

UNIVERSITY OF JAMMU, JAMMU
(NAAC ACCREDITED 'A+' GRADE UNIVERSITY)

NOTIFICATION
(18/Dec./Adp/81)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the revision in the Syllabi and Courses of Study in the subject of **Zoology** of Master Degree Programme for I to IV semester under the **Choice Based Credit System (through regular mode)** in the main campus (as given in the Annexure) for the Examinations to be held in the years indicated against each semester as under:-

Subject	Semester	For the examinations to be held in the year
Zoology	Semester-I	December 2019, 2020 and 2021
	Semester-II	May 2020, 2021 and 2022
	Semester-III	December 2020, 2021 and 2022
	Semester-IV	May 2021, 2022 and 2023

The Syllabi of the courses is available on the University website: www.jammuuniversity.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/18/12365-12373

Dated: 01-01-2019

Copy for information and necessary action to:

1. Dean, Faculty of Life-Science
2. HOD/Convener, Board of Studies in Zoology
3. C.A to the Controller of Examinations
4. I/c Director, Computer Centre, University of Jammu
5. Asst. Registrar (Conf. /Exams. PG/Pub.)
6. Incharge, University Website for necessary action please.


Assistant Registrar (Academic)




UNIVERSITY OF JAMMU
COURSE STRUCTURE FOR MASTERS DEGREE PROGRAMME
IN ZOOLOGY

The Courses of study prescribed for 1st to 4th semesters/ Master's Degree Programme under CBCS in the subject of Zoology (Session 2019-21) onwards

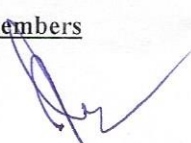
Semester	Course Code	Course Title	Credits	Nature of Course	
I	PSZOTC-101	Ecology & Environmental Biology	4	CORE	
	PSZOTC-102	Fundamentals of Genetics	4	CORE	
	PSZOTC-103	Ichthyology	4	CORE	
	PSZOTC-104	Immunology	2	CORE	
	PSZOTC-105	An Introduction to Insect Diversity	2	CORE	
	PSZOPC-106	Lab Course -I	4	PRACTICAL	
	PSZOPC-107	Lab Course -II	4	PRACTICAL	
	Total credits			24	
PSZOPC-106 Based on Theory Course No.101 & 103 PSZOPC-107 Based on Theory Course No.102, 104 & 105					
II	PSZOTC-201	Cell Biology & Research Instrumentation	4	CORE	
	PSZOTC-202	Functional Anatomy of Animals	4	CORE	
	PSZOTC-203	Basic Endocrinology	4	CORE	
	PSZOTC-204	Biotechnology	2	CORE	
	PSZOTC-205	Biodiversity, Conservation & Management	2	CORE	
	PSZOPC-206	Lab Course -I	4	PRACTICAL	
	PSZOPC-207	Lab Course -II	4	PRACTICAL	
	Total credits			24	
PSZOPC-206 Based on Theory Course No.201 & 203 PSZOPC-207 Based on Theory Course No.202, 204 & 205					
III	PSZOTC-301	Animal Physiology	4	CORE	
	PSZOTC-302	Fundamentals of Biochemistry	4	CORE	
	PSZOTC-303	Biosystematics, Taxonomy & Evolution	4	CORE	
	PSZOTO-304	*Economic Zoology	4	OPEN	
	PSZOPC-305	Lab Course -I	4	PRACTICAL	
	PSZOPC-306	Lab Course -II	4	PRACTICAL	
	Total credits			24	
PSZOPC-305 Based on Theory Course No.301 PSZOPC-306 Based on Theory Course No.302 & 303					
IV	PSZOTC-401	Reproductive & Developmental Biology	4	CORE	
	PSZOTC-402	Aquaculture	2	CORE	
	PSZOTC-403	Microbiology	2	CORE	
	<i>Any one of the following elective courses</i>				
	PSZOTE-404	Limnology	4	ELECTIVE	
	PSZOTE-405	Fish & fisheries	4	ELECTIVE	
	PSZOTE-406	Molecular Genetics & Cytogenetics	4	ELECTIVE	
	PSZOTE-407	Entomology	4	ELECTIVE	
	PSZOTO-408	*Biological Anthropology	4	OPEN	
	PSZOPC-409	Lab Course -I	4	PRACTICAL	
	PSZOPC-410	Lab Course -II	4	PRACTICAL	
	Total credits			24	
	PSZOPC-409 Based on Theory Course No.401, 402 & 403 PSZOPC-410 Based on Theory Course No.404/405/406/407				
Total credits earned by the students			96		

*For students of other Departments.

(Head of the Department)
Prof. & Head
Department of Zoology
University of Jammu
JAMMU

DAC members

1.



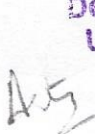
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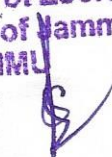
3.



4.



5.



SEMESTER-I

Course No. PSZOTC-101
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Course Title: Ecology & Environmental Biology
 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, 2019; December, 2020 and December, 2021

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.

SYLLABUS

Unit- I (12 hrs.)

- 1.1 Concept of eco-system : Ecological habitat, niche & Ecological equivalents
- 1.2 Hydrological cycle:
 - 1.2.1 Impact on Environment & biota.
 - 1.2.2 Man's Impact on Hydrological cycle
- 1.3 Energy flow in an ecosystem & mineral cycling (C,N,P)
- 1.4 Primary & Secondary productivity
 - 1.4.1 Methods of determination of primary productivity
- 1.5 Limiting factors: Law of minimum, Law of tolerance

Unit –II (13 hrs.)

- 2.1 Organization of communities:
 - 2.1.1 Biotic community concept
 - 2.1.2 Intra-community classification
 - 2.1.3 Patterns in communities
- 2.2 Ecological dominance, species diversity, Ecotones & Edge effect
- 2.3 Succession
 - 2.3.1 Types
 - 2.3.2 Mechanism
 - 2.3.3 Concept of climax
- 2.4 Terrestrial Biota & Permeants
- 2.5 Soil subsystem

Unit- III (13 hrs.)

- 3.1 Characteristics of Population
 - 3.1.1 Size & density
 - 3.1.2 Dispersal & Dispersion
 - 3.1.3 Age structure
 - 3.1.4 Natality & Mortality
 - 3.1.5 Life tables
- 3.2 Isolation & territoriality
- 3.3 Biological Invasions
- 3.4 Species interaction
 - 3.4.1 Negative: Competition, Predation, Parasitism
 - 3.4.2 Positive: Commensalism, Mutualism

Unit – IV (13 hrs.)

- 4.1 Sources and Uses of Non-conventional energy
- 4.2 Remote sensing: Definition, Importance and application
- 4.3 Bio-indicators

C. No. PSZOTC-101, Ecology & Environmental Biology (2019-21)

- 4.4 Bio-remediation
- 4.5 Sustainable development, natural resources management in changing environment

Unit- V

(12 hrs.)

- 5.1 Biodiversity
 - 5.1.1 Definition & assessment
 - 5.1.2 Management
- 5.2 Natural resources
 - 5.2.1 Wild life
 - 5.2.2 Minerals
- 5.3 Conservation Biology
 - 5.3.1 Principles
 - 5.3.2 Keystone species
 - 5.3.3 Protected Areas
 - 5.3.4 Acts & Related International Conventions

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 two sections (A & B)
- ii) Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii) Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

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. Wiegert, R.G. 1976. Ecological Energetic Dowden, Hutchinson & Ross. Inc. Pennsylvania.
7. Scuthwick, C.H. 1976. Ecology and the quality of our environment. D. Van Nestrand
8. Colinbaux, P.A. 1985 Introduction to ecology. John Wiley & Sons
9. Strinberg, Christian E. 2003. Ecology of humic substances in freshwater, Springer publishers.
10. Scheffer, Marten. 2004. Ecology of shallow lakes.
11. M.P. Sinha, Soma Dey, Bijaj. S. Singh. 2004. Conservation of biodiversity and Natural Resources. Daya Publ. House Delhi.
12. Odum, Eugene P. 2005. Fundamentals of Ecology. Publishers Cenage learning.
13. Wilkinson, D.M. 2007. Fundamental Resources in Ecology: An Earth System Approach. Oxford Univ. Press. UK.
14. Fahey, J.J, and Knapp, A.K. 2007. Principles and Standards for measuring primary production. Oxford Univ. Press. UK.
15. Grant, W.E. and Swanmack, T.M. 2008. Ecological Modeling. Blackwell Publ. House.
16. Bhatia, S.C. 2008. Ecology and sustainable development, Atlantic Publishers.
17. Arumugar N, 2014. Concept of Ecology, Saras Publishers, year-2014.
18. Ecology & Environment(13th edition) (2 copies) Author- Sharma, P.B. Rastogi-Publishers, year-2018
Molen, Manciel C.1048 Ecology. Publishers- Mc-Grew Hill Year-1048.

Course No. PSZOTC-102
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Course Title: Fundamentals of Genetics
 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, 2019; December, 2020 and December, 2021

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 the knowledge of the nature and structure of genetic material and basic principles of heredity. The course deals with the fundamentals of genetic processes namely structure of DNA, RNA and processes underlying central dogma of life.

