenic Animals
- 5.2 Animal Tissue Culture
- 5.3 Captive Breeding of fishes
- 5.4 Application of biotechnology in Medicine and Pharmaceuticals
- 5.5 Environmental Biotechnology (Sewage Treatment).

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. W.M. Wheeler. 2006. Social Insects: Their Origin and Evolution. Discovery Publ. House, New Delhi
2. Dholakia, A.D. 2010. Identification of Prawns/Shrimps of India and their Culture. Daya Publ. House, New Delhi.
3. R.S. Sethi and V. Sreekrishna. Biotechnology 2. 2004. New Age International, Delhi.
4. J.D. Murray, G.B. Anderson, A.M. Oberbaver and M.M. McGloughlin. 2005. Transgenic Animals in Agriculture. New India Publ. Agency, New Delhi.
5. J.S. Lucas and P.C. Southgate. 2012. Aquaculture : Farming Aquatic Animals and Plants. Wiley-Blackwell, U.K.

SEMESTER IV

Course No. PSZOTC-401

Title: **Reproductive and
Developmental Biology**

Credits: 4

Maximum Marks: 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015 and May 2016**OBJECTIVES**

The details of reproductive processes differ in various species. As reproductive events are regulated by a complex of interlocked extroceptive and interceptive (neuroendocrine) factors, it becomes essential to acquaint students with the basis of reproductive functioning of the gonads and synchronization of the functioning of the sex mechanisms. The present course is, therefore, designed to provide basic concepts of sex, reproduction, hormonal and other signaling systems that have evolved in the different species. This course also prepares the students to visualize and understand the principles of development. The fundamental and universal processes of vertebrate development from the comparative stand point along with examples of typical forms are stressed so as to provide a thorough understanding of the structural and other aspects of the embryo to the students.

SYLLABUS**UNIT I Gametogenesis and Fertilization**

- 1.1 Origin of primordial germ cell
- 1.2 Spermatogenesis: Process, Ultra structure of sperms, Spermiogenesis
- 1.3 Oogenesis: Process, Vitellogenesis, Types of eggs and Egg membranes
- 1.4 Fertilization process
 - 1.4.1 Capacitation
 - 1.4.2 Recognition between male and female gamete
 - 1.4.3 Acrosome reaction of sperm
 - 1.4.4 Cortical reaction of egg
 - 1.4.5 Sperm penetration into egg
 - 1.4.6 Amphimixes

UNIT-II Reproduction and Breeding in Vertebrates

- 2.1 Gonads and their ducts
- 2.2 Secondary sex characters
- 2.3 Sexual maturation and breeding patterns
- 2.4 Breeding seasons and breeding behaviour
- 2.5 Environmental and hormonal factors effecting maturation and breeding

UNIT III Endocrinology of Reproduction

- 3.1 Gonadotropin and sex hormones and their role in ovulation, pregnancy and parturition
- 3.2 Corpora lutea, their structure and function
- 3.3 Atresia: formation and significance
- 3.4 Reproductive cycles in mammals and their hormonal control
 - 3.4.1 Estrous cycle
 - 3.4.2 Menstrual cycle

UNIT-IV

- 4.1 Cleavage and blastulation
 - 4.1.1 Characteristics and Mechanism of cleavage
 - 4.1.2 Patterns of cleavage
 - 4.1.3 Types of blastula, factors involved in shaping the blastula (Blastulation in sea urchin, frog, chick, mammals)
- 4.2 Gastrulation
 - 4.2.1 Presumptive fatemaps in chordates
 - 4.2.2 Process of gastrulation
 - 4.2.3 Kinds of mechanism of gastrulation with special reference to birds and mammals.
- 4.3 Neurulation in vertebrates
 - 4.3.1 Mechanism of neural tube formation
 - 4.3.2 Segregation of neural tube formation

UNIT-V

- 5.1. Development and Organogenesis in birds and mammals
 - 5.1.1 Early development of chick.
 - 5.1.2. Development of Excretory organs.
 - 5.1.3. Development of eye.
 - 5.1.4 Development of ear.
- 5.2 Extra embryonic membrane
- 5.3 Tissue interaction and induction in organogenesis.
- 5.4 Metamorphosis in Amphibians

