

**UNIVERSITY OF JAMMU**  
**COURSE STRUCTURE FOR MASTERS DEGREE PROGRAMME**  
**IN ZOOLOGY**

**The Courses of study prescribed for 1<sup>st</sup> to 4<sup>th</sup> semesters/ Master's Degree Programme under CBCS in the subject of Zoology (Session 2021-23)**

Semester	Course Code	Course Title	Credits	Nature of Course	% of Change	
I	PSZOTC-101	Ecology & Environmental Biology	4	CORE	20 %	
	PSZOTC-102	Fundamentals of Genetics	4	CORE	25 %	
	PSZOTC-103	Ichthyology	4	CORE	10 %	
	PSZOTC-104	Immunology	2	CORE	35 % (Newly introduced)	
	PSZOTC-105	An Introduction to Insect Diversity	2	CORE	30 %	
	PSZOPC-106	Lab Course -I	4	PRACTICAL	25 %	
	PSZOPC-107	Lab Course -II	4	PRACTICAL	30 %	
	<b>Total credits</b>			<b>24</b>		
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	30 %	
	PSZOTC-202	Functional Anatomy of Animals	4	CORE	10 %	
	PSZOTC-203	Basic Endocrinology	4	CORE	15 %	
	PSZOTC-204	Biotechnology	2	CORE	25%	
	PSZOTC-205	Biodiversity, Conservation & Management	2	CORE	50% Newly introduced	
	PSZOPC-206	Lab Course -I	4	PRACTICAL	30%	
	PSZOPC-207	Lab Course -II	4	PRACTICAL	25%	
	<b>Total credits</b>			<b>24</b>		
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	10 %	
	PSZOTC-302	Fundamentals of Biochemistry	4	CORE	10%	
	PSZOTC-303	Biosystematics, Taxonomy & Evolution	4	CORE	10%	
	PSZOTO-304	*MOOC through SWAYAM portal	4	MOOC	New introduction	
	PSZOPC-305	Lab Course -I	4	PRACTICAL	30 %	
	PSZOPC-306	Lab Course -II	4	PRACTICAL	25 %	
	<b>Total credits</b>			<b>24</b>		
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	10 %	
	PSZOTC-402	Aquaculture	2	CORE	50 % (Newly introduced)	
	PSZOTC-403	Microbiology	2	CORE	30 %	
	<i>Any one of the following elective courses</i>					
	PSZOTE-404	Limnology	4	ELECTIVE	30%	
	PSZOTE-405	Fish & fisheries	4	ELECTIVE	30%	
	PSZOTE-406	Molecular Genetics & Cytogenetics	4	ELECTIVE	30%	
	PSZOTE-407	Entomology	4	ELECTIVE		
	PSZOTO-408	*Biological Anthropology	4	OPEN		
	PSZOPC-409	Lab Course -I	4	PRACTICAL	40 %	
	PSZOPC-410	Lab Course -II	4	PRACTICAL	25 %	
	<b>Total credits</b>			<b>24</b>		
PSZOPC-409 Based on Theory Course No.401, 402 & 403 PSZOPC-410 Based on Theory Course No.404/405/406/407						
<b>Total credits earned by the students</b>			<b>96</b>			

**\*For students of other Departments.**

**(Head of the Department)**

**DAC members**

- 1.
- 2.
- 3.
- 4.
- 5.

### **Programme specific outcomes**

#### **The Programme has been designed to enable the students to understand**

- ❖ vital aspects of biological processes like Comparative Animal physiology, Endocrinology, Microbiology, Environmental Biology, Evolution, Animal Biodiversity, Conservation etc.
- ❖ the application of biological sciences in other entrepreneurship skill enhancing fields viz., Apiculture, Fisheries, Aquaculture ,Aquarium Fish keeping, Vermiculture etc.

#### **Based on the knowledge acquired, students would get an opportunity**

- ❖ to find jobs as wildlife biologists, Zoo Curator, Wildlife educators, Fishery Managers, Sericulture officers, Forensic experts etc.
- ❖ to be inducted in both government and private higher and high education departments as teaching professionals.
- ❖ to set up new ventures as entrepreneurs in the fish/pond culture, aquarium keeping, formulation of value added edible animal products, setting of Apiary, setting of clinical diagnostic labs as technical expert.
- ❖ to qualify various competitive and research aptitude exams like NET/GATE/ IAS/IFS/KAS and in other allied fields.

# SEMESTER-I

**Students would develop an understanding with respect to:**

**PSO1:** the basic concepts and components of various ecosystems with respect to habitat, community structure, biodiversity and conservation strategies.

**PSO2:** the nature and structure of genetic material, basic genetic principles and processes involved.

**PSO3:** the fish taxonomy, morphology, physiology and adaptive strategies.

**PSO4:** the concepts of immunity and immunological processes.

**PSO5:** the morphology, ecology and physiology of insects.

**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, 2021; December, 2022 and December, 2023**

### **Course Outcomes**

#### **Students would develop an understanding with respect to:**

- ❖ CO1: the concept of basic theories and principles of ecology.
- ❖ CO2: critical understanding of the concepts like population dynamics, community structure and abundance, species interactions, energy flow, productivity, succession, biological invasions etc.
- ❖ CO3: critical understanding of the human influence on environment.
- ❖ CO4: the practical aspects based on research/field trainings.

#### **SYLLABUS**

#### **Unit- I (12 hrs.)**

- 1.1 Concept of eco-system : Ecological habitat, niche & Ecological equivalents
- 1.2 Hydrological cycle and its Impact on Environment & biota
- 1.3 Energy flow in an ecosystem
- 1.4 Mineral cycling: Carbon ,Nitrogen ,Phosphorus
- 1.5 Primary & Secondary productivity and their methods of determination.
- 1.6 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

**C. No. PSZOTC-101, Ecology & Environmental Biology (2021-23)**  
**(13 hrs.)**

**Unit – IV**

- 4.1 Sources and Uses of Non-conventional energy
- 4.2 Remote sensing: Definition, Importance and application
- 4.3 Bio-indicators
- 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 and Management
- 5.2 Natural resources
  - 5.2.1 Wild life and its management
  - 5.2.2 Aquatic resources: Freshwater , Marine and Estuarine
- 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 Cenagelearing.
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. Sharma, P.B. 2018. Ecology & Environment (13<sup>th</sup> edition) Rastogi-Publishers,
19. Molen, Manciell C. 2018. Ecology - Publishers- Mc-Grew Hill Year-1048.
20. Oswald J. Schmitz. 2018. The New Ecology: E-book 9781400883462
21. Gelfand, Alan, E, Fuentes, Montserrat, Hoeting, Jennifer, A, Smith, Richard Lyttleton. 2019. Handbook of Environmental and Ecological Statics. Publisher Chappman and Hall/CRC.
22. William D. Bowman and Sally D. Hacker. 2020. Ecology Publisher: Oxford University Press.