SYLLABUS

- Unit-I Structure and organization of chromosomes (13 hrs.)**
- 1.1 Structure of chromatin
 - 1.1.1 heterochromatin, euchromatin,
 - 1.1.2 Nucleosome model
 - 1.2 Chromosome structure:
 - 1.2.1 Prokaryotes
 - 1.2.2 Eukaryotes
 - 1.2.3 Giant chromosome
 - 1.3 Specialized chromosomes:
 - 1.3.1 Lampbrush chromosomes
 - 1.3.2 Polytene chromosomes
 - 1.4 Mitochondrial Genome & Chloroplast Genome
 - 1.5 Telomere structure
- Unit- II Numerical and structural chromosome Variations (13 hrs.)**
- 2.1 Numerical Changes and their genetic implications
 - 2.1.1 Polyploidy
 - 2.1.2 Allopolyploidy
 - 2.1.3 Aneuploidy
 - 2.2 Numerical Change associated disorders in humans
 - 2.3 Structural chromosome alterations
 - 2.3.1 Deletions
 - 2.3.2 Duplications
 - 2.3.3 Inversions
 - 2.3.4 Translocations
 - 2.4 Structural changes associated disorders in humans
- Unit-III DNA, Mutation, DNA repair and transposons (13 hrs.)**
- 3.1 DNA
 - 3.1.1 DNA as genetic material
 - 3.1.2 Structure of DNA: nucleotides, Watson and Crick Model
 - 3.1.3 Repetitive DNA
 - 3.2 Mutation
 - 3.2.1 Types, causes and detection
 - 3.2.2 Loss of function, gain of function
 - 3.2.3 Germinal versus somatic mutants
 - 3.2.4 Insertional mutagenesis
 - 3.3 DNA Repair and mechanisms

C. No. PSZOTC-102, Fundamentals of Genetics(2019-21)

- 3.4 Transposons
 - 3.4.1 Transposons in prokaryotes
 - 3.4.2 Transposons in eukaryotes

Unit –IV Fundamental processes-I (12 hrs.)

- 4.1 DNA replication, Repair and Recombination
 - 4.1.1 Origin of replication, enzymes involved and replication fork
 - 4.1.2 DNA replication in eukaryotes and prokaryotes
 - 4.1.3 Extra chromosomal replicons
 - 4.1.4 Homologous and site specific recombination
- 4.2 RNA synthesis and processing
 - 4.2.1 Transcription factors
 - 4.2.2 Transcription in Prokaryotes and Eukaryotes
 - 4.2.3 RNA processing: RNA splicing, polyadenylation, RNA editing
 - 4.2.4 Types of RNA

Unit -V Fundamental processes-II (12 hrs.)

- 5.1 Protein Synthesis and processing
 - 5.1.1 Ribosome
 - 5.1.2 Formation of initiation complex
 - 5.1.3 Elongation and termination
 - 5.1.4 Genetic Code
 - 5.1.5 Activation of tRNA
 - 5.1.6 Translational inhibitors
 - 5.1.7 Post translation modifications
- 5.2 Control of gene expression
 - 5.2.1 Regulation of gene expression in prokaryotes
 - 5.2.2 Regulation of gene expression in eukaryotes
 - 5.2.2.1 Role of chromatin in gene expression and gene silencing

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books recommended

1. Sinnett, E.W., Dunn, L.C. and Debzhanski, Th (1958): Principles of genetics. Kugakusha. Co. Inc. Ltd. Japan.
2. Burnham, C.R. (1962) : Discussions in Cytogenetics Burgess Publ. Co. Minneapolis.
3. Swanson, R.C.P. Mertz, T. and Young, W.J. (1967): Cytogenetics, Prentice Hall of India, Pvt. Ltd.
4. Garber, G.B. (1972): Cytogenetics. McGraw Hill. Pub. Co. Ltd.
5. Strickbarger, M.W. (1976): Genetics. Mc. Millan Publ. Co. Inc. New York.
6. Gardner and Snustad. J.W. & Sons.(1981). Principles of Genetics.
7. A.G. Atherly, J.R. Girton & J.F. McDonald. Saunders College Publ. USA. (1999). The Science of Genetics
8. Miglani. Narosa Publ. House . New Delhi.(2011). Fundamentals of Genetics
9. Terry Brown, Taylor and Francis Group. USA.(2012). Introduction to Genetics: A Molecular Approach
10. Hartl and Ruvolo (2012).Analysis of genes and genomes, 8th edition.
11. E.J. Gardner, M.J. Simmons and D.P. Srustad. J.W. Sons Publ. Singapore.(2012). Principles of Genetics 8th Ed.
12. William Klug (2016) .Essentials of genetics 9th edition Pearson education ltd

Course No. PSZOTC-103
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Course title : Ichthyology
 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, 2019; December, 2020 and December, 2021**

OBJECTIVES

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

SYLLABUS

Unit-I Morphology and classification (13 hrs.)

- 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 (13 hrs.)

- 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 (13 hrs.)

- 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 (12 hrs.)

- 4.1 Reproductive organs and Accessory sex organs
- 4.2 Secondary sexual characters
- 4.3 Oviparity, viviparity (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**(13 hrs.)**

- 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

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended:

1. S.F. Harmer, W.A Herdman, T.W. Bridge, G.A. Boulenger. Discovery Publishing House New Delhi (1999). Classification of fishes, Volume
2. Lynwood, S. Smith. Narendra Publ. House, Delhi. (2003). Introduction to the fish physiology.
3. Albert C.L.G Gunther, Arihant Publishing House, Jaipur (2004). Study of Fishes
4. Arvind Kumar and Pushaplata Dubey. Daya Publ. House, Delhi. (2006). Fish Management and Aquatic Environment.
5. Lagler, Bardock, Miller & Possino, John Wiley & Sons, N.Y., London: (2012). Ichthyology, 2nd Ed.
6. K.C Badapanda Narendra Publishing House, Delhi(2012). Fishery Biology
7. Vasanth Kumar, Daya Publ. House, New Delhi. (2013). Advances in Aquatic Ecology.
8. B N Yadav. Daya Publishing House, Delhi (2016). Fish and Fisheries.
9. KC Jayaram. Narindra Publishing House, Delhi(2017). Fundamentals of fish taxonomy.

Course No. PSZOTC 104
CREDITS: 2
Time Duration: 2Hrs

Course Title: Immunology
MAXIMUM MARKS : 50
a) Minor Test I : 10
b) Minor Test II : 10
c) Major Test : 30

Semester-I

Syllabus for the examination to be held in
December, 2019; December, 2020 and December, 2021.

OBJEVTIVES

Immunology is a branch of biology that covers the study of immune systems in all organisms. Immunology charts, measures, and contextualizes the physiological functioning of the immune system in states of both health and diseases; malfunctions of the immune system in immunological disorders (such as autoimmune diseases, hypersensitivities, immune deficiency, and transplant rejection). Immunology has applications in numerous disciplines of medicine, particularly in the fields of organ transplantation, oncology, virology, bacteriology, Parasitology, psychiatry, and dermatology. The course is designed to present an essential but simplified account of the current situation of the Immunology for the students of Zoology of Master Degree Programme.

SYLLABUS

UNIT- I	Introduction to immune system	(12 hrs.)
1.1	Innate and adaptive immunity	
1.2	Immune cells:	
	1.2.1 Type of cells	
	1.2.2 Role of Immune cells in immunity	
1.3	B-Lymphocyte and T-Lymphocyte	
1.4	General Properties of Cytokines and Chemokines	
1.5	Antibody: Type, Structure and Function	
UNIT-II	Humoral Immunity	(13 hrs.)
2.1	Antigen, Antigenicity and Immunogenicity.	
2.2	Signal Transduction:	
	2.2.1 B-Cells	
	2.2.2 T-Cells	
2.3	T-cell Receptors and types	
2.4	Monoclonal antibodies	
2.5	Antibody engineering	
UNIT-III	Cell mediated immunity	(13 hrs.)
3.1	B-cell and T-cell Activation, Differentiation and Memory	
3.2	Major Histo-Compatibility complex and Antigen presentation	
3.3	Allergy and Hypersensitivities:	
	3.3.1 Allergy type I, II,III, IV Hypersensitivities	
	3.3.2 Tolerance, Autoimmunity and Transplantation	
3.4	Role of Immune system in Cancer	
3.5	Immunological Techniques	
	3.5.1 ELISA	
	3.5.2 Immunoprecipitation	

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

BOOKS RECOMMENDED

1. William E.Paul.(1984).Fundamental Immunology.
2. Janis Kuby, Barbara A. Osborne,(1992). Immunology.
3. Abul K. Abbas and Andrew H. Lichtman,(2001). Basic Immunology: Functions and Disorders of the Immune System.
4. Lauren Sompayrac, (2001). How the immune system works.
5. Matthew Helbert and Roderick Nairn,(2002). Immunology for Medical Students
6. Kenneth Murphy, Paul Travers , Mark Walpart.(2008). Janeways Immunobiology,7th edition
7. Arumugan N, Dulsy Fatima (2015). Immunology.Saras Publications.
8. Abul K Abbas ,Andrew H Lichtman and Shiv Pillai.(2018).Cellular and Molecular Immunology. Elsevier.

Course No. PSZOTC-105
CREDITS: 2
Time Duration: 2Hrs

Course Title: An Introduction to Insect Diversity
MAXIMUM MARKS : 50
a) Minor Test I : 10
b) Minor Test II : 10
c) Major Test : 30

**Syllabus for the examination to be held in
 December, 2019; December, 2020 and December, 2021**

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

SYLLABUS

Unit- I Insects General Organization and Classification (10 hrs.)