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Blinsky, B.I. (1981): Introduction to Embryology, Saunders College Pub. Philadelphia
2. Saunders, J. W. (1982): Dev. Biology Patterns, Principles, Problems, Macmillan Pub. Co. Inc. New York
3. Berrill N.J: Developmental Biology. McGraw Hill, New Delhi.
4. Pattern B.M. Carlson, B.M. (1977). Foundation of Embryology. T.M.M. edition.
5. McEwen, Vertebrate Embryology.
6. Alferd Kuhn: Lectures on Developmental Physiology. 18.J.W. Saunders, Jr. Animal Morphogenesis.
7. C.R. Martin: Endocrinology. Oxford University Press
8. R.H. Williams. Text book of Endocrinology. W.B. Saunders
9. Scott F, Gilbert: Developmental Biology (6th Ed.) NCBI Bookself
10. Bruce, M. Carlson (2013): Human Embryology and Developmental Biology

SEMESTER IV**Course No. PSZOTC-402****Title: Biosystematics, Taxonomy
and Evolution****Credits: 4****Maximum Marks: 100****Time Duration: 2Hrs and 30 Mins.**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60****Syllabus for the examination to be held in May 2014, May 2015, May 2016****OBJECTIVES**

The course is designed to make students aware not only of the great diversity which is being displayed by animals around us but also to prepare them theoretically and practically to study and arrange the Bio-diversity in scientific and natural manner. The theoretical background of systematics and taxonomy thus will go a long way in elucidating the natural grouping which exists in the biodiversity around us. Besides the course is also designed to convey the student's knowledge and principles of evolution. The syllabus also deals with evolutionary thoughts in biology, how in nature the variations are developed which subsequently lead to the formation of new taxa.

SYLLABUS**UNIT-I**

- 1.1 Definition and basic concept of Biosystematics, Taxonomy and Classification
- 1.2 History of taxonomy, systematics
- 1.3 Importance and application of biosystematics in biological studies
- 1.4 Systematics as a profession and its future perspectives
- 1.5 Theories of biological classifications

UNIT-II

- 2.1 Species categories and species concept.
 - 2.1.1 Typological species concept.
 - 2.1.2 Nominalistic species concept
 - 2.1.3 Biological species concept
 - 2.1.4 Evolutionary species concept.
- 2.2 Difficulties in application of Biological species concept.
- 2.3 Intraspecific categories & Taxons
 - 2.3.1 Variety
 - 2.3.2 Subspecies
 - 2.3.3 Super species
 - 2.3.4 Sibling species
- 2.4 The new systematics

UNIT-III

- 3.1 Taxonomic Procedures
 - 3.1.1 Taxonomic collections
 - 3.1.2 Preservation and Curation
 - 3.1.3 Identification

- 3.2 Taxonomic Keys
- 3.3 Taxonomic Publication
 - 3.3.1 Major features of taxonomic publication
 - 3.3.2 Forms and styles of taxonomic Article
 - 3.3.3 Kinds of publications
- 3.4 International code of zoological nomenclature
 - 3.4.1 Important properties
 - 3.4.2 The interpretation and application of code

UNIT-IV

- 4.1. Concepts of Evolution
 - 4.1.1. Historic development of the concept of evolution
(Theory of special creation, Greek theories, Pre-modern theory, Modern theories)
 - 4.1.2. Evidences of Organic evolution
- 4.2. Origin of Life
- 4.3. Darwin's theory of Natural Selection
- 4.4. Neo-Darwinism and Current concept of evolution (Modern Synthesis of evolution)

UNIT-V

- 5.1 Isolating mechanisms and their role in evolution
- 5.2. Genetic drift, Founder's Principle, Bottle Neck effects as factors in speciation.
- 5.3. Animal distribution
 - 5.3.1. Aspects and patterns of animal distribution
 - 5.3.2. Dispersal: Means of Dispersal and barriers to dispersal of animals
- 5.4. Zoogeographical Distribution of animals:
 - 5.4.1. Zoogeographical realms of the world
 - 5.4.2. Distribution of vertebrate fauna in different zoogeographical realms.
 - 5.4.3. Continental Drift
- 5.5. Evolution of Man

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. G.G. Simpson : Principles of animal taxonomy, Oxford IBH Pub. Co.
2. E. Mayer : Principles of systematic zoology. Tata McGraw Pub.
3. E. Mayer: Principles of animal systematics. Tat McGraw Pub.
4. E.O. Wilson : The diversity of life W.W. Northern & Co.
5. Dobzhansky, Th.Genetics and Origin of Species. Columbia University press