**List of Practicals**

**Course code: PSZOPC-106**

(Based on Theory course No. 101 &103)

- To determine minimum size of quadrat to be laid down for study of community.
- To determine minimum number of quadrat to be laid down for study of community.
- Texture of different types of soils.
- To estimate the temperature and moisture contents of the different soils samples at different profile. (Surface, 10 cm, 20 cm, 30 cm).
- To study physical characteristics of water (temperature, depth, velocity, pH, colour).
- To find out the amount of CO<sub>2</sub> in water sample.
- To find out the amount of DO from water sample.
- To find out the amount of Calcium in water sample.
- To find out the amount of CO<sub>3</sub> and HCO<sub>3</sub> in water sample.
- To find out the amount of Ca<sup>2+</sup> and Mg<sup>2+</sup> in water sample.
- To analyze water sample for amount of TDS.
- To analyze water sample for amount of TSS.
- To identify the local macrophytes.
- Estimation of Primary productivity.
- Estimation of SOM.
- Estimation of BOD.
- Identification of rocks and minerals on basis of physical characters.
- Determination of Mean, Mode and Median in different data (Individual, discrete and continuous data)
- Calculation of Standard deviation and Chi square test.
- Estimation of dissolved organic matter.

Course No. PSZOTC-102

Course Title: Fundamentals of Genetics

CREDITS: 4

MAXIMUM MARKS : 100

Time Duration: 2hrs and 30 mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in  
December, 2021; December, 2022 and December, 2023

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ CO1: basic concepts of chromosomes, their special forms and aberrations.
- ❖ CO2: structure of genetic material, basic hereditary principles ; mutations and DNA repair mechanism .
- ❖ CO3: fundamentals of DNA replication , protein synthesis and control of gene expression..

### 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 Telomere structure
  - 1.2.4 Centromere
  - 1.2.5 Kinetochores
- 1.3 Specialized chromosomes:
  - 1.3.1 Lampbrush chromosomes
  - 1.3.2 Polytene chromosomes
- 1.4 Mitochondrial Genome and Chloroplast Genome

#### Unit- II Numerical and structural chromosomal Variations in Human

(13 hrs.)

- 2.1 Numerical Changes and their genetic implications
  - 2.1.1 Polyploidy
  - 2.1.2 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 Historical Milestone
  - 3.1.2 DNA as genetic material
  - 3.1.3 Structure of DNA: nucleotides and various models
  - 3.1.4 Types of DNA
  - 3.1.5 Repetitive DNA

**C. No. PSZOTC-102, Fundamentals of Genetics (2021-23)**

- 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
- 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 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**

<b>Examination Theory</b>	<b>Syllabus to be covered in examination</b>	<b>Time allotted for Exam</b>	<b>% weightage (marks)</b>
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).



**C. No. PSZOTC-102, Fundamentals of Genetics (2021-23)**

**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, 8<sup>th</sup>edittion.
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 9<sup>th</sup> edition Pearson education ltd.
13. Lynn B. Jorde , John C. Carey MD MPH and Michael J. Bamshad M. D. Medical Genetics 2019. Publisher: Elsevier ISBN 978-0323597371.
14. D. Peter Snustad. 2019. Principles of Genetics, 7<sup>th</sup> Edition. Publisher: John Wiley.
15. Daniel and Bruce. 2019 Genetics analysis of Genes and Genomes. Publisher: Jones and Bartlett Learning, Llc.

**C. No. PSZOTC-102, Fundamentals of Genetics (2021-23)**

**List of Practicals**

**Course code: PSZOPC-107**

(Based on Theory Course No. 102, 104 & 105)

- To study different parts and working principle of bright field microscope.
- Study of general principles and BSL guidelines for working in molecular genetics lab.
- To study the general morphology of Chironomus larva.
- To prepare the temporary mount of salivary gland of Chironomus larva and study the polytene chromosome structure.
- To study the morphological differences between male and female grasshopper.
- To dissect out the male grasshopper to expose its testicular tubules so as to study the different stages of meiosis.
- To study the procedure of blood sample collection and storage from different individuals.
- To carry out the DNA extraction from the stored blood samples by using organic method.
- Qualitative and quantitative analysis of extracted DNA samples.
- To carry out the agarose gel electrophoresis of the provided DNA sample.

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, 2021; December, 2022 and December, 2023

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ CO1: the fish classification, structure and adaptations in relation to diverse habitat conditions in fishes.
- ❖ CO2: the basic concepts of feeding, reproductive & respiratory ecology in fishes
- ❖ CO3: parental care and adaptive capabilities to special environment in fishes etc.

### 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: Fresh water, Marine water and migratory 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 PushaplataDubey. Daya Publ. House, Delhi. (2006). Fish Management and Aquatic Environment.
5. Lagler, Bardock, Miller & Possino, John Wiley & Sons, N.Y., London: (2012). Ichthyology, 2<sup>nd</sup> 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.
10. R. Hamilton Publisher Forgotten books (2018) Ichthyology.
11. D. K. Mukherjee and J.V.S. Rauthan Publisher Medtec (2019) Ichthyology: An Introduction to Fish Science.

**List of Practicals**

**Course code: PSZOPC-106**

(Based on Theory course No. 101 &103)

- To study the general characters, classification and morphology of fishes.
- To study the body forms in fishes.
- To study the fin modifications with special reference to paired and unpaired fins.
- To study the modification of Lateral line in fishes.
- To study the skeleton system of Teleost fish.
- To study the Electric, Poisonous and Venomous organs in fishes.
- To study the classification and general characters of Dipnoi with examples.
- To study the structure of different types of gills, accessory respiratory organs and gill rakers in fishes.
- To study the modifications in Hill stream fishes.
- To study the different types of swim bladder in fishes.
- To study the structure of Weberianossicles in different fishes.
- To study the adaptations/modification in Deep sea and Cave dwelling fishes.
- To study the different types of scales in fishes.
- To study the different types of eggs in fishes.
- To study the reproductive organs and secondary sexual characters in fishes.

**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, 2021; December, 2022 and December, 2023.**

### **Course Outcomes**

**Students would develop an understanding with respect to:**

- ❖ **CO1:** the basic knowledge about immune system and its role in improving general health and immunity.
- ❖ **CO2:** critical concepts of immune system, immune cells and immunological techniques
- ❖ **CO3:** tumour immunology and transplantation immunology .