- 1.1 General characters, classification and Bionomics of insect orders
 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
 1.2 Insect and Man

Unit- II Adaptive Modifications in the body Parts (10 hrs.)

- 2.1 The mouth parts and their diversity
 2.2 Types of Antennae in insects
 2.3 Types of leg modifications in insects
 2.4 Wings and wing coupling mechanism
 2.5 Sensory structure in insects: compound eye, chemoreceptors, mechanoreceptors

Unit-III (10 hrs.)

- 3.1 Metamorphosis, its types with respect to different groups
 3.2 Diapause in insects
 3.3 Stridulation in insects
 3.4 Defence mechanism
 3.5 Introduction to various immune systems with special reference to cockroach/ grasshopper

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

Books Recommended

1. Horowitz A.R. and Ishaya I. (2004). Insect pest management Springer. Rajkamal electric press
2. Timothy, (2007). Marc, Insect Ecology. Marc J. Klowden Elsevier Inc.
3. Marc J. Klowden Elsevier Inc. (2007). Physiological Systems in Insects.

C. No. PSZOTC-105, An Introduction to Insect Diversity (2019-21)

4. Waldbauer,(2007). The Handy Insect G.K. Book. Jaico Publ. House.
5. Pedigo and Rice, (2009). Entomology and Pest Management. Publ. PHI Learning, Pvt. Ltd.
6. R.F. Chapman, (2013) 2nd Ed. The Insect; Structure and Function
7. Gullan and Cranston. (2014). 5th Edition. The Insects. Wiley Blackwell.
8. Rivers, Dand B.(2017). Insects Jaico Publishing House
9. Lanham, (2018).The Insects. Gene Tech Books.

SEMESTER-II

Course No. PSZOTC- 201
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Course Title: Cell Biology & Research Instrumentation
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 2020, May, 2021 and May, 2022**

OBJEVTIVES

The course of cell biology is an integral part of the curriculum of Master degree programme. The field has emerged as an indispensable branch as it deals with the structural and functional unit of life. The techniques for cell study, cellular components, cell communication and cell signaling are dealt in detail to provide the students a comprehension of cell machinery. Besides the cell death, death in form of apoptosis is taken up in detail. 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 Cell membranes: Structure and function

(13 h)

- 1.1 Cell Membrane
 - 1.1.1 Structure and models of membrane organization
 - 1.1.2 Composition of cell membrane
 - 1.1.3 Function of cell membrane
- 1.2 Transport across membranes
 - 1.2.1 Active and Passive transport
 - 1.2.2 Endocytosis and Exocytosis
 - 1.2.3 Membrane transport proteins
- 1.3 Transport of macromolecules: Semi permeability; Osmosis
- 1.4 Modification of cell membrane
 - 1.4.1 Microvilli
 - 1.4.2 Cilia
 - 1.4.3 Flagella

UNIT-II Cell Cycle, Cell Communication and Cell signaling

(12h)

- 2.1 Cell Cycle and its Regulation
- 2.2 Cell Communication
 - 2.2.1 General principles of cell communication
 - 2.2.2 Cell adhesion and role of different adhesion molecules
 - 2.2.3 Gap Junctions
 - 2.2.4 Extracellular Matrix, Integrins
- 2.3 Cell signaling
 - 2.3.1 Cell Surface receptors
 - 2.3.2 Signaling through G-protein coupled receptors
 - 2.3.4 Enzyme linked receptor signaling

UNIT-III Cell death: Apoptosis

(12h)

- 3.1 Cell death in mammals
 - 3.1.1 Role of caspases
 - 3.1.2 Bcl2 family proteins, IAPs
 - 3.1.3 Intrinsic and Extrinsic Pathways
- 3.2 Cell death in C.elegans
- 3.3 Cell death in Drosophila
- 3.4 Apoptosis targeted therapies
- 3.5 Apoptosis and Cancer, Role of p53

C. No. PSZOTC 201, Cell Biology & Research Instrumentation (2020-22)

UNIT-IV Research Instrumentation-I

(13h)

- 4.1 Electrophoretic techniques
- 4.2 Chromatography techniques
 - 4.2.1 Liquid and gas chromatography
 - 4.2.2 Thin layer chromatography
 - 4.2.3 Planar/ paper chromatography
 - 4.2.4 Ion exchange chromatography
 - 4.2.5 Size exclusion chromatography
 - 4.2.6 Affinity chromatography
- 4.3 Centrifugation: principles and types

UNIT-V Research Instrumentation-II

(13h)

- 9.1 Tools and methods
 - 9.1.1 Bright Field Microscopy, Dark Field Microscopy
 - 9.1.2 Electron microscopy: Transmission Electron microscopy and Scanning Electron microscopy
 - 9.1.3 Fluorescence Microscopy (Principle and Types)
 - 9.1.4 Flow Cytometry
- 5.2 DNA sequencing Techniques
 - 5.2.1 Sanger Sequencing
 - 5.2.2 Chemical Degradation method
 - 5.2.3 Introduction to NGS
- 5.3 Polymerase Chain Reaction
- 5.4 Southern Blotting, Western Blotting, Northern Blotting, Slot Blots and Dot Blots.

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended:

1. Korenberg, (1974) DNA Replication W.H. / Freeman and Co. San Francisco
2. Avers, C.J.(1976.) Cell Biology. D. Van Nostrand, Co. New York.
3. De witt(1977.) Biology of the cell- An Evolutionary Approach. Saunders Co.
4. Jones and Bartlett,(1980.) Cells: Principle of Molecular Structure and function, Prescott.
5. De Robertis, E.D.F. and De Robertis, E.M.F. (1981). Cell and Molecular Biology. Saunders International Edition.
6. Alberts,(1983.) Molecular Biology of the Cell.
7. Maniatis (1983). Molecular cloning
8. Garland, A. (1983). Molecular Biology of the cell A, Bestrisetical, Garland Pub. Inc. New York.
9. Watson et al. (1987) Molecular Biology of Genes Vol I and II.
10. Gene- Watson (1987) Molecular biology
11. Smith and E.J. Wood, Chapman & Hall., HongKong. (1992.) Cell Biology
12. P.K. Gupta, Rastogi Publ. Merrut. (1994). Cytogenetics, Genetics and Evolution.
13. Bruce Alberts, Bray, Johnson, Lewis, Raff, Roberts, Walter (1997). Essential Cell Biology
14. Melacinki & Freifelder, John and Bartlett Publ. Boston. (1998.) Essentials of Molecular Biology.
15. Mousami Debnath, Shashi Jain Publ. Jaipur.(2008)Cell and Molecular Biology,
16. Thomas .D.Pollaed et.al.(2017).Cell biology.3rd edn.Elsiver.

Course No. PSZOTC-202
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Semester-II

Course Title : Functional Anatomy of Animals
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 2020, May 2021 and May 2022**

OBJECTIVES

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 (13h)

- 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 (13h)

- 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 (12h)

- 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 (12h)

- 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

C.No. PSZOTC-202, Functional Anatomy of Animals (2020-22)

- 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: (12h)
 - 5.1.1 Crustacean
 - 5.1.2 Insecta
 - 5.1.3 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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended:

1. Frederic Martini(1986) .Prentice-Hall Publishing House.Fundamentals of Anatomy and physiology.
2. Karelilium, William Bemis, Wallen F. Walker and Lancer (2000). Functional anatomy of vertebrates: An Evolutionary Perspectives.
3. Gerald, J, tertora, Sandra, R. And Bonnie (2000) Principles of Anatomy and Physiology.
4. R. Mc Neill Alexander (2006) Principles of Animal Locomotion
5. William O. Recce (2009). Functional Anatomy and Physiology of domestic animals
6. Gunther Von Hagens and Angelina Whalley (2011) Body Worlds: The anatomy of animal-catalog.
7. J.Ruth Lawson(2011). Platypus Global Media, Anatomy and physiology of Animals .
8. RK Saxana, Sumitra Saxena(2015). Viva Books Pvt Ltd .Comparative Anatomy of vertebrates.
9. Piper Treuting et.al, (2017).C omparative anatomy and histology .2nd edn Elsevier.

Course No. PSZOTC-203
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Course 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, 2020, May, 2021 and May, 2022**

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 Neural versus hormonal coordination (12h)
 1.2 Morphology and Physiology of Neuroendocrine system in Crustacea
 1.2.1 Neurosecretory cells: X and Y Organs.
 1.2.2 Role of Neuroendocrine Secretions on growth, reproduction and metabolism
 1.3 Morphology and Physiology of Neuroendocrine system in Insecta
 1.3.1 Neuro secretory cells, Corpora cardiac, Corpora allatum and Prothoracic gland
 1.3.2 Neuroendocrine control of growth reproduction and metabolism

Unit II

- 2.1 Structure and function of putative endocrine glands (13h)
 2.1.1 Pineal gland
 2.1.2 Thymus gland
 2.1.3 Urophysis
 2.1.4 Corpuscle of stannius
 2.2 Pheromones: Types, Structure and Functions
 2.3 Hormone Assays Techniques
 2.3.1 Ablation
 2.3.2 Bio-assays
 2.3.3 Radio-immuno Assays.