6. Hartl, D.L. A Primer of population Genetics. Sinauer associates, Inc. Massachusetts.
7. Dobzhansky, Th. F.J. Ayala, I.L. Stebbins and J.M. valentine. Evolution. Surjeet Publication, Delhi.
8. Futuyama, D.J. Evolutionary Biology, Sinauer Associated, INC Publishers, Dunderland.
9. Jha, A.P. Genes and Evolution. John Publication, New Delhi
10. King, M. Species Evolution-The role of chromosomal Change. The Cambridge University Press, Cambridge.
11. Merrel, D.J. Evolution and genetics, Holt, Rinchart and Winston, Inc.
12. Smith, J.M. Evolutionary Genetics, Oxford university Press, New York
13. Strickburger, N.W. Evolution, Jones and Bartett Publishers, Boston London.
14. Mayer, E. 1982. The growth of Biological thought. The Pulknap Press of Harvard University, Masvachusetts.

Course No. **PSZOTE-403**
Credits: **4**
Time Duration: **2Hrs and 30 Mins.**

Title: **Cell biology and Cytogenetics-II**
Maximum marks : **100**
a) Minor Test I : **20**
b) Minor Test II : **20**
c) Major Test : **60**

Syllabus for the examination to be held in May 2014, May 2015 and May 2016

OBJECTIVES

Cell Biology and Cytogenetics are fascinating branches of biological studies and Genetics in particular is today making inroads increasingly into new areas of Biology if only to make man understand the mysteries of life and its activities and find answers to questions that have remained unanswered for a long time. The courses prescribed in this syllabus are meant for students with some background of the cell structure and principles of inheritance and designed to help students in acquiring knowledge for further comprehension of the cytological phenomenon and principles of Genetics as understood today and keeping abreast of a rapidly advancing field.

SYLLABUS

Unit I

- 1.1 Chromosome Banding Techniques
 - 1.1.1 G-Banding, C-Banding, NOR Staining, R-Banding and Q-Banding
 - 1.1.2 Significance and applications of chromosome banding techniques
- 1.2 ISH
- 1.3 FISH
- 1.4 GISH
- 1.5 Comparative Genomic Hybridization/ Chromosomal Microscopy Analysis
- 1.6 Computer Assisted Chromosome Analysis

Unit II

- 2.1 Sex chromosome polymorphism
 - 2.1.1 In plants
 - 2.1.2 In animals
- 2.2 Variability in structure of sex chromosomes and related anomalies in man
- 2.3 Variability in number of sex chromosomes and related anomalies in man
- 2.4 Hyperactivity of sex chromosomes in *Drosophila*
- 2.5 Ring chromosomes
 - 2.5.1 Formation
 - 2.5.2 Detection
 - 2.5.3 Behaviour at meiosis
- 2.6 Telocentric and Isochromosomes

Unit III

- 3.1 Stem cell research and cloning
 - 3.1.1 Source and Isolation of stem cells
 - 3.1.2 Use of stem cells in human welfare
 - 3.1.3 Making stem cell lines
 - 3.1.4 Methodology

- 3.1.5 Whole body cloning
- 3.1.6 Organ cloning
- 3.2 Gene therapy
- 3.3 Genetic basis of following:
 - 3.3.1 Huntington's disease
 - 3.3.2 Cystic fibrosis
 - 3.3.3 Duchene Muscular Dystrophy
 - 3.3.4 Hemophilia
 - 3.3.5 Thalassemia
 - 3.3.6 G-6PD
 - 3.3.7 Fragile-X

Unit IV

- 4.1 Human Genetics: Current topics in Human Genetics
 - 4.1.1 Medical Cytogenetics
 - 4.1.2 Biochemical Genetics
 - 4.1.3 Pharamagenetics
 - 4.1.4 Prenatal diagnosis and birth defects

Unit V

- 5.1 Human Genome Project
 - 5.1.1 History, Organization and Goals of Human Genome Project
 - 5.1.2 Human Genome Project: Friend or Foe
- 5.2 Genetic counseling
 - 5.2.1 Purpose of Counselling
 - 5.2.2 Eugenics
 - 5.2.3 Euphenics
- 5.3 Genomic and Gene diversity