### **SYLLABUS**

#### **UNIT- I Introduction to immune system**

**(12 hrs.)**

- 1.1 Historical Background
- 1.2 Innate and adaptive immunity
- 1.3 Immune cells and organs of immune system
  - 1.3.1 Type of cells
  - 1.3.2 Role of Immune cells in immunity
  - 1.3.3 Primary, Secondary and Tertiary tissues and organs of immune system.
- 1.4 B-Lymphocyte and T-Lymphocyte
- 1.5 General Properties of Cytokines and Chemokines

#### **UNIT-II Humoral Immunity and Cell Mediated Immunity**

**(13 hrs.)**

- 2.1 Antigen, Antigenicity and Immunogenicity.
- 2.2 Antibody: Types, Structure, Function and generation of diversity.
- 2.2 Signal Transduction:
  - 2.2.1 B-Cells
- 2.3 Monoclonal antibodies
- 2.4 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 Tolerance, Autoimmunity and Transplantation
- 3.4 Hypersensitivities
- 3.5 Role of Immune system in Cancer
- 3.6 Immunological Techniques
  - 3.6.1 ELISA
  - 3.6.2 Immunoprecipitation, Immuno blotting,

**C. No. PSZOTC 104, Immunology (2021-23)**

**Note for Paper Setting**

<b>Examination Theory</b>	<b>Syllabus to be covered in examination</b>	<b>Time allotted for Exam</b>	<b>% weightage (marks)</b>
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,7<sup>th</sup> 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.
9. Alex Collins. (2019). Transplantation Immunology Publisher: Foster Academics.

**List of Practicals:**

**Course code: PSZOPC-107**  
(Based on Theory Course No. 102, 104 & 105)

- To study the different types of cells involved in immune system of human beings.
- To study the different types of immunoglobins.
- To perform the hemagglutination assay for ABO Blood group typing determination and Rh factor.
- To learn the techniques of immune electrophoresis.
- Amplification of Interleukin-28b gene Using Polymerase Chain Reaction assays.
- Electrophoresis of interleukin-28 gene PCR product.
- To determine the concentration of antigen by sandwich ELISA method.
- To determine Total Leukocytes Count (TLC) of the given sample.
- To determine Differential Leukocytes Count (DLC) of the given sample.
- To study the 3D structural organisation of various proteins by using bioinformatics tools.



Course No. PSZOTC-105

Course Title: An Introduction to Insect Diversity

CREDITS: 2

MAXIMUM MARKS : 50

Time Duration: 2hrs

a) Minor Test I : 10

b) Minor Test II : 10

c) Major Test : 30

Syllabus for the examination to be held in  
December, 2021; December, 2022 and December, 2023

### Course Outcomes

Students would develop an understanding with respect to:

- CO1:** the basic knowledge about the morphology, taxonomic diversity and physiology of insects.  
**CO2:** Critical understanding of the key concepts of insect ecology, biology and its relationship with various biotic and abiotic factors.  
**CO3:** practical and applied aspects of entomology.

### SYLLABUS

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

- 1.1 General characters, classification  
 1.2 Bionomics of insect orders  
     1.2.1 Subclass Apterygota, Thysanura, Collembola  
     1.2.2 Subclass Pterygota:  
         1.2.2.1 Exopterygota: Odonata, Orthoptera, Dictyoptera, Dermaptera, Hemiptera, Homoptera  
         1.2.2.2 Endopterygota: Lepidoptera, Diptera, Coleoptera, Hymenoptera

#### Unit- II Morphology of insects (10 hrs.)

- 2.1 Head  
     2.1.1 Structure  
     2.1.2 The mouth parts and their diversity  
     2.1.3 Types of Antennae in insects  
     2.1.4 Compound eye  
 2.2 Thorax  
     2.2.1 Structure  
     2.2.2 Leg modifications in insects  
     2.2.3 Wings and wing coupling mechanism  
 2.3 Abdomen and Reproductive structures  
 2.4 Chemoreceptor and Mechanoreceptor

#### Unit-III Insect Physiology and Specilized structures (10 hrs.)

- 3.1 Insect Integument: structure and function  
 3.2 Metamorphosis : its types and regulation  
 3.3 Diapause in insects  
 3.4 Stridulation in insects  
 3.5 Defence mechanism  
 3.6 Introduction to various physiological systems with special reference to digestive and nervous system of cockroach

**C. No. PSZOTC-105 , An Introduction to Insect Diversity (2021-23)**

**Note for Paper Setting**

<b>Examination Theory</b>	<b>Syllabus to be covered in examination</b>	<b>Time allotted for Exam</b>	<b>% weightage (marks)</b>
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.
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) 2<sup>nd</sup> Ed. The Insect; Structure and Function
7. Gullan and Cranston. (2014). 5<sup>th</sup> Edition. The Insects. Wiley Blackwell.
8. Rivers, Dand B.( 2017). Insects Jaico Publishing House
9. Lanham, (2018).The Insects. Gene Tech Books.
10. Robert G Foottit and Peter H. Adler (2018) . Insect Biodiversity: Science and Society.Wiley-Blackwell.
11. LaichattiwarMukeshAnandrao: (2020) Introduction to Insects and their diversity. Delve Publishing House.

**C. No. PSZOTC-105 , An Introduction to Insect Diversity (2021-23)**

**List of Practicals:**

**Course code: PSZOPC-107**

**(Based on Theory Course No. 102, 104 & 105)**

- To study, classify and comment upon the orders of subclass Apterygota: Thysonura and Collembola.
- To study, classify and comment upon the orders of subclass Exopterygota: Odonata, Orthoptera, Dictyoptera, Dermaptera and Homoptera.
- To study, classify and comment upon the orders of subclass Endoterygota: Lepidoptera, Diptera, Coleoptera and Hymenoptera.
- To study the diversity of mouth parts of various insects : Cockroaches, grasshoppers, mosquito, butterfly, bug, housefly, honeybee etc.
- To study various types of antennae in insects.
- To study the different types of leg modifications in insects.
- To study the different types of larva and pupae.
- To study the mechanism and groups showing metamorphosis.
- To dissect out and study the digestive system of grasshopper/Cockroach.

# SEMESTER-II

**Students would develop an understanding with respect to:**

- PSO-1:** the nature and basic concepts of cell biology and instrumentation .
- PSO-2:** a comparative account of structure & functioning of various organs and organ systems as developed during evolution.
- PSO-3:** the basic morphology, anatomy, histology, endocrines and their functioning.
- PSO-4:** the study of biotechnological techniques and their applications.
- PSO-5:** the concepts of biodiversity and their management.

<b>Course No. PSZOTC- 201</b>	<b>Course Title: Cell Biology &amp; Research Instrumentation</b>		
<b>CREDITS: 4</b>		<b>MAXIMUM MARKS</b>	<b>: 100</b>
<b>Time Duration: 2hrs and 30 mins.</b>		a) <b>Minor Test I</b>	<b>: 20</b>
		b) <b>Minor Test II</b>	<b>: 20</b>
		c) <b>Major Test</b>	<b>: 60</b>

Syllabus for the examination to be held in  
May 2022, May, 2023 and May, 2024

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO-1:** the structural and functional unit of life.
- ❖ **CO-2:** the basic concepts of cell biology: cell cycle, cell communication, cell signaling and cell death.
- ❖ **CO-3:** principles and working of various instruments for the study of cell architecture, cellular components and cell machinery.