Unit III Comparative Vertebrate Endocrinology

(13h)

- 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
 3.3 Parathyroid Gland: Comparative morphology, anatomy and histology of the gland
 3.3.1 Role of Calcitonin, PTH and Vit. D in calcium homeostasis.
 3.4 Gastro-intestinal hormones

UNIT IV

(12h)

- 4.1 Adrenal Gland: Comparative Morphology, anatomy, functions and chemical structure of hormones released
 4.1.1 Morphology and Histology of the Adrenal cortex
 4.1.2 Biosynthesis and role of corticosteroids
 4.1.3 Biosynthesis and role of Adrenal medullary hormones (Catecholamine)
 4.1.4 Renin angiotensin system

C. No. PSZOTC-203, Basic Endocrinology (2020-22)

4.2 Pancreatic Islets: Structure, Role and Regulation of Insulin and Glucagon

Unit V

- 5.1 Formation of hormones
- 5.2 Release & transport of hormones.
- 5.3 Homeostasis and feedback mechanism
- 5.4 Mechanism of hormone action
- 5.5 Hormonal deficiency diseases : Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas.

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books recommended

1. Chandler and Gulbert (1962) Hormones and Neurosecretions. State Univ. of New York,
2. Tombs, A.S. (1970) Introduction to invertebrates Endocrinology
3. Bantley, P.J. (1976) : Comparative vertebrate Endocrinology, Cambridge Univ. Press, U.K.
4. Norman, Anthony, Litwack (1997): Hormones. Acad. Press
5. Williams Text book of Endocrinology (1998). W.B. Saunders Company.
6. Brook, Chales and Marshall (2000) Essential Endocrinology
7. Brook, Chales and Marshall (2000) Essential Endocrinology
8. Barrington, E.E.W.(2001) An introduction to comparative endocrinology, Willey Eastern Pvt. Ltd. USA.
9. Hadley MaE and Levine, J.E. (2006): Endocrinology by Addison-Wesley
10. Memled Shlomo and Polonsky Kenneth (2016).13th ed Text book of Endocrinology,Elsevier.

Course No. PSZOTC-204
CREDITS: 2
Time Duration: 2Hrs

Title: **Biotechnology**
MAXIMUM MARKS : 50
a) Minor Test I : 10
b) Minor Test II : 10
c) Major Test : 30

**Syllabus for the examination to be held in
 May, 2020, May, 2021 and May, 2022**

OBJEVTIVES

The course aims to acquaint the students with underlying principles of Biotechnology. 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. Biotechnological studies have led to the rise of techniques like Recombinant DNA and tissue culture techniques which are the highlights of the present course. Besides the immense potentials of biotechnology in the agriculture, health, and industrial sector are also the main components of the course. Overall the course is an essential part and of highly significance of the Master degree curriculum.

SYLLABUS

UNIT I Basics of Biotechnology (10h)

- 1.1 Origin, history and scope of Biotechnology
- 1.2 Recombinant DNA Technology & Gene cloning
 - 1.2.1 Plasmids, bacteriophage, phagemids, cosmids, artificial chromosomes (YAC and BAC)
 - 1.2.2 Recombinant DNA Technique.
 - 1.2.3 Screening of recombinant DNA
- 1.3 Generation of genomic and cDNA libraries
- 1.4 Restriction enzymes, types, classifications and examples.
- 1.5 Isolation and purification of:
 - 1.5.1 RNA,
 - 1.5.2 DNA (genomic and plasmid)
 - 1.5.3 Proteins.

UNIT II Animal cell and tissue culture (10h)

- 2.1 Laboratory facilities for Animal Tissue culture
- 2.2 Primary culture, cell line and cloning
 - 2.2.1 Disaggregation of tissue.
 - 2.2.2 Maintenance of cultured-cell lines
 - 2.2.3 Large scale cell culture
- 2.3 Tissue and organ culture
 - 2.3.1 Tissue culture: Slides, flasks, test tube culture
 - 2.3.2 Organ culture
 - 2.3.3 Whole embryo culture
- 2.4 Somatic cell Hybridization
- 2.5 Tissue engineering: Artificial skin and artificial cartilage.

UNIT III Applied Biotechnology (10h)

- 3.1 Analysis of Nucleic acids and proteins.
 - 3.1.1 One and two dimensional gel electrophoresis.
 - 3.1.2 Isoelectric focusing gels.
- 3.2 Environmental Biotechnology
 - 3.2.1 Sewage treatment
 - 3.2.2 Biosensors

C. No. PSZOTC-204, Biotechnology (2020-22)

- 3.3 Medical Biotechnology
 - 3.3.1 Molecular approaches to diagnosis
 - 3.3.2 Gene Therapy
- 3.4 Biophysical methods
 - 3.4.1 X-Ray crystallography
 - 3.4.2 NMR
- 3.5 Transgenic Animals
 - 3.5.1 Gene construct
 - 3.5.2 Vectors
 - 3.5.3 Transfection methods

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs.	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

Books Recommended

1. I.J.Higgins, Best and Jones(.1985). Biotechnology: Principles and Applications, Blackwell Scientific Publications
2. Bernard R. Glick and Jack J Pasternak,(1998).Principles and Applications of Recombinant DNA ,2nd edition
3. Joshi, V.K. and Pandey, A. Ed. (1999). Biotechnology. Food Fermentation, (2 Vol. set). Education Publ. New Delhi
4. Rajeshwari, S. Sethi and Sreekrishna, V.(2004). Biotechnology-2 New Age International Publ. Delhi.
5. M.P. Arora. (2005). Microbiology. Himalaya Publ. House. Mumbai 14. Wulf Crueger and Anneliese Crueger. 2005. B
6. Jay, J.M. (2008) Modern Food Microbiology (Sixth Edition).Aspen Publishers, Inc, Gaithersburg, Maryland.
7. Ananthanaryan & Panikerø. (2009.) Textbook of Microbiology. Univ. Press Pvt. Ltd. Himayatnagar, Hyderabad.
8. Gerard, J. Tortora, Berdell R. Funke & Christine L. Case.(2011). Microbiology: An Introduction 9th Ed, Pearson Education.
9. S.Ignacimuthu, s.j. (2012). Biotechnology an introduction Narasa Publishing House.
10. Mohan P.Arora,(2013).Biotechnology .Himalaya Publishing House
11. David Clarke and Nanette Pazdernik.(2015) .Biotechnology .2nd edition

Course No. PSZOTC-205

CREDITS: 2

Time Duration: 2Hrs

Semester-II

Course Title : Biodiversity, Conservation & Management

MAXIMUM MARKS : 50

a) Minor Test I : 10

b) Minor Test II : 10

c) Major Test : 30

Syllabus for the examination to be held in
May, 2020; May, 2021 and May, 2022

OBJECTIVES

There is a growing need for knowing what biodiversity means and what its importance in the balance of nature. The designed course is intended to convey the desirous students information regarding biodiversity, 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 biodiversity resources and its importance in India

SYLLABUS

Unit-I Biodiversity-Concepts, definition, Scope and Constraints (10h)

- 1.1 Composition and levels of Biodiversity (Genetic diversity, species/ organismal diversity, Ecological/ Ecosystem Diversity, Agrodiversity)
- 1.2 Patterns and scales of Biodiversity (, ,)
- 1.3 Biogeographic classification of India, India as a megadiversity nation
- 1.4 Biodiversity and Human welfare

Unit-II Indian Biodiversity: Vegetational Zones, zones of Faunal distribution (10h)

- 2.1 Biodiversity Hot Spots
- 2.2 Major protected areas (National Parks & Wildlife sanctuaries) and their importance
- 2.3 Endangered and Endemic animal species of India
- 2.4 Strategies for biodiversity conservation, in-situ and ex-situ conservation strategies
- 2.5 Values of Biodiversity Instrumental/ Utilitarian value and their categories
 - 2.5.1 Direct use value
 - 2.5.2 Indirect/ Non-consumptive use value

Unit-III Threats to Biodiversity (10h)

- 3.1 Cause, Patterns and consequences on the Biodiversity of Major Land and Aquatic Systems and organisms
- 3.2 Ecosystems Extinction: Types of Extinctions, Processes responsible for Species Extinction, Current and Future Extinction Rates
- 3.3 IUCN Threatened Categories and endangered animals
- 3.4 National wildlife Act, Red Data Book and its significance
- 3.5 Conservation of economically important terrestrial and aquatic species, Significance of gene banks and germ plasm conservation.

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

CNo. PSZOTC-205, Biodiversity, Conservation Management (2020-22)

Books Recommended:

1. Odum, E.P. (1971). Fundamentals of Ecology, W.B. Saunders, USA.
2. Kormondy, E.T. (1971). Concept of Ecology. Prentice Hall of India, New Delhi.
3. Scuthwick, C.H. (1976). Ecology and the quality of our environment. D. Van Nestrand
4. M.P. Sinha, Soma Dey, Bijaj. S. Singh. (2004). Conservation of biodiversity and Natural Resources. Dya Publ. House Delhi.
5. Singh, M.P. Dey, S and Singh, B.S. (2004). Conservation of Biodiversity and Natural Resources
6. Wilkinson, D.M. (2007). Fundamental Resources in Ecology: An Earth System Approach. Oxford Univ. Press. UK.
7. Grant, W.E. and Swanmack, T.M.(2008). Ecological Modeling. Blackwell Publ. House.
8. S.K. Singh.(2009_). Textbook of Wildlife Management. 2nd Ed. Int. Book. Distributing Co.
9. M.V. Reddy. (2009). Wildlife Biodiversity Conservation. Daya Publ. New Delhi.
10. M.G. Chitkara.(2012). Wildlife. APH Publ. Co. New Delhi.
11. Pellens Roseli and grand colas(2016) Biodiversity conservation and phylogenetic systematics. Spinger publication.