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

- 1. Nigyi : Human Genetics: Principles practice
- 2. Arora : Genetics
- 3. Pawar : Cell Biology
- 4. Prasad : Mutagenesis basic and applied

5. M.J.D. White : Animal Cytology and Evolution
6. Sinha : Trends in molecular Genetics
7. Levine : Genes
8. Hanawalt : Molecules to Living Cells
9. Stent : Molecular Genetics
10. Kunchler : Animal Cell Culture and Virology
11. Levine : Genetics
12. Whilcox: Molecular approach to Eukaryotic Genetic Systems.
13. Strange : Cell Surface Receptors
14. Ruthman : Methods in Cell Research
15. Gall : Electrophoresis in the separation of Biological Macromolecules
16. Kent : New Approaches to Genetics

Course No. PS ZOTE-404
 Credits: 4
 Time Duration: 2Hrs and 30 Mins.

TITLE: Fish & Fisheries II
 Maximum Marks : 100
 a) Minor Test I : 20
 b) Minor Test II : 20
 c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015 and May 2016

OBJECTIVES

The present course on fish and fisheries is, designed to acquaint the students with information on different types of water bodies, their changing physicochemical nature, their influence on inhabiting biota and fish production. This course aims to provide sufficient knowledge regarding life of fishes, their breeding potentials and culturing methods.

SYLLABUS

Unit I Fish Breeding

- 1.1 Natural Breeding of Indian major carps
 - 1.1.1 Location of breeding grounds
 - 1.1.2 Factors responsible for natural breeding
- 1.2 Wet and Dry bund breeding techniques for breeding Indian major carps
- 1.3 Induced breeding of fish through Hypophysation
 - 1.3.1 Principle techniques and advantages of Hypophysation
- 1.4 Selective breeding and hybridization
 - 1.4.1 Important fish hybrids

Unit II

- 2.1 Definition, Purpose, Scope and Status of Aquaculture
- 2.2 Biological Principles underlying fish culture
- 2.3 Types of culture :
 - 2.3.1 Open Water Culture, Semi closed and Closed type
 - 2.3.2 Extensive and Intensive Culture
 - 2.3.3 Criteria for selection of Sites
- 2.4 Culture Techniques
 - 2.4.1 Carp culture
 - 2.4.2 Trout Culture
 - 2.4.3 Prawn Culture
 - 2.4.4 Cage Culture

Unit III

- 3.1 Nutritional requirements of fish
 - 3.1.1 Protein
 - 3.1.2 Lipids
 - 3.1.3 Vitamins and Minerals
- 3.2 Feed formulation, Types and Forms of feed
- 3.3 Feed ingredients
- 3.4 Feed storage and distribution
- 3.5 Live Feed

Unit IV

- 4.1 Biochemical Composition, Preservation and Fish diseases
- 4.2 Fish spoilage and Rigor mortis
 - 4.2.1 Chemical spoilage
 - 4.2.2 Microbial spoilage
- 4.3 Fish Processing
 - 4.3.1 Principles and processes of:
 - 4.3.1.1 Drying
 - 4.3.1.2 Salting
 - 4.3.1.3 Freezing
 - 4.3.1.4 Refrigeration
- 4.4 Symptoms, Etiology, Prophylaxis and treatment of bacterial, viral, protozoan and helminth diseases.

Unit V

- 5.1 Traditional Fishing methods (crafts) used in India for fishing in Inland and Marine waters
- 5.2 Recent advances in fishing methods
 - 5.2.1 Light fishing
 - 5.2.2 Electric Fishing
 - 5.2.3 Sonar/Echosounders
- 5.3 Aquarium fish, setting up aquaria, their maintenance and uses
 - 5.3.1 Setting and maintenance of fish aquaria.
 - 5.3.2 Aquaria Accessories
 - 5.3.3 Biological notes on some common aquarium fishes

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
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Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Sarkar, S.K. . 2002. Freshwater Fish Culture. Daya Publ. House, New Delhi.
2. Jagtap, H.S, S.N. Mukherjee and V.K. Garad. 2009. A Textbook of Pisciculture and Aquarium. Daya Publ. House, New Delhi.
3. Selvamani, B.R and R.K. Mahadevan. 2008. Fish Harvesting and Processing. Campus Books International.
4. Amita Sexana. 2003. Aquarium Management. Daya Publ. House, New Delhi.
5. J.S. Lucas and P.C. Southgate . 2012. Aquaculture: Farming, Aquatic Animals and Plants. 2nd Ed. Wiley Blackwell, U.K.