### SYLLABUS

#### UNIT I Cell: Structure and function

##### 1.1 Eukaryotic and Prokaryotic cell structure and their differences

(13 hrs)

##### 1.2 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

##### 1.3 Transport across membranes

- 1.2.1 Active and Passive transport
- 1.2.2 Endocytosis and Exocytosis
- 1.2.3 Membrane transport proteins
- 1.2.4 Pinocytosis and Phagocytosis
- 1.2.5 Osmosis

##### 1.5 Cell Organelles

- 1.4.1 Golgi Apparatus
- 1.4.2 Mitochondria
- 1.4.3 Nucleus
- 1.4.4 Endoplasmic reticulum

##### 1.6 Extracellular Matrix

#### UNIT-II Cell Cycle, Cell Communication and Cell signaling

(12hrs)

##### 2.1 Regulation of Cell Cycle

##### 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

**C. No. PSZOTC 201, Cell Biology & Research Instrumentation (2022-24)**

**UNIT-III Cell death: Apoptosis**

(12hrs)

- 3.1 Cell death in mammals
  - 3.1.1 Role of caspases
  - 3.1.2 Bcl2 family proteins, IAP's
  - 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

**UNIT-IV Tools and Techniques -I**

(13hrs)

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

**UNIT-V Tools and techniques -II**

(13h)

- 11.1 Tools and methods
  - 11.1.1 Bright Field Microscopy, Dark Field Microscopy
  - 11.1.2 Electron microscopy: Transmission Electron microscopy and Scanning Electron microscopy
  - 11.1.3 Fluorescence Microscopy (Principle and Types)
  - 11.1.4 Polymerase Chain Reaction
- 5.2 DNA sequencing Techniques
  - 5.2.1 Sanger Sequencing
  - 5.2.2 Chemical Degradation method
  - 5.2.3 Introduction to NGS
- 5.3 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.

**C. No. PSZOTC 201, Cell Biology & Research Instrumentation (2022-24)**

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 Melacinki&Freifelder, John and Bartlett Publ. Boston. (1998.) Essentials of Molecular Biology.
14. MousamiDebnath, Shashi Jain Publ. Jaipur.( 2008 )Cell and Molecular Biology,
15. Thomas .D.Pollaed et.al.(2017).Cell biology.3<sup>rd</sup>edn.Elsiver.
16. Alberts, Bruce, Hopkins Karen and Johnson , Alexander D. (2019). Essential Cell Biology (Fifth Edition).

**C. No. PSZOTC 201, Cell Biology & Research Instrumentation (2022-24)**

**List of Practicals**

**Course code: PSZOPC-206**  
(Based on Theory Course No. 201&203)

- ❖ Handling and operation of following apparatus and equipments:
  - (a) Compound research microscope
  - (b) Electrophoretic Unit
  - (c) Thermocycler
  - (d) Stereo-microscope
- ❖ To study the process of mitosis from the onion root tip.
- ❖ Study of stained preparation of mitochondria and golgi bodies under the light microscope.
- ❖ Study of stained preparations of mitochondria and golgi bodies under the light microscope
- ❖ Isolation of DNA from Insect tissue.
- ❖ Quantification and qualification of DNA.
- ❖ Demonstration of polymerase chain reaction.
- ❖ Bioinformatic tools online for analyzing DNA sequences.
- ❖ Demonstration of automated biochemical analyzer.
- ❖ Electrophoresis of DNA.



Course No. PSZOTC-202  
 CREDITS: 4  
 Time Duration: 2hrs and 30 mins.

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 2022, May 2023 and May 2024

### Course Outcomes

Students would develop an understanding with respect to:

**CO1:** comparative functioning of the organ systems across the animal world.

**CO2:** the insights into developmental and physiological adaptations vs evolutionary strategies.

**CO3:** coordination of various biological systems within diverse animal groups.

### SYLLABUS

#### UNIT I Movement and Locomotion

(13hrs)

- 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

(13hrs)

- 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

(12hrs)

- 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

(12hrs)

- 4.1 Primitive nervous system

**C.No. PSZOTC-202, Functional Anatomy of Animals (2022-24)**

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

**UNIT V Development and Adaptation**

- 5.1 Larval forms and their functioning in: **(12hrs)**
  - 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.RuthLawson(2011). Platypus Global Media, Anatomy and physiology of Animals .
8. Saurav Singh (2013) A Textbook of Comparative Anatomy of Vertebrates. Centrum Press-e-book.
9. Gerard J. Tortora and Bryan H Derrickson (2014).Priciples of Anatomy anfd Physiology, 15<sup>th</sup> Edition Wiley online library.
10. RK Saxana, SumitraSaxena(2015). Viva Books Pvt Ltd .Comparitve Anatomy of vertebrates.
11. Piper Treuting et.al, (2017).C omparative anatomy and histology .2<sup>nd</sup>edn Elsevier.
12. Kino Kenneth and V. Kardong (2018) Vertebrates: Comparative Anatomy, Function, Evolution. McGraw-Hill, Higher Education.
13. George Kent and Bob Carr (2019). Comparative Anatomy of Vertebrates 9<sup>th</sup> Edition.

**C.No. PSZOTC-202, Functional Anatomy of Animals (2022-24)**

**List of Practicals**

**Course code: PSZOPC-207**

(Based on Theory Course No. 202, 204 & 205)

- To study skull of frog, rabbit, Varanus, fowl.
- To study vertebrae of frog, rabbit, Varanus, fowl.
- To study ribs, of varanus, fowl, rabbit.
- To study pectoral girdle of frog, varanus, fowl, rabbit.
- To study pelvic girdle of frog, varanus, fowl, rabbit.
- To study fore-limbs of frog, varanus, fowl, rabbit.
- To study hind-limbs of frog, varanus, fowl, rabbit.
- To study nervous system (Coelenterates, Echinodermata, Arthropoda, Mollusca)
- To study larval forms (Crustacea, Echinodermata)
- To study Circulatory system through model.
- To study Respiratory system through model.
- To study Appendages of Prawn.
- To study Filter feeding apparatus of Cladoceran zooplankton
- To study feeding in fluid feeders (Leech).
- To study osmoregulation in Earthworm.
- To study different types of liquid feeding adaptations in insects.
- To study filter feeding adaptations in Polychaetes( Chaetopterus).