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

Semester-III

**Syllabus for the examination to be held in
December 2020, December, 2021 and December, 2022**

OBJECTIVES

The course has been designed to supplement the understanding of the functioning of organ systems of animals, after having exposure to students for 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
- 1.4 Physiology of gastrointestinal disorders

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

C. No. PSZOTC-301, Animal Physiology (2020-22)

- 4.2 Neurophysiology
 - 4.2.1 Nerve cell organization
 - 4.2.2 Nerve impulse origin and propagation, ion channels
 - 4.2.3 Synapsis and transmitters
- 4.3 Neuro anatomy of brain and spinal cord

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
 - 5.2.1.1 Contraction cycle
 - 5.2.1.2 Excitation- contraction coupling
 - 5.2.1.3 Length tension relationship
 - 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	41% to 100%	2Hrs.& 30 mins.	60

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended

1. Dennis, W. Wood .(1970). Principles of Animal Physiology. Arnold, Publ. Ltd., London.
2. Malcolin & Gorden. (1977). Animal Physiology: Principles and Adaptation. Macmillan Publ. Co. New York.
3. Nagabhushnam. (1993), Textbook of Animal Physiology. Oxford & IBH Publ. Co. Pvt. Ltd
4. Louw.(1993). Physiological Animal Ecology. Langman House, Burnt Mill, Harlow, England
5. Randall, Burggren and French.(2000). Eckert Animal Physiology Mechanisms and Adaptations. W.H.Freeman and Co. New York.
6. Guyton and Hall.(2013). Textbook of Medical Physiology.
7. K.Sembulingam and Prema Sembulingam.(2016).Essentials of Medical Physiology, 7th edition.

Course No. PSZOTC-302
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Course Title: Fundamentals of Biochemistry
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, 2020, December 2021 and December 2022.**

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.

SYLLABUS

UNIT I - Proteins : Structure, Function & Metabolism (13h)

- 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 (13h)

- 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 ó a concept, Allosteric inhibition

UNIT III- Carbohydrates : Structure and Function (12h)

- 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.

C. No. PSZOTC-302, Fundamentals of Bio-chemistry (2020-22)

3.3 Hexosamines, Glycoproteins and Glycophorins.

UNIT IV- Lipids : Structure & Function

(12h)

- 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, Lipoprotein, Prostaglandins

UNIT V- Metabolism of Carbohydrates & Lipids

(13h)

- 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

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended:

1. Geogrey L. Zubay, William W. Parson, Dennis E. Vance. (1995). Principles of Biochemistry.
2. R.I. Gumport, Frank, H. Deis, Nancy Counts Gerber & Rager. W.H. Freeman Co. N.Y. (2002). Biochemistry 5th Ed.
3. Horton Moran, Scrimgeour Perry Rawn. (2006). Principles of Biochemistry : Pearson International Edition. Fourth Edition.
4. Donald Voet, Judith, G. Voet, Wiley Plus Charlotte, W. Pratt. (2008). Principles of Biochemistry
5. Murray, Bender, Botham, Kennelly Rodwell, (2009). Harper's Illustrated Biochemistry, Mc. Graw Hill Publ. House.
6. Lehninger, Michael M. Cox and David L. Nelson. W.H. Freeman & Co. N.Y. (2010). Principles of Biochemistry
7. R. Hannah Sulochana, (2010). Principles of Biochemistry.
8. Thomas M. Devlin. (2011). Text book of Biochemistry, 7th Edition
9. John, L. Tymoczko, Jeremy M, Berg & Lubert Stryer (2013). Biochemistry, 2nd Ed.
10. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. (2013). Biochemistry 7th Edition.

**Course No. PSZOTC -303
Evolution**

CREDITS: 4

Time Duration: 2Hrs and 30 Mins.

Course Title: Biosystematics, Taxonomy &

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, 2020, December, 2021 and December, 2022.**

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 students 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 Definition and basic concepts of biosystematics

- 1.1 History, Importance and application of biosystematics
- 1.2 Species concepts
 - 1.2.1 Typological
 - 1.2.2 Nominalistic
 - 1.2.3 Biological
 - 1.2.4 Evolutionary species concept
- 1.3 Species Category
 - 1.3.1 Variety
 - 1.3.2 Sub & super species
 - 1.3.3 Sibling species and identical forms

Unit-II

- 2.1 Trends in taxonomy: Chemotaxonomy, cytotaxonomy and molecular taxonomy
- 2.2 Taxonomic collections, preservation, curation
- 2.3 Taxonomic keys, different types of keys, their merits and demerits
- 2.4 International code of Zoological Nomenclature (ICZN)

Unit-III

- 3.1 Concepts of evolution
- 3.2 Theories of organic evolution
 - 3.2.1 Lamarckism
 - 3.2.2 Neo Lamarckism
 - 3.2.3 Darwinism Theory and Natural selection
 - 3.2.4 Origin of species
 - 3.2.5 Theories of sexual selection
 - 3.2.6 Neo Darwinism
 - 3.2.7 Mutation theory of evolution

Unit-IV

- 4.1 Evolutionary time scale: Eras, period and epoch
- 4.2 Major events in evolutionary time scale and origin of unicellular and multi cellular organisms
- 4.3 History of life on earth
- 4.4 Speciations: Origin and mode of speciations
 - 4.4.1 Allopatricity and sympatricity
- 4.5 Adaptive radiations
- 4.6 Isolating mechanisms

C.No. PSZOTC 303, Biosystematics, Taxonomy & Evolution (2020-22)

Unit-V

- 5.1 Evidences of Biological evolution
 - 5.1.1 Comparative anatomy and morphology
 - 5.1.2 Vestigial organs
 - 5.1.3 Atavism and reversion
 - 5.1.4 Paleontological: Formation and types of fossils
 - 5.1.5 Connecting links : Zoo geography and its significance
- 5.2 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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended

1. Mayer, E. (1982). The growth of Biological thought. The Pulknep Press of Harvard University, Masvachusetts.
2. E. Mayer(1983). Principles of animal systematics. Tat McGraw Pub.
3. Jha, A.P. (1983). Genes and Evolution. John Publication, New Delhi
4. Merrel, D.J. (1993). Evolution and genetics, Holt, Rinchart and Winston, Inc.
5. E.O. Wilson(1999). The diversity of life W.W. Northern & Co.
6. Strickburger, N.W. (2000). Evolution, Jones and Bartett Publishers, Boston London.
7. Dobzhansky,(2005). The Genetics and Origin of Species. Columbia University press
8. Dobzhansky, Th. F.J.Ayala, I.L. Stebbines and J.M. valentine.(2005). Evolution. Surjeet Publication, Delhi.
9. King, M. (2009). Species Evolution-The role of chromosomal Change. The Cambridge University Press, Cambridge.
10. Pellens Roseli and Grand Colas (2016) Biodiversity conservation and phylogenetic systematics.Spinger publication.

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

Course Title: Economic Zoology
 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, 2020; December, 2021 and December, 2022.

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*
- 1.2 Biological notes and control of some harmful insects:
 - 1.2.1 Housefly, Cockroach, Mosquitoes
- 1.3 Field Insects
 - 1.3.1 Stem borer, Cotton bug, Aphids, Rice weevil

UNIT-II Economic Fishery and Aquaculture

- 2.1 Aquaculture: aim, purpose and status
 - 2.1.1 Type of culture: Open, Semi closed, Extensive & Intensive culture
- 2.2 Biological characteristics of culturable fishes
- 2.3 Carp culture
- 2.4 Trout culture
- 2.5 Prawn culture
- 2.6 Fish products & By products

UNIT-III Animal farming: Types and Economic Importance

- 3.1 Animal Husbandry: Purpose, scope & management
- 3.2 Dairy Animals, Breeds & Economic importance of
 - 3.2.1 Cow
 - 3.2.2 Buffalo
 - 3.2.3 Goat
- 3.3 Modern methods of breeding for improvement of Dairy animals
- 3.4 Poultry : Breeds & economic importance of
 - 3.4.1 Duck
 - 3.4.2 Chicken
 - 3.4.3 Quail

UNIT-IV Disease 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 Application of Biotechnology in:
5.3.1 Medicine
5.3.2 Pharmaceutical
5.3.3 Agriculture

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended

1. John E. Bardach, Ryther and McLarney (1972). Aquaculture. The Farming and Husbandry of Fresh water and marine organisms.
2. C.V. Kurian and V.O. Sebastian, (1976). Prawns and Prawn fisheries of India
3. R.S. Sethi and V. Sreekrishna. Biotechnology. (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. W.M. Wheeler. (2006). Social Insects: Their Origin and Evolution. Discovery Publ. House, New Delhi
6. Dholakia, A.D. (2010). Identification of Prawns/Shrimps of India and their Culture. Daya Publ. House, New Delhi
7. J.S. Lucas and P.C. Southgate. (2012). Aquaculture : Farming Aquatic Animals and Plants. Wiley-Blackwell, U.K.
8. S.S. Khanna and H.R. Singh (2014). A Textbook of Fish Biology and Fisheries of India. Hindustan Publishing House

SEMESTER - IV

Course No. PSZOTC-401
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Course Title: Reproductive & Developmental Biology
 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, 2021, May, 2022 and May, 2023.