Course No. PSZOTE-405
Credits: 4
Time Duration: 2Hrs and 30 Mins.

Title: Limnology II
Maximum Marks: 100
 a) Minor Test I : 20
 b) Minor Test II : 20
 c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015, May 2016

OBJECTIVES

In view of importance of biotic life in aquatic sources this course is designed to enlighten the the students about various biotic components of aquatic sources.

SYLLABUS

Unit-I

- 1.1 Plankton –Definition and classification
- 1.2 Distribution of plankton in aquatic ecosystem
- 1.3 Phytoplankton
 - 1.3.1 Seasonal periodicity
 - 1.3.2 Horizontal and vertical distribution
 - 1.3.3 Role of light and temperature in phytoplanktonic growth
 - 1.3.4 Role of organic nutrients in phytoplanktonic growth
 - 1.3.5 Floating adaptation in phytoplankton
 - 1.3.6 Phytoplanktonic associations
- 1.4 Macrophytes
 - 1.4.1. Composition and ecological classification
 - 1.4.2. Seasonal dynamics
 - 1.4.3. Economic importance and control measures

UNIT II

- 2.1 Zooplankton
 - 2.1.1 Composition and distribution (Horizontal and vertical) in rivers
 - 2.1.2 Composition and distribution (Horizontal and vertical) in lakes
 - 2.1.3 Cyclomorphosis
 - 2.1.4 Seasonal variations in lakes
 - 2.1.5 Seasonal variations in rivers
 - 2.1.6 Role of zooplankton in fish culture

UNIT III

- 3.1 Benthos (Macrobenthos)
 - 3.1.1 Composition and seasonal variations in Lakes
 - 3.1.2 Composition and seasonal variations in Rivers
 - 3.1.3 Composition and seasonal variations in Ponds
- 3.2 Interrelationship between benthos and vertebrates
- 3.3 Interrelationship between fish and invertebrates with special reference to:
 - 3.3.1 Protozoa
 - 3.3.2 Rotifers
 - 3.3.3 Coelenterates
 - 3.3.4 Worms
 - 3.3.5 Crustaceans

UNIT IV

- 4.1 Limnology and Human
- 4.2 Water Use
 - 4.2.1 Domestic
 - 4.2.2 Aquaculture
 - 4.2.3 Irrigation
 - 4.2.4 Industrial
 - 4.2.5 Navigation
 - 4.2.6 Recreation
 - 4.2.7 Hydroelectricity
- 4.3 Fisheries
 - 4.3.1 Indian riverine fisheries
 - 4.3.2 Indian lacustrine fisheries
 - 4.3.3 Indian reservoir fisheries
- 4.4 Integration of freshwater uses

UNIT V

- 5.1 Aquatic pollution
 - 5.1.1 Sources and kinds
 - 5.1.2 Effect of pollution on physico chemical parameters of water
 - 5.1.3 Effect of pollution on biota
- 5.2 International problems and future
 - 5.2.1 Translocation
 - 5.2.2 Acidification
 - 5.2.3 Global warming
 - 5.2.4 The future of freshwaters

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- vii) Major test will have seven questions each of 15 marks
- viii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- ix) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended:

1. Cole, A.A. 1974. text book of Limnology. The G.V. Mosby Company Saint Louis.
2. Olepper, H. 1979. Careers in conservation. A Ronaldn Press publication John Wiley and Sons, New York. .

3. Davies, B.R. and Walker, K.F. 1986. The Ecology of River Systems. Dr. W. Junk Publishers, Boston
4. Goldman, C.R. and Horne, A.J. 1983. Limnology. Mc Graw Hill International Book Company, New Delhi .
5. Hutchinson, G.E. 1977. A treatise on Limnology Vol. I John Willey and Sons, New York
6. Hutchinson, G.E. 1977. A treatise on Limnology Vol. II John Willey and Sons, New York.
7. Hutchinson, G.E. 1975. Limnological Botany John Willey and Sons, New York
8. Hybes, H.B. N. 1979. 'The Ecology of running waters. Liver Pool University Press.
9. Jhingran, V.G. 1982. Fish and Fisheries of India. Hindustan Publishing corporation, India.
10. Hutchinson, G.E. 1977. A treatise on Limnology Vol. I John Willey and Sons, New York
11. Jorgenson, S.E., Loffler, H, rast, W and Straskraba, M. 2005. Lakes and Reservoir Management.
12. G.E. Hutchinson. 2004. A Treatise on Limnology. John Willey & Sons, Canada.
13. Arvind Kumar. 2005. Fundamentals of Limnology
14. Welch, P.S. 2011. Limnology. N.H.P.
15. Brian Moss. Blackwell Science. 1998. Ecology of Freshwaters 3rd Ed.