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, 2022, May, 2023 and May, 2024

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO-1:** the comparative morphology and physiology of neuro-endocrine systems in invertebrates and vertebrates.
- ❖ **CO-2:** the basic information about the endocrine glands & their secretions.
- ❖ **CO-3:** the working principles of hormones and their related deficiency diseases.

### SYLLABUS

#### Unit I Invertebrate Neuro Endocrinology

- 1.1 Neural versus hormonal coordination (12hrs)
- 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 cardiaca, Corpora allata and Prothoracic gland
- 1.3.2 Neuroendocrine control of growth reproduction and metabolism

#### Unit II Vertebrate Endocrinology -I (13hrs)

- 2.1 Hypothalamo-hypophysial System
- 2.1.1 General organization of Hypothalamus: Localization, chemistry and action of hypophysiotropic hormones.
- 2.1.2 Pituitary gland
- 2.1.2.1 Localization, Chemistry and physiological roles of Adenohypophysial hormones and Neurohypophysial hormones.
- 2.1.2.2 Neural and vascular supply of hypophysis
- 2.1.2.3 Pathophysiology of Pituitary hormones
- 2.2 Thyroid Gland: Morphology, anatomy and histology of the gland
- 2.2.1 Biosynthesis of Thyroid hormones
- 2.2.2 Physiologic roles
- 2.2.3 Pathophysiology of Thyroid hormones
- 2.3 Parathyroid Gland: Morphology, anatomy and histology of the gland
- 2.3.1 Role of Calcitonin, PTH and Vit. D in calcium homeostasis.

#### UNIT III Vertebrate Endocrinology -II (12hrs)

- 3.1 Adrenal Gland: Comparative Morphology, anatomy, functions and chemical structure of hormones released
- 3.1.1 Morphology and Histology of the Adrenal cortex
- 3.1.2 Biosynthesis and role of corticosteroids
- 3.1.3 Biosynthesis and role of Adrenal medullary hormones (Catecholamine)
- 3.1.4 Renin angiotensin system
- 3.1.5 Pathophysiology of adrenal hormones

### C. No. PSZOTC-203, Basic Endocrinology (2022-24)

- 3.2 Pancreatic Islets: Structure, Role and Regulation of Insulin and Glucagon
- 3.2.1 Pathophysiology of Pancreatic hormones
- 3.3 Gastro-intestinal hormones : types and functions

#### Unit IV Putative endocrine glands and pheromones

(13hrs)

- 4.1 Structure and function of pineal gland
  - 4.1.1 Biosynthesis of Melatonin
- 4.2 Structure and function of Thymus gland
- 4.3 Structure and function of Urophysis
- 4.4 Structure and function of Corpuscle of stannius
- 4.5 Pheromones: Types, Structure and Function

#### Unit V Hormonal action and assaying techniques

- 5.1 Formation, Release& transport of hormones
- 5.2 Homeostasis : Temperature ,calcium,water
- 5.3 Feedback mechanism
- 5.4 Mechanism of hormone action
- 5.5 Hormone Assays Techniques
  - 5.5.1 Ablation
  - 5.5.2 Bio-assays
  - 5.5.3 Radio-immuno Assays.

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. MemledShlomo and Polonsky Kenneth (2016).13<sup>th</sup>ed Text book of Endocrinology, Elsevier.
11. MemledShlomo, Koeing Ronald and Rosen Clifford, (2019) 14<sup>th</sup> ed. Williams Text book of Endocrinology, Elsevier.

**C. No. PSZOTC-203, Basic Endocrinology (2022-24)**

**List of Practicals**

**Course code: PSZOPC-206**  
(Based on Theory Course No. 201&203)

- **To study the Endocrine glands of Frog/Rabbit/Fish/Mammals through histological slides:**
  - I.Pituitary gland
  - II.Adrenal gland
  - III.Thymus gland
  - IV.Thyroid gland
  - V.Parathyroid gland
  - VI.Testis
  - VII.Ovary
  - VIII.Pancreas
  - IX.Pineal gland
  - X.Urophysis of Fish
  - XI.Corporcle of Stannius
  
- **Neroendocrine system of Prawn**
- **Neuroendocrine system of insects**
- **Ultrastructure of Neurosecretory cells**

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, 2022, May, 2023 and May, 2024

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO-1:** the basics and applied aspects of biotechnology and animal tissue culture.
- ❖ **CO-2:** the advanced biotechnological practices and approaches.
- ❖ **CO-3:** technology application in medical, industrial, environmental and agricultural areas.

### SYLLABUS

#### UNIT I Basics of Biotechnology

(10hrs)

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

#### UNIT II Animal cell and tissue culture

(10hrs)

- 2.1 Laboratory facilities for Animal Tissue culture
  - 2.1.1 Tissue culture; Slides, Flasks, Test tube 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 Organ culture
  - 2.3.2 Whole embryo culture
- 2.4 Somatic cell Hybridization
- 2.5 Tissue engineering: Artificial skin and artificial cartilage.

#### UNIT III Applied Biotechnology

(10hrs)

- 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

### C. No. PSZOTC-204, Biotechnology (2022-24)

- 3.2.1 Sewage treatment
- 3.2.2 Biosensors
- 3.3 Medical Biotechnology
  - 3.3.1 Molecular approaches to diagnosis
  - 3.3.2 Gene Therapy
  - 3.3.3 Transgenic Animals
- 3.4 Biophysical methods
  - 3.4.1 X-Ray crystallography
  - 3.4.2 NMR
- 3.5 Bio-Informatics

#### 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 ,2<sup>nd</sup> 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. WulfCrueger and AnnelieseCrueger. 2005. B
6. Jay, J.M. (2008) Modern Food Microbiology (Sixth Edition).Aspen Publishers, Inc, Gaithersburg, Maryland.
7. Ananthanaryan&Paniker's. (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 .2<sup>nd</sup> edition
12. Birbal Singh, Gorakh Mal, Sanjeev K. Gautam, ManishiMukesh (2019) Advances in Animal Biotechnology Springer.
13. Gyun Min Lee, Helene FastrupKildegaard, Sang Yup Lee, Jens Nielsen (2019) Cell Culture Engineering Publisher: Wiley-VCH.