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

- 1.1 Comparative Anatomy of Vertebrate Gonads and their ducts. (12h)
- 1.2 Histomorphology of mammalian Gonads
 - 1.2.1 Gonadotropin: types and functions
 - 1.2.2 Sex steroids : structure, Biosynthesis & Role in Reproduction
- 1.3 Corpora lutea, their structure and function
- 1.4 Atresia: formation and significance

UNIT-II Gametogenesis and Fertilization

(13h)

- 2.1 Origin of primordial germ cell
- 2.2 Spermatogenesis: Process, Ultra structure of sperms, Spermiogenesis
- 2.3 Oogenesis: Process, Vitellogenesis, Types of eggs and Egg membranes
- 2.4 Fertilization process
 - 2.4.1 Capacitation
 - 2.4.2 Recognition between male and female gamete
 - 2.4.3 Acrosome reaction of sperm
 - 2.4.4 Cortical reaction of egg
 - 2.4.5 Sperm penetration into egg
 - 2.4.6 Amphimixes

UNIT-III Reproduction and Breeding in Vertebrates

(12h)

- 3.1 Reproduction in non mammals
 - 3.1.1 Environmental factors affecting breeding in fishes, amphibians, reptiles, birds
 - 3.1.2 Secondary sex characters & Breeding Behaviour
- 3.2 Reproductive cycles in mammals
 - 3.2.1 Estrous cycle
 - 3.2.2 Menstrual cycle

UNIT-IV

- 4.1 Cleavage and blastulation (13h)
 - 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 fate maps in chordates
 - 4.2.2 Process of gastrulation

C. No. PSZOTC-401, Reproductive & Developmental Biology (2021-23)

- 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 (12h)
 - 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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended

1. Pattern B.M. Carlson, B.M. (1977). Foundation of Embryology. T.M.M. edition
2. Blinsky, B.I. (1981): Introduction to Embryology, Saunders College Pub. Philadel
3. Saunders, J. W. (1982): Dev. Biology Patterns, Principles, Problems, Macmillan Pub. Co. Inc. New York
4. Berrill N.J: Developmental Biology. McGraw Hill, New Delhi.
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

Course No. PSZOTC-402
CREDITS: 2
Time Duration: 2Hrs.

Course Title: Aquaculture
MAXIMUM MARKS : 50
a) Minor Test I : 10
b) Minor Test II : 10
c) Major Test : 30

Syllabus for the examination to be held in
May, 2021, May, 2022 and May, 2023.

OBJECTIVES

With the ever increasing human population there is need to look in for alternative source of food and in this respect aquaculture provides a good scope. So the present course is designed to acquaint the students with various aspects of aquaculture along with the culture of aquatic organisms and practices involved.

SYLLABUS

Unit-I Basics of Aquaculture (10h)

- 1.1 Definition, History, Importance and status of aquaculture
- 1.2 Forms of Aquaculture
- 1.3 Aquaculture practices
- 1.4 Criteria of selection of site for fish farm
- 1.5 Types of ponds for carp culture and their preparation
 - 1.5.1 Control of aqua insects, weeds, lining & fertilization
 - 1.5.2 Water quality management

Unit-II Fish feeding & breeding technology (10h)

- 2.1 Nutritional requirement of fish viz. protein, lipids, vitamins & minerals
- 2.2 Formulation & preparation of supplementary / artificial feed
 - 2.2.1 Feed ingredients
 - 2.2.2 Types of feed
 - 2.2.3 Feed preparation technology
 - 2.2.4 Feed formulation through Pearson's square method
- 2.3 Induced Breeding Techniques in carps
- 2.4 Feeding Techniques (manual & mechanical)

Unit-III Aquaculture Practices (10h)

- 3.1 Biological criteria of selection of cultivable fish species IMC, Chinese carps and Cat fish and Shell fish
- 3.2 Culture of Fresh water prawn
- 3.3 Trout Culture
- 3.4 Cat fish culture
- 3.5 Culture of sea weed and its importance

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs.	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

Books Recommended:

1. Bardack edition, (1979), Aquaculture-The faring and Husbandry of freshwater and marine organisms John Wiley and Sons New York.
2. Boyd, (1982), Water quality management for land fish culture, CE Elsevier Scientific publishing company.
3. Pillay, T.V.R. (1993), Aquaculture principles and practices.
4. Robert R. Stickney, (1994), Principles of Aquaculture, John Wiley and sons Inc.
5. De Silva, S.S, Anderson, T.A, (1994), Springer Netherlands.
6. Rath R.K,(2002), Freshwater aquaculture.
7. Srivastava, C.B.L. (2006), Atext book of Fishery Science and Indian Fisheries.
8. Ayyapan, T.V.R (1993) Aquaculture principles and practices.
9. John S. Lucas, (2013), Aquaculture farming aquatic animals and plants, FFishing new books
10. Handbook of fisheries and Aquaculture 2nd edition (2013), ICAR New Delhi.
11. R.R. Sticking, (2017), Aquaculture introductory (3rd edition), CAB International U.K.

COURSE NO. PSZOTC-403
Credits: 2
Time Duration: 2Hrs.

Course Title: Microbiology
Maximum Marks: 50
a) Minor Test I : 10
b) Minor Test II : 10
c) Major Test : 30

Semester-IV

Syllabus for the examination to be held in
May, 2021, May, 2022 and May, 2023.

OBJECTIVES

This course covers the importance of microbiology in different spheres like human health, industries and agriculture. The course includes the overview of disease transmission which will help students to understand the clinical presentations of various common diseases. The course will also enable the students to assess the role of microbes in industrial and agricultural arena.

SYLLABUS

UNIT I Medical Microbiology:

(10h)

- 1.1 Causative Agents, Etiology, Pathogenesis and Prophylaxis of Air borne diseases.
 - 1.1.1 Tuberculosis
 - 1.1.2 Pneumonia
 - 1.1.3 Pertussis
 - 1.1.4 Diphtheria
- 1.2 Food/ water/ Soil borne diseases
 - 1.2.1 Food poisoning - Botulism
 - 1.2.2 Typhoid fever
 - 1.2.3 Cholera
 - 1.2.4 Tetanus
- 1.3 Viral diseases
 - 1.3.1 Hepatitis
 - 1.3.2 HIV AIDS
 - 1.3.3 H1N1 infection
 - 1.3.4 Rabies
 - 1.3.5 Zika virus

UNIT-II Industrial Microbiology

(10h)

- 2.1 Microbial Fermentation
- 2.2 Products of microbial fermentation
 - 2.2.1 Food products- vegetables, vinegar, pickles
 - 2.2.2 Milk products ó cheese, yogurt
 - 2.2.3 Beverages ó wine and beer
- 2.3 Other microbial products
 - 2.3.1 Antibiotics
 - 2.3.2 Organic acids
 - 2.3.3 Enzymes

Unit-III Agricultural Microbiology

(10h)

- 3.1 Agricultural microbiology: Introduction
- 3.2 Soil microbiology ó Microbes in soil ó rhizosphere, phyllosphere and mycorrhiza
- 3.3 Biological nitrogen fixation: symbiotic and non symbiotic micro organisms
- 3.4 Bioremediation: the pollution solution
 - 3.4.1 Bacteria as excellent players in reducing water pollution
 - 3.4.2 Super bug: a tool to treat oil spills

3.5 Impact of microbes on the environment

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.	10
Minor Test II	21% to 40%	1 Hr.	10
Major Test	41% to 100%	2Hrs.	30

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1 mark each and be spread over entire syllabus
- iii. Section B comprises of 4 questions from remaining 2 units and candidate has to attempt one question from each unit of 10 marks each.

Books Recommended:

1. Wood, J. B. (1985). *Microbiology of fermented foods*. Volumes I and II. Elsevier Applied Science Publishers. London, England
2. Mitchell R. (1992). *Environmental Microbiology*. John Wiley & Sons.
3. Tauro P, Kapoor KK & Yadav KS. (1996). *Introduction to Microbiology*. Wiley Eastern.
4. Pelczar MJ, Chan ECS & Kreig NR. (1997). *Microbiology: Concepts and Application*. Tata McGraw Hill.
5. Joshi, V.K. and Pandey, A. Ed. (1999). *Biotechnology. Food Fermentation*, (2 Vol. set). Education Publ. New Delhi
6. Levine MM, Kaper JB, Rappuoli R, Liu MA & Good MF. (2004). *New Generation Vaccines*. 3rd Ed. Informa Healthcare.
7. Rajeshwari, S. Sethi and Sreekrishna, V. (2004). *Biotechnology-2* New Age International Publ. Delhi
8. M.P. Arora. (2005). *Microbiology*. Himalaya Publ. House. Mumbai
9. Wulf Crueger and Anneliese Crueger. (2005). *Biotechnology: A text book of Industrial Microbiology 2nd Ed.* Panima Publ. Corporation, New Delhi.
10. Male D, Brostoff J, Roth DB & Roitt . (2006). *Immunology*. Elsevier.
11. Jay, J.M. (2008) *Modern Food Microbiology* (Sixth Edition). Aspen Publishers, Inc, Gaithersburg, Maryland.
12. Ananthanaryan & Panikerø. (2009). *Textbook of Microbiology*. Univ. Press Pvt. Ltd. Himayatnagar, Hyderabad.
13. Gerard, J. Tortora, Berdell R. Funke & Christine L. Case. (2011). *Microbiology: An Introduction 9th Ed*, Pearson Education.
14. Pedro Escoll (2017). *Bacterial evasion of the host immune system*. Caister Academic Press.