Course No. PSZOTE-406

Credits: 4

Time Duration: 2Hrs and 30 Mins.

Title: Entomology II

Maximum Marks : 100

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014 May 2015 May 2016**OBJECTIVES**

This course is the continuation of Entomology I already dealt in semester III. In view of the importance of insect behaviour and insect plant relationship in the management of insect pests, this course³ is designed to make the students aware regarding these aspects. In addition, the major roles of insects in ecology have been incorporated in this part of the syllabus

SYLLABUS**Unit-I Insect behaviour and Insect – Plant relationship**

- 1.1 Social insects: Social organization, cast differentiation and evolution of social instinct. Honey bees and termites as social units.
- 1.2 Luminiscent insects

Unit-II Patterns of Insect-Plant relationship

- 2.1 Host selection
- 2.2 Attractants and repellants
- 2.3 Plant characteristics in host plant selection
- 2.4 Behavioural and physiological components in insect plant relationship
- 2.5 Plant stimuli and insect response

Unit-III Insect Communication

- 3.1 Chemical communication
 - 3.1.1 Pheromones, Kairomones, Allomones, Synomones
 - 3.1.2 Chemoreception
- 3.2 Audio communication
 - 3.2.1 Sound production
 - 3.2.2 Sound reception
- 3.3 Visual communication
 - 3.3.1 Compound eye and ocelli
 - 3.3.2 Light production
- 3.4 Tactile communication
 - 3.4.1 Mechanoreceptors

Unit-IV Major ecological role of insects

- 4.1 Insects and herbivores (Phytophagy)
 - 4.1.1 Leaf-chewing
 - 4.1.2 Plant mining and boring
 - 4.1.3 Sap-sucking
 - 4.1.4 Gall formation
- 4.2 Insects as pollinators
- 4.3 Insects as predators and parasites

- 4.3.1 Prey-Host location
- 4.3.2 Prey-Host acceptance
- 4.4 Role of termites in forestry
- 4.5 Role of insects in aquatic eco-system
- 4.6 Role of insects in forensic science
- 4.7 Ground dwelling insects
 - 4.7.1 Insects of soil and litter
 - 4.7.2 Dung insects
 - 4.7.3 Insects-carrion interaction
 - 4.7.4 Insect-fungal interaction
- 4.8 Insects Biotic potential, environmental resistance
- 4.9 Insects as human food

Unit-V Defence Mechanism in Insects

- 5.1 Behavioral Defence
 - 5.1.1 Defence by hiding
- 5.2 Structural defence
 - 5.2.1 Mechanical defence
- 5.3 Chemical defence
 - 5.3.1 Chemical structure of defence components
 - 5.3.2 Sources and organs of chemical defence
- 5.4 Colouration defence
 - 5.4.1 Cryptic colouration
 - 5.4.2 Flash patterns
 - 5.4.3 Warning coloration
- 5.5 Mimicry
 - 5.5.1 Batesian mimicry
 - 5.5.2 Mullerian mimicry

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. R.F. Chapman. 2013. The Insects: Structure and Functions, 5th Ed. Cambridge Univ. Press. Singapore
2. Timothy, D. Schowalter. 2000. Insect Ecology. Acad. Press.
3. Waldbauer. 2007. Thae Handy Insect. Jaico Publ. house
4. Wigglesworth, V.B. 1976. Insect and the life of Man. London Chapman & Hall.
5. Hermann, H.R. 1982. Social Insects (Vol-III). Academic Press, London.
6. Pedigo, L.P. and Rics, M.E. 2009. Entomology and Pest Management (VI Edi.) PHI Learning Private Limited.