**C. No. PSZOTC-204,Biotechnology (2022-24)**

**List of Practicals**

**Course code: PSZOPC-207**

(Based on Theory Course No. 202, 204 &205)

- ❖ To carry out the DNA Isolation of DNA from blood sample.
- ❖ To study the various Cloning vectors –their properties and functions through diagrams.
- ❖ To study Transgenic animals through photographs.
- ❖ To carry out Purity determination and quantitation of DNA.
- ❖ Electrophoresis of DNA - linear, circular and super coiled
- ❖ Southern blotting.
- ❖ Western-blotting
- ❖ To carry out RFLP analysis.
- ❖ Northern blotting.
- ❖ Isolation of Plasmids.
- ❖ Demonstration of ELISA
- ❖ Study various bioinformatics tools online
- ❖ Immunodiagnosics (demonstration using commercial kits)
- ❖ Bioinformatics –tools on line

Course No. PSZOTC-205  
 CREDITS: 2  
 Time Duration: 2hrs

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, 2022; May, 2023 and May, 2024

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO1:** the basic concepts of biodiversity and its use for human welfare.
- ❖ **CO2:** critical understanding of Indian biodiversity and its zoogeographical distribution.
- ❖ **CO3:** threats to biodiversity and conversational scope and strategies.

### SYLLABUS

**Unit-I Biodiversity-Concepts, definition, Scope and Constraints (10hrs)**  
 1.1 Composition and levels of Biodiversity (Genetic diversity, Species diversity, Ecosystem Diversity)  
 1.2 Patterns and scales of Biodiversity ( $\alpha$ ,  $\beta$ ,  $\gamma$ )  
 1.3 Introduction to mega global biodiversity sites: an over view  
 1.4 Direct and indirect use of Biodiversity

**Unit-II Indian Biodiversity: Vegetational Zones, zones of Faunal distribution (10hrs)**  
 2.1 Geographical distribution of biodiversity  
 2.2 Hot spots of biodiversity  
 2.3 Protected network areas  
     2.3.1 National Parks  
 2.3.2 Wildlife sanctuaries  
 2.3.3 Wet lands  
     2.3.4 Bioreserves  
 2.4 Vertebrate diversity of India with special reference to Endangered, Endemic and Invasive species of India

**Unit-III Threats and conservation of Biodiversity (10hrs)**

- 3.1 Anthropogenic pressure on biodiversity of major land and Aquatic Systems
- 3.2 IUCN Threatened Categories
- 3.3 National wildlife Act, Red Data Book and its significance
- 3.4 Strategies for Biodiversity Conservation
  - 3.4.1 In-situ
  - 3.4.2 Ex -situ

#### 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.

**C.No. PSZOTC-205, Biodiversity, Conservation & Management (2022-24)**

**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. andSwanmack, T.M.( 2008). Ecological Modeling. Blackwell Publ. House.
8. S.K. Singh.( 2009). Textbook of Wildlife Management. 2<sup>nd</sup> 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. PellensRoseli and Grand colas (2016) Biodiversity conservation and Phylogenetic Systematics. Springer publication.
12. Annual Report (2019) Implementation of India's National Biodiversity Action Plan: An Overview: E-content.
13. Dar, Ghulam and Hassan Khuroo (2020) Biodiversity of the Himalaya: Jammu and Kashmir State Springer: e-Book

**C.No. PSZOTC-205, Biodiversity, Conservation & Management (2022-24)**

**List of Practicals**

**Course code: PSZOPC-207**  
(Based on Theory Course No. 203,204 &205)

- To survey the National Parks in India.
- To study the Biosphere Reserves in India.
- To study the protected area network and its significance with respect to Jammu division of J&K.
- To study the protected area network and its significance with respect to Kashmir division of J&K.
- To study and calculate the diversity indices from the given biological data set.
- To study the community by quadrant method on basis of frequency and density.
- To study the Zoo-diversity of J & K in context to their IUCN status:
  - I. Reptiles
  - II. Birds
  - III. Mammals
- To study the Plankton diversity of different Aquatic ecosystems.
- Fish diversity of different lentic and lotic water bodies of Jammu region.
- Field visits will be integral part of the Practical. Visits to nearby Zoo, Museum, Sea-shore, Nursery aquaria or any other relevant site must be arranged. The report of these visits will be submitted as part of the Practical work.

# **SEMESTER-III**

**Students would develop an understanding with respect to:**

**PSO-1:**the basic and advanced concepts of animal physiology in mammals.

**PSO-2:**the structure, function and metabolic pathways of various bio-molecules.

**PSO-3:**evolutionary trends of diverse taxa along the geological time scale.

**PSO-4:**various skill based and entrepreneurship oriented practices such as insect management ,poultry / dairy breeds, aquaculture etc for human welfare.

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 2022, December, 2023 and December, 2024

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO-1:** basic concepts of physiology viz : digestion, respiration, excretion, cardiovascular, excretory, nervous and muscular systems.
- ❖ **CO-2:** gastrointestinal disorders, respiratory stresses vs environment.
- ❖ **CO-3:** the mechanisms that work to keep the human body alive and functioning.

### SYLLABUS

#### Unit-I Animal Nutrition

- 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 Gastro-intestinal tract (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 Respiration

- 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 Excretion and Neurophysiology**

- 4.1 Excretory physiology (in mammals)
  - 4.1.1. Detailed structure of nephron
  - 4.1.2. Glomerular functions
  - 4.1.3. Tubular functions
  - 4.1.4. The rennin angiotensins
  - 4.1.5. Aldosterone system
- 4.2 Neurophysiology
  - 4.2.1 Nerve cell organization
  - 4.2.2 Nerve impulse origin and propagation, ion channels
  - 4.2.3 Synapsis and transmitters
- 4.3 Neuro anatomy of brain and spinal cord

**UNIT V Muscle Physiology**

- 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 PremaSembulingam.(2016).Essentials of Medical Physiology, 7<sup>th</sup> edition.
8. Linda S. Costanzo (2018) Physiology 7<sup>th</sup> Edition Publisher: Wolters Kluwer
9. S. C Rastogi (2019) Essentials of Animal Physiology. Publisher: New Age Internationals.

**List of Practicals**

**Course code: PSZOPC-305**  
(Based on Theory Course No. 301)

- Enumerate the total RBC count of your own blood.
- Enumerate the total WBC count of your own blood.
- Estimation of Haematocrit value in a blood sample.
- Examination of Human blood groups.
- Determination of Rh+ and Rh- blood groups.
- To determine the bleeding and clotting time of blood.
- Find out the Hemoglobin %age of your own blood.
- Preparation of Haemin crystal.
- To demonstrate action of salivary enzyme amylase.
- To demonstrate action of pepsin on Proteins
- To demonstrate action of Trypsin on protein.
- Emulsification of fats.
- To prepare blood smear and study the polymorph by Arneth's count of polymorph.
- To study the structure of haemocytometer.
- To determine Blood pressure of men.
- To demonstrate coagulation in blood.



**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, 2022, December 2023 and December 2024.**

### **Course Outcomes**

**Students would develop an understanding with respect to:**

- ❖ **CO-1:** structure, types and classification of proteins, carbohydrates and fats.
- ❖ **CO-2:** enzymes and mechanism of enzyme action .
- ❖ **CO-3:** metabolic pathways of various bio-molecules and their functional significance.