Course No. PSZOTE- 404
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Course Title: Limnology
 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, 2021, May, 2022 and May, 2023.**

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, 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 (12h)
 1.1.1 History and scope
 1.1.2 Limnology in India
 1.2 Ponds: Origin & Classification
 1.3 Lakes
 1.3.1 Origin & Classification
 1.3.2 Eutrophication and its restoration
 1.4 Rivers
 1.4.1 Origin & Classification.
 1.4.2 Abiotic & Biotic characteristics

UNIT- II

- 2.1 Estuaries: (13h)
 2.1.1 Origin and classification.
 2.2 Bogs:
 2.2.1 Origin & types
 2.2.2 Abiotic and biotic characteristics
 2.3 Marshes:
 2.3.1 Origin and characteristics
 2.4 Vernal pools and their significance

UNIT-III

- 3.1 Plankton: Definition & Classification (12h)
 3.2 Phytoplankton
 3.2.1 Composition & Distribution in aquatic ecosystem
 3.2.2 Role of Organic nutrients in Phytoplanktonic growth
 3.2.3 Floating adaptation
 3.3 Zooplankton
 3.3.1 Composition & distribution
 3.3.2 Cyclomorphosis
 3.3.3 Role in aquaculture
 3.4 Benthos: Composition & Distribution
 3.4.1 Role in Aquatic ecosystems

UNIT-IV

- 4.1 Physical Characteristics (13h)
 4.1.1 Light
 4.1.2 Turbidity
 4.1.3 Currents
 4.2 Chemical characteristics

- 4.2.1 PH
- 4.2.2 DO
- 4.2.3 FCO₂
- 4.3 Bottom: Composition, sources and diversity
- 4.4 Thermal stratification

UNIT-V

(12h)

- 5.1 Wetland
 - 5.1.1 Introduction & Characteristics
 - 5.1.2 Management techniques
- 5.2 Translocations
- 5.3 Acidification
- 5.4 Dwindling freshwater Resources their conservation & 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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

BOOKS RECOMMENDED

1. Cole, A.A. (1974). Text book of Limnology. The G.V. Mosby Company Saint Louis.
2. Hutchinson, G.E. (1975). Limnological Botany John Willey and Sons, New York
3. Hutchinson, G.E. (1977). A treatise on Limnology Vol. I John Willey and Sons, New York
4. Hutchinson, G.E. (1977). A treatise on Limnology Vol. II John Willey and Sons, New York.
5. Hutchinson, G.E. (1977). A treatise on Limnology Vol. I John Willey and Sons, New York
6. Olepper, H. (1979). Careers in conservation. A Ronaldn Press publication John Wiley and Sons, New York.
7. Hybes, H.B. N. (1979). 'The Ecology of running waters. Liver Pool University Press.
8. Jhingran, V.G. (1982). Fish and Fisheries of India. Hindustan Publishing corporation, India.
9. Goldman, C.R. and Horne, A.J. (1983). Limnology. Mc Graw Hill International Book Company, New Delhi .
10. Davies, B.R. and Walker, K.F. (1986). The Ecology of River Systems. Dr. W. Junk Publishers, Bostan
11. Brian Moss. Blackwell Science. (1998). Ecology of Freshwaters 3rd Ed.
12. Wetzel, R.G. (2001). Limnology (3rd edition). Publishers-Academic press year
13. G.E. Hutchinson. (2004). A Treatise on Limnology. John Willey & Sons, Canada.
14. Arvind Kumar. (2005). Fundamentals of Limnology
15. Rotipeax Author-Martens. (2005). K ed Publisher- Springer
16. Jorgenson, S.E., Loffler, H, rast, W and Straskraba, M. (2005). Lakes and Reservoir Management.
17. Welch, P.S. (2011). Limnology. N.H.P.
- 18 Agarwal. (2014). Limnology (2 copies). Publishers-Apm
19. Cola, Gerald. (2015). Textbook of Limnology (4th edition). CBS Publishers
20. Hosetti, B.B. (2016). A textbook of applied aquatic Biology. Daya publishers
21. Welch, P.S. (2018). Limnology. Narendra Publishers
22. Biju, A, (2018). Marine zooplankton Publisher-NPH

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

Course Title: Fish & fisheries
 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, 2021, May, 2022 and May, 2023.**

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 Introduction to Fishery science and fisheries of India (12 hrs)

- 1.1. Importance of Fishery Science.
- 1.2. Fishery Science as an integrated study.
- 1.3. Lacustrine fishery: Origin and classification of lakes.
- 1.4. Major Reservoirs and Reservoir fishery.
- 1.5. Riverine fisheries.
- 1.6. Marine Fisheries.

Unit-II Fish Environment (13hrs)

- 2.1.1 Abiotic
 - 2.1.1 Temperature: Effect on vital biological processes and thermal stratification
 - 2.1.2 Light: Sources, factors influencing light penetration, methods of measuring penetration and its relationship with aquatic organisms.
 - 2.1.3 pH - Definition, distribution and significance.
 - 2.1.4 CO₂: Sources, methods of determination and significance.
 - 2.1.5 DO : Sources, methods of determination and significance.
 - 2.1.6 Nitrates, Nitrites and Ammonia: Sources and significance.
- 2.2. Biotic
 - 2.2.1. Plankton: Definition, classification and its role in fishery.
 - 2.2.2. Benthos: Definition, classification and its role
 - 2.2.3. Common benthic organisms

Unit III Nutritional requirements, Biochemical Composition and of fish processing (12hrs)

- 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 Biochemical Composition of fish
- 3.4 Fish spoilage and Fish diseases

Unit IV Fish Breeding (13hrs)

- 4.1 Natural Breeding of Indian Major carps
 - 4.1.1 Location of breeding grounds and seed collection
 - 4.1.2 Factors responsible for Natural breeding
- 4.2 Wet and Dry bund breeding techniques for breeding Indian major carps
- 4.3 Induced breeding of fish through Hypophysation
 - 4.3.1 Principle techniques and advantages of Hypophysation
- 4.4 Selective breeding and hybridization

Unit-V Aquarium management/Diseases

(12hrs)

- 5.1. Aquarium fish, setting up aquaria and their maintenance and uses.
 5.1.1. Setting and Maintenance
 5.1.2. Aquarium Accessories
 5.1.3. Biological notes on Common aquarium fishes.
 5.2. Fish Diseases: Symptoms, Etiology, Prophylaxis and treatment of
 5.2.1 Bacterial
 5.2.2 Viral
 5.2.3 Protozoan
 5.2.4 Helminth
5.3 Fishing methods
 5.3.1 Traditional Fishing methods used in inland and marine waters
 5.3.2 Recent advances in fishing methods
 5.3.2.1. Light fishing
 5.3.2.2. Electric Fishing
 5.3.2.3. Sonar/Echosounders

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

Books Recommended

1. John E.Bardach, Ryther and McLarney (1972). Aquaculture. The Farming and Husbandry of Fresh water and marine organisms.
2. C.B.L. Srivastava. (1985). A Textbook of Fisheries Science and Indian Fisheries.
3. Jhingran, V.G. (1997). Fish and Fisheries of India. Hindustan Publishing Corporation, India.
4. Sarkar, S.K. (2002). Freshwater Fish Culture. Daya Publ. House, New Delhi.
5. Amita Sexana. (2003). Aquarium Management. Daya Publ. House, New Delhi. Selvamani, B.R and R.K.
6. Mahadevan.(2008). Fish Harvesting and Processing. Campus Books International
7. Jagtap, H.S, S.N. Mukherjee and V.K. Garad. (2009). A Textbook of Pisciculture and Aquarium. Daya Publ. House, New Delhi.
8. J.S. Lucas and P.C. Southgate . (2012). Aquaculture: Farming, Aquatic Animals and Plants. 2nd Ed. Wiley Blackwell, U.K.
9. S.S. Khanna and H.R.Singh (2014). A Textbook of Fish Biology and Fisheries of India. Hindustan Publishing House.
10. Rahul P.Parihar.(2014). Fish Biology and Indian Fisheries.
11. Heimo Mikkola (2017). Fisheries and aquaculture in the modern world.