Course No. PSZOTE- 407

Title: **Wildlife Biology,
Conservation & Management-II**

Credits: 4

Maximum Marks: **100**Time Duration: **2Hrs and 30 Mins.**a) Minor Test I : **20**b) Minor Test II : **20**c) Major Test : **60****Syllabus for the examination to be held in May 2014, May 2015, May 2016****OBJECTIVES**

There is a growing need for knowing what wildlife means and what its importance is in the balance of nature. The designed course is intended to convey the desirous students information regarding wildlife in India, its management along biological lines and the techniques associated with it. The course highlights major approaches for problem-solutions and the ways for implementing these solutions, with the over-riding goal of giving students a scientific point of view in understanding management of wildlife resources and its importance in India.

SYLLABUS**Unit I**

- 1.1 Distribution of Wildlife in India
 - 1.1.1 The Himalayan Mountain system
 - 1.1.2 The Peninsular Indian sub-region
 - 1.1.3 The Indian Desert
 - 1.1.4 The Tropical rain forest region
- 1.2 Endangered fauna of India
 - 1.2.1 Mammals
 - 1.2.2 Birds
 - 1.2.3 Reptiles
- 1.3 Endemic Wildlife in India

UNIT II

- 2.1 Criteria of sex and age
 - 2.1.1 Determining age and sex in game birds
 - 2.1.2 Determining age and sex in mammals
- 2.2 Bio-genomic regions of world with their characteristic wildlife
- 2.3 Vegetation sampling methods for use in wildlife habitat manipulation
- 2.4 Rangeland habitat; its evaluation and management for wildlife
- 2.5 Ecotourism- costs and benefits

UNIT III

- 3.1 Wildlife conservation projects of Govt. of India, their scope and success
 - 3.1.1 Project Tiger
 - 3.1.2 Project Gir Lion
 - 3.1.3 Project Hangul

- 3.1.4 Project Muskdeer
- 3.1.5 Project Manipur Deer
- 3.2 Wildlife status in J&K State
- 3.3 Wildlife damage: assessment and control
- 3.4 Habitat management for water fowl and other Wildlife

UNIT IV

- 4.1 Birds as bio-control agents
- 4.2 Pairing bonds in birds
- 4.3 Interspecific interaction (Predator-Prey relationship)
- 4.4 Intraspecific interaction
- 4.5 Behaviour in relation to Wildlife Management
- 4.6 Social Life in animals

UNIT V

- 5.1 Biodiversity, its meaning, assessment and conservation
- 5.2 Enlisting of mammals, birds, reptiles and amphibians of various Schedules of wildlife (Protection) Act (1972) amended upto 2006
- 5.3 Role of non—government organization like; IUCN, CITES, WWF, BNHS etc. in wildlife conservation
- 5.4 India’s National Parks and important Wildlife sanctuaries and biosphere reserves with their characteristic Wildlife
- 5.5 Protected areas of J&K State

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
Minor Test I	upto 20%	1 Hr.	20
Minor Test II	21% to 40%	1 Hr.	20
Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
- ii) One question will be very short answer type of multiple parts compulsory spread over entire syllabus
- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Eugene, P. Odum, 1971. Fundamentals of Ecology , Pub. W.B. Saunders Co. Ltd.
2. R.F. Dassan, 1982. Wildlife Biology (2nd ed.) Pub. Wiley Eastern Ltd. NDL.
3. S.H. Prater, 1980. The Book on Indian Animals, Pub. BNHS Calcutta
4. B.K. Tikadar, 1983. Threatened Animals of India, Pub. ZSI, Calcutta
5. J. Sparke, 1970. Bird Behaviour, Pub. Govosset and Dunlop, Inc. NDL.
6. S.K. Singh. 2009. Textbook of Wildlife Management. International Book. Distribution. Co.
7. Singh, M.P. Dey, S and Singh, B.S. 2004. Conservation of Biodiversity and Natural Resources

8. M.G. Chitkara. 2012. Wildlife. APH Publ. Co. New Delhi.
9. B.K. Singh. 2004. Biodiversity: Conservation and Management. Mangal Depp. Publ. Jaipur

Semester IV

COURSE NO. PSZOTE- 408

Credits: 4

Time Duration: 2Hrs and 30 Mins.