### **SYLLABUS**

#### **UNIT I - Proteins : Structure, Function & Metabolism (13hrs)**

- 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 Quartary.
    - 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 (13hrs)**

- 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 Feedback inhibition: Allosteric site – a concept, Allosteric inhibition

#### **UNIT III- Carbohydrates : Structure and Function (12hrs)**

- 3.1 General features and classification.
  - 3.1.1 General features

**C. No. PSZOTC-302, Fundamentals of Bio-chemistry (2022-24)**

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

**UNIT IV- Lipids : Structure & Function (12hrs)**

- 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 (13hrs)**

- 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. Gumpert, Frank, H. Deis, Nancy Counts Gerber & Rager. W.H. Freeman Co. N.Y. (2002). Biochemistry 5<sup>th</sup> Ed.
- 3. Horton Moran, Scrimgeour Perry Rawn. (2006). Principles of Biochemistry : Pearson International Fourth Edition.

**C. No. PSZOTC-302, Fundamentals of Bio-chemistry (2022-24)**

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, 7<sup>th</sup> Edition
9. John, L. Tymoczko, Jeremy M, Berg & Lubert Stryer (2013). Biochemistry, 2<sup>nd</sup> Ed.
10. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. (2013). Biochemistry 7<sup>th</sup> Edition.
11. Jeremy M. Berg, John L. Tymoczko, Gatto J. Gregory and Lubert Stryer (2019) Biochemistry 8<sup>th</sup> Edition.
12. Manjeshwar R. Prasad (2019) Textbook of Biochemistry 5<sup>th</sup> Edition.

## **List of Practicals**

**Course code: PSZOPC-306**

(Based on Theory Course No. 302 & 303)

- Qualitative Analysis of Carbohydrates
- Monosaccharides (glucose and fructose)
- Disaccharides
- Quantification of the amount of carbohydrates content provided in sample using Anthrone reagent.
- Analysis of protein
- Colour reactions of protein
- Precipitation of protein by alkaloid reagent.
- Quantification of the amount of proteins in the provided sample by Lowry et al method.
- Quantification of the amount of lipids in the provided sample using Folch et al. 1975 method.
- Test on fats and oils
- Estimation of the amount of moisture content in the provided sample.
- Quantification of the ash content in the provided sample.
- Test on Enzymes.
- To carry out the biochemical estimation of following from the tissue
  - Carbohydrates
  - Lipids
  - Proteins
- Determination of blood glucose and haemoglobin.
- To determine the presence of antibodies in a given sample by using the technique ELISA.

Course No. PSZOTC -303

Course Title: Biosystematics, Taxonomy & Evolution

CREDITS: 4

MAXIMUM MARKS : 100

Time Duration: 2Hrs and 30 Mins.

a) Minor Test I : 20

b) Minor Test II : 20

c) Major Test : 60

Syllabus for the examination to be held in  
December, 2022, December, 2023 and December, 2024.

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO1:** the importance and application of biosystematics.
- ❖ **CO2:** evolution with reference to various theories of organic evolution.
- ❖ **CO3:** the major events in evolutionary time scale.
- ❖ **CO4:** concepts, origin and mode of speciation.
- ❖ **CO5:** evolution of man in lieu of evidences favoring biological evolution.

### 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 Species
  - 1.3.2 Sub & super species
  - 1.3.3 Sibling species and identical forms

#### Unit-II

- 2.1 New trends in Taxonomy: Chemotaxonomy, cytotaxonomy and molecular taxonomy
- 2.2 Taxonomic collections, preservation, curating
- 2.3 Taxonomic keys: Types, 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 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

### C. No. PSZOTC 303, Biosystematics, Taxonomy & Evolution (2022-24)

#### 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 Allopatry and sympatry
- 4.5 Adaptive radiations
- 4.6 Isolating mechanisms

#### 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 and missing 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. PellensRoseli and Grand Colas (2016) Biodiversity conservation and phylogenetic systematics. Spinger publication.

**C.No. PSZOTC 303, Biosystematics, Taxonomy & Evolution (2022-24)**

**List of Practicals**

**Course code: PSZOPC-306**  
(Based on Theory Course No. 302 & 303)

- To study the general characters and classification of Phylum Porifera.
- To study the general characters and classification of Phylum Coelentrata.
- To study the general characters and classification of Phylum Annelida.
- To study the general characters and classification of Phylum Plathyhelminthes.
- To study the general characters and classification of Phylum Aschelminthes.
- To study the general characters and classification of Phylum Mollusca.
- To study the general characters and classification of Phylum Echinodermata.
- To study the various evidences of Evolution.
- To study the examples of Discontinuation distribution of animals.

**Course No. PSZOTO-304**  
**CREDITS: 04**

**Course Title: MOOC through SWAYAM**

**Course Description:** One 04 credit MOOC (Massive Open Online Course) selected from SWAYAM (Study Webs of Active-Learning For Young Aspiring Minds) UGC (University Grant Commission) portal. SWAYAM is a programme initiated by Government of India to achieve the three cardinal principles of Education policy viz, access, equity and quality.

**Course Objectives:**

- To provide the students high quality learning experience using multimedia on anytime, anywhere basis.
- To acquaint the students with online mode of learning using ICT platform.
- To diverse the knowledge of students through open learning and help them to access different disciplines online and thus promoting interdisciplinary knowledge.
- To provide the students a hybrid model of learning that adds to the quality of classroom teaching.

**Course Selection Guidelines for Students:**

- The students are required to enroll and qualify any one of the MOOC course from SWAYAM (UGC) portal that should of 04 credits.
- The course can be selected from the SWAYAM platform depending upon the availability of courses as notified by UGC generally on predefined dates, 1<sup>st</sup> June or 1<sup>st</sup> November respectively, every year.
- The students are required to enroll for the SWAYAM course immediately after the commencement of 1<sup>st</sup> Semester as per notified dates by UGC for SWAYAM courses.
- The course should be completed before the completion of 3<sup>rd</sup> Semester of M.Sc.
- Student ideally should not select self-paced MOOCs, and the courses selected must be different from one offered in the course curriculum of semesters in order to duplication.
- The student must fill an undertaking form, as given in the brochure, and submit the same after duly filled form to their respective Departments/ Colleges for future reviews and record purposes.
- SWAYAM Examination fees (if any), or any other fee prescribed, shall be borne by the students only.

**Course Content:**

To be provided by the Course Coordinator of SWAYAM Course through online mode.