Course No. PSZOTE-406

Title: Molecular Genetics & 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
May, 2021, May, 2022 and May, 2023.**

OBJECTIVES

Human Molecular Genetics and Cytogenetics are fascinating branches of biological studies and molecular 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 Analysing Human Chromosomes (13hrs)

- 1.1 Chromosome Banding Techniques
 - 1.1.1 G-Banding
 - 1.1.2 C-Banding
 - 1.1.3 High resolution Banding
 - 1.1.4 Q-Banding
 - 1.1.5 Significance and applications of chromosome banding techniques
- 1.2 Advanced Cytogenetic Techniques
 - 1.2.1 Fluorescent in Situ Hybridization (FISH)
 - 1.2.2 Comparative Genomic Hybridization (CGH)
 - 1.2.3 Spectral Karyotyping
- 1.3 Computer Assisted Chromosome Analysis

(12hrs)

Unit II Human Genome and its evolution

- 2.1 Organization of human genome
 - 2.1.1 Nuclear genome
 - 2.1.2 Mitochondrial Genome
- 2.2 Human Gene families
- 2.3 Homolog, paralogs and orthologs
- 2.4 Repetitive DNA and its types
- 2.5 Evolution of human nuclear genome

Unit III Stem Cell Biology, gene therapy and genetic disorders (13hrs)

- 3.1 Stem cell research and therapeutic cloning
 - 3.1.1 Stem Cell Basics: types, potency
 - 3.1.2 Source and Isolation of stem cells
 - 3.1.3 Use of stem cells in human welfare
- 3.2 Therapeutic Cloning
- 3.3 Ethical Issues in therapeutic cloning
- 3.4 Gene therapy
- 3.5 Genetic basis of following:
 - 3.5.1 Huntington's disease
 - 3.5.2 Cystic fibrosis
 - 3.5.3 Thalassemia
 - 3.5.4 Haemophilia
 - 3.5.5 DMD
 - 3.5.6 Fragile-X

C. No. PSZOTE-406, Molecular Genetics & Cytogenetics (2021-23)

Unit IV Genetic Diagnosis and treatment of genetic diseases (12hrs)

- 4.1 DNA based diagnosis
- 4.2 Biochemical Diagnostics

- 4.3 Pre-implantation diagnosis
- 4.4 Population Screening
- 4.5. Prenatal diagnosis:
 - 4.5.1 Invasive techniques: CVS, Amniocentesis, Fetoscopy
 - 4.5.2 Non invasive techniques: Ultrasonography, Fetal Cells in maternal blood, maternal fetal serum
- 4.6 Treatment of genetic diseases

Unit V Human Genome project and genetic counseling (13hrs)

- 5.1 Human Genome Project
 - 5.1.1 History, Organization and Goals of Human Genome Project
 - 5.1.2 Human Genome Project: ESLI
- 5.2 Genetic counselling
 - 5.2.1 Purpose of Counselling
 - 5.2.2 Eugenics
 - 5.2.3 Euphenics
- 5.3 Human Genetic Variations
- 5.4 Gene and Environmental Interactions
- 5.5 DNA Fingerprinting : Principle and Applications

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 two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

BOOKS RECOMMENDED

- 1) T.A.Brown, (2002).Genome,Second Edition, Bios Scientific Publishers Ltd
- 2) David P. Clark, (2005). Molecular Biology. Elsevier Academic Press.
- 3) T. A. Brown, (2006): Genome : Third Edition, Garland Science
- 4) Benjawan Lewin, (2008). Gene IX. Jones and Barlett Publishers.
- 5) Ricki Lewis. (2009) Human Genetics-Concepts and Application. Second Edition. WCB-McGraw Hill.
- 6) Judith Goodship, Patrick Chinnery, and Tom Strachan (2010). Genetics and Genomics in Medicine.
- 7) F Vogel A.G. Motulusky. (2010). Human Genetics: Problems and Approaches. Third Completely Revised Edition, Springer-Verlag.
- 8) D. Peter Snustad and Michael J.Simmons. (2012). Principles of Human Genetics. Fifth edition. John Wiley & Sons, Inc

Course No. PSZOTE-407
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

Course Title: Entomology
MAXIMUM MARKS : 100
a) Minor Test I : 20
b) Minor Test II : 20
c) Major Test : 60

Semester-IV

**Syllabus for the examination to be held in
May, 2021, May, 2022 and May, 2023.**

OBJECTIVES

This course 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 Important species of insect pests with special reference to J&K state: (12hrs)

- 1.1 Cereal and crop pests
 - 1.1.1 Fruit & vegetable pests
 - 1.1.2 Stored grain & household pests
 - 1.1.3 Forest pests, pest of fibrous crops
- 1.2 Insect Pest control & Management:
 - 1.2.1 Cultural control
 - 1.2.2 Chemical control
 - 1.2.3 Hazards of insecticides
 - 1.2.4 Insecticidal resistance
- 1.3 Modern techniques of Insect control
 - 1.3.1 Hormonal and Pheromonal control
 - 1.3.2 Biological control
 - 1.3.3 Sterile Insect & genetic tactics in insect control
 - 1.3.4 Plant Resistance to insects
 - 1.3.5 Biotechnological approach in pest management

Unit-II Insects of medical Importance (13hrs)

- 2.1 Insects as vectors of human diseases
 - 2.1.1 Mode of transmission and epidemiology of major vector borne diseases such as Malaria, yellow fever, kalazar, typhus, plague, filiarisis
- 2.2 Insects of commercial Importance & products
 - 2.2.1 Honey bees
 - 2.2.2 Silk and Tassar Worms
 - 2.2.3 Lac insects

Unit-III Major Ecological Role of Insects (12hrs)

- 3.1 Insects as herbivores
 - 3.1.1 Insect as pollinators
 - 3.1.2 Aquatic insects
 - 3.1.3 Insects as parasites and predators
 - 3.1.4 Role of insects in forensic sciences
 - 3.1.5 Ground dwelling insects
 - 3.1.6 Insect biotic potential and environmental resistance
 - 3.1.7 Insect as human food
- 3.2 Insect Plant Relationship:
 - 3.2.1 Host selection and plant characteristics in host plant selection

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3.2.2 Behavioural and physiological components in insect plant relationship

Unit-IV Insect communication (13hrs)

- 4.1 Social Insects
 - 4.1.1 Social organization
 - 4.1.2 Caste differentiation and evolution of social instinct
 - 4.1.3 Honey bees
 - 4.1.4 Termites and ants as social units
- 4.2 Insect communication
 - 4.2.1 Chemical communication
 - 4.2.2 Audio & tactile communication
 - 4.2.3 Visual communication
 - 4.2.4 Luminiscent insects

Unit-V

- 5.1 Defense Mechanism in Insects (12h)
- 5.2 Behavioural & Structural defense
- 5.3 Chemical defense
- 5.4 Coloration defense
- 5.5 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
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Major Test	41% to 100%	2Hrs.& 30 mins.	60

- i. Major test will have two sections (A & B)
- ii. Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- iii. Section B comprises of 6 questions (2 from each unit) from the remaining 3 units and candidate has to attempt one question from each unit (15 marks each).

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.
7. Haldhar and Deshwal (2017). Fundamentals of Agriculture Entomology. New Vishal Publication.

COURSE NO. PSZOTO- 408
CREDITS: 4
Time Duration: 2Hrs and 30 Mins.

CourseTitle: 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, 2021, May, 2022 and May, 2023.**

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 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 (12h)

- 1.1 Definition, Nature, scope of Anthropology
- 1.2 Branches of Anthropology with special reference to Biological Anthropology
 - 1.2.1. Biological Anthropology
 - 1.2.2. Cultural anthropology
 - 1.2.3. Lingual Anthropology
 - 1.2.4. Forensic Anthropology

UNIT- II Biological basis of life, Heredity and Evolution (13h)

- 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 (12h)

- 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 Preliopithecus, Australopithecus, Paranthropus, Homoerectus, 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 (13h)

- 4.1 Human races and racial classification
 - 4.1.1 Skin colour
 - 4.1.2. Hair stature

C. NO. PSZOTO-408, Biological Anthropology (2021-23)

- 4.1.3. Eye colour
- 4.2 Concept of culture society and civilization
- 4.3 Basic concept of population structure
 - 4.3.1 Age and sex composition
 - 4.3.2 Natality, mortality and morbidity
 - 4.3.3 Fecundity and fertility

UNIT- V Human Health (13h)

- 5.1 Epidemiology and susceptibility to various diseases
- 5.2 Infectious diseases : Causes, symptoms, diagnosis
 - 5.2.1. Bacterial: TB, Cholera
 - 5.2.2. Viral: AIDS, Zika Virus
- 5.3. Non-Infectious
 - 5.3.1. Hormonal: Diabetes, Thyroidism
 - 5.3.2. Genetic: Cancer, sickle cell Anemia
- 5.4 Late onset Diseases
 - 5.4.1 Alzheimer's Disease
 - 5.4.2. Parkinson's Disease

Note for Paper Setting

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Books Recommended

1. Ember, E.R., M. Ember & P.N. Peregrine. (1963). Anthropology. Prentice Hall, India Pvt. Ltd.
2. Beals, R & Hoijer. (1966) An Introduction to Anthropology
3. Victor Neriou (1982). Physical Anthropology and Archeology
4. Russell, L. Coochon and Fleagle John (1985). Primate Evolution and Human Origin.
5. Brace, C.L. (1989). Stages of Human Evolution
6. Larsen, C.S. (2010). A Companion to Biological Anthropology. 2nd Ed. Wiley Blackwell
7. Wood, B. (2011). Encyclopedia of Human Evolution. Wiley Blackwell
8. Bodmer & Cavallisforza (2012). Genetics, Evolution and Man. Freeman
9. Das, B.M. (2013), Outlive of Physical Anthropology
10. Stanford, Allen and Anton (2018). Biological Anthropology. Pearson Education.