Title: Biological Anthropology

Maximum Marks: 100

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in May 2014, May 2015, May 2016

OBJECTIVES

Anthropology is the holistic science of mankind. It is an interdisciplinary field of infinite curiosity about human beings, their existence and activity. Biological Anthropology is a branch of science that deals with the adaptations, variability and human evolution to know the origin of man and type of people in the past, based on the evidence of fossil remains. It attempts to classify early forms of man, the physical differences between the races of the species, human genetics, modes of adaptation to the different physical environments. The course aims at introducing the students to the basics of Biological Anthropology, its historical background, importance, scope and application to the welfare of mankind. The subject provides a background in understanding the story of human evolution focusing widely on basic principles and processes involved in Human Evolution. Through this course students are expected to know and use the biological Anthropological knowledge like Human biology, Human genetics, Epidemiology, Susceptibility to various diseases etc.

SYLLABUS

Unit-I Introduction to Anthropology

- 1.1 Nature, scope and branches of Anthropology with special reference to Biological Anthropology
- 1.2 Applied aspects of Biological Anthropology
- 1.3 Historical development of the concept of evolution
 - 1.3.1 Theories of Evolution: Lamarckism, Darwinism and Neo Darwinism
- 1.4 Modern concept of natural selection, variation, isolation and speciation.
- 1.5 Zoogeographical realms- an Overview and Evidences of Evolution.

UNIT II Biological basis of life, Heredity and Evolution

- 2.1 Cell structure
- 2.2 Chromosome structure and number
- 2.3 DNA and RNA
- 2.4 Cell division:
 - 2.4.1 Mitosis
 - 2.4.2 Meiosis
 - 2.4.3 Evolutionary significance of Meiosis
- 2.5 Autosomal and Sex chromosome aberrations.

UNIT III Evolution of man

- 3.1 Major primate taxa
 - 3.1.1 Classification of living primates

- 3.2 Phylogenetic status, characteristics and distribution of the following:
 - 3.2.1 Prepliopithecus, Australopithecus, Paranthropus, Homo erectus, Homo sapiens, Java man, Peking man, Neanderthal man, Rhodesian man.
- 3.3 Relationship of man with Anthropoid ape
- 3.4 Evolutionary changes in Primates with special references to skull and limbs.

UNIT IV Human Variations

- 4.1 Human races and racial classification
 - 4.1.1 Study of racial criteria: Skin colour, Hair stature, Blood group, Eye colour, Palm and Finger pattern.
- 4.2 Multiregional human variations
- 4.3 Biocultural evolution of Humans
 - 4.3.1 Concept of culture, society and civilization

UNIT V Demographic and biological diversity studies in Anthropology

- 5.1 Basic concepts of population structure
 - 5.1.1 Hardy Weinberg law
 - 5.1.2 Age and sex composition
 - 5.1.3 Fecundity, fertility and sterility
 - 5.1.4 Natality, migration and morbidity
- 5.2 Ethnic and biological diversity among Indian population
- 5.3 Genetic and Environmental variations and adaptations in man.
 - 5.3.1 Role of social factors in influencing variations in Human
 - 5.3.1.1 Monogamy, Polygamy, Inbreeding, Endogamy and Exogamy.
- 5.4 Human Health:
 - 5.4.1 Infectious and Non-infectious diseases
 - 5.4.2 Epidemiology and susceptibility to various diseases

Note for Paper Setting

Examination Theory	Syllabus to be covered In Examination	Time allotted for Exam.	% weightage (marks)
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Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i) Major test will have seven questions each of 15 marks
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- iii) The remaining six question will be from the remaining 41% to 100% portion of the syllabus and the candidate will have to attempt any three of them

Books Recommended

1. Erickson & Nielson. A History of Anthropology
2. Victor Nerriou, Physical Anthropology and Archeology
3. Ember, E.R., M. Ember & P.N. Peregrine. Anthropology. Prentice Hall, India Pvt. Ltd.
4. Beals, R & Hoijer. An Introduction to Anthropology

5. Coon, L.S. Anthropology from A-Z
6. Jones Steve, Robert Martin and David Pilbean. The Cambridge Encyclopedia of Human Evolution. Cambridge University Press.
7. Russell, L., Coochon and Fleagle John, Primate Evolution and Human Origin.
8. Das, B.M. , Outlive of Physical Anthropology
9. Brace, C.L., Stages of Human Evolution
10. Larsen, C.S., 2010: A Companion to Biological Anthropology. 2nd Ed. Wiley Blackwell
11. Wood, B. 2011: Encyclopedia of Human Evolution. Wiley Blackwell

Bodmer & Cavallisforza: Ge