**Examination:**

**To be conducted by the host Institution offering SWAYAM course selected by the student. The students are required to submit the qualifying mark sheet/certificate to the office of the Department of Zoology.**



# SEMESTER - IV

**Students would develop an understanding with respect to**

**PSO1:** advances in reproductive behavior and developmental processes in vertebrates.

**PSO2:** crucial aspects involved in modern aquaculture practices.

**PSO3:** basic and applied aspects of microbiology in medicines, industries and agriculture.

**PSO4:** critical aspects of limnology with emphasis on bio resource management.

**PSO5:** basic concepts, utility and management strategies in fish and fisheries.

**PSO6:** principles of inheritance and advances in cyto genetics and molecular biology.

**PSO7:** the key concepts of insect behavior, ecology, their interactions and role in agriculture.

**PSO8:** biological anthropology and its use for human welfare.

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, 2023, May, 2024 and May, 2025.

### Course Outcomes

Students would develop an understanding with respect to:

- ❖ **CO-1:** the gonads and their role in reproductive process.
- ❖ **CO-2:** the factors and breeding behavior in non mammalians and mammalians.
- ❖ **CO-3:** the mechanism, patterns and processes involved in cleavage, blastulation and gastrulation.
- ❖ **CO-4:** the key concepts of neural tube formation, organ formation in birds and mammals, metamorphosis in amphibians.

### SYLLABUS

#### UNIT I (12hrs)

- 1.1 Histomorphology of mammalian Gonads
  - 1.2.1 Gonadotropin: types and functions
  - 1.2.2 Sex steroids : structure, Biosynthesis & Role in Reproductions
- 1.3 Corpora lutea, their structure and function
- 1.4 Atresia: formation and significance

#### UNIT-II Gametogenesis and Fertilization (13hrs)

- 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 (12hrs)

- 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

## C. No. PSZOTC-401, Reproductive & Developmental Biology (2023-25)

### UNIT-IV

- 4.1 Cleavage and blastulation (13hrs)
  - 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
  - 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 (12hrs)
  - 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 (6<sup>th</sup> Ed.) NCBI Bookself
10. Bruce, M. Carlson (2013): Human Embryology and Developmental Biology.
11. Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias 5<sup>th</sup> Ed. (2015) Principles of Development Oxford University Press
12. Michael J F Barresi and Scott F, Gilbert 12<sup>th</sup> Ed. (2019) Developmental Biology: Oxford University Press.

**C. No. PSZOTC-401, Reproductive & Developmental Biology (2023-25)**

**List of Practicals**

**Course code: PSZOPC-409**  
(Based on Theory Course No. 401, 402 & 403)

- ❖ Comparative Anatomy of Vertebrate Gonads and their ducts.
- I. Fish
- II. Frog
- III. Reptile
- IV. Mammal
- ❖ To prepare the chick development stages upto 120 hrs
- ❖ To study different pattern of cleavage.
- ❖ To study different types of blastula (sea urchin, chick and mammal).
- ❖ To study the different stages of Frog embryo :Morula, Blastula and Gastrula.
- ❖ To study gastrulation of in case of chick development stages.
- ❖ To study the L.S. of Frog tadpole through prepared slide.
- ❖ To study the Corpus luteum and corpus atreticum through prepared slides.
- ❖ Detailed study of graffian follicles.

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, 2023, May, 2024 and May, 2025.

### Course Outcomes

Students would develop an understanding with respect to

- ❖ **CO1:** various forms and practices of aquaculture.
- ❖ **CO2:** aquaculture practices with special emphasis on culture of aquatic organisms
- ❖ **CO3:** preparation and management of different types of ponds for carp culture.
- CO4:** types of fish feed, their composition and formulation techniques.

### SYLLABUS

#### Unit-I Basics of Aquaculture (10hrs)

- 1.1 Definition, History, Importance and status of aquaculture
- 1.2 Kinds of Aquaculture: Pen water, Semiclosed, Closed
- 1.3 Aquaculture practices: Traditional aquaculture, Extensive, semi extensive and Intensive.
- 1.4 Criteria of selection of site for fish farm
- 1.5 Types of ponds their preparation and management
  - 1.5.1 Liming & fertilization
  - 1.5.2 Control of aqua insects, algae and weeds.
  - 1.5.3 Water quality management

#### Unit-II Fish feeding technology (12hrs)

- 2.1 Nutritional requirement of fish viz. protein, lipids, vitamins & minerals
- 2.2 Formulation & preparation of supplementary / artificial feed
  - 2.2.1 Feed ingredients additives
  - 2.2.2 Types of feed
  - 2.2.3 Feed preparation technology
- 2.3 Eco-biology of Indian Major carps (IMC), Seed production in laboratory
- 2.4 Feeding distribution Techniques (manual & mechanical)
- 2.5 Feed storage and factors affecting it

#### Unit-III Culture techniques (10hrs)

- 3.1 Biological criteria of selection of cultivable fish species .
- 3.2 Culture of Fresh water prawn and its life cycle.
- 3.3 Trout Culture
- 3.4 Cat fish culture in Cages.
- 3.5 Culture of sea weed and its importance
- 3.6 Pearl culture

**C. No. PSZOTC-402, Aquaculture (2023-25)**

**Note for Paper Setting**

<b>Examination Theory</b>	<b>Syllabus to be covered in examination</b>	<b>Time allotted for Exam</b>	<b>% weightage (marks)</b>
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 2<sup>nd</sup> edition (2013), ICAR New Delhi.
11. R.R. Sticking, (2017), Aquaculture introductory (3<sup>rd</sup> edition), CAB International U.K.
12. Jesse Trushenski (2019) Understanding Aquaculture: 5m Publishing House.

**C. No. PSZOTC-402, Aquaculture (2023-25)**

**List of Practicals**

**Course code: PSZOPC-409**

(Based on Theory Course No. 401, 402 & 403)

- ❖ To study the eco-biology of Indian major Carps-Catla, Mrigal and Rohu.
- ❖ To study the eco-biology of exotic carps-Silver carp, Grass carp, Common carp.
- ❖ To study the layout plan of major fin fish culture farm.
- ❖ To study the structure of cages/rafts/tray culture etc.
- ❖ To prepare fish meal using Pearson's square method.
- ❖ To study the different types of seaweed and their culture techniques.
- ❖ To study the life cycle of Prawn.
- ❖ To study the life cycle of Trout.
- ❖ To study the catfish culture.

**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**

**Syllabus for the examination to be held in**  
**May, 2023, May, 2024 and May, 2025.**

### **Course Outcomes**

**Students would develop an understanding with respect to**

- ❖ **CO1:** microorganisms and their application in health, industries and agriculture.
- ❖ **CO2:** transmission mechanism and clinical presentations of common diseases.
- ❖ **CO3:** agriculture / soil microbiology and bio remediation .

### **SYLLABUS**

#### **UNIT I Medical Microbiology**

**(10hrs)**

- 1.1 Classification
- 1.2 Causative Agents, Etiology, Pathogenesis and Prophylaxis of Air borne diseases.
  - 1.1.1 Tuberculosis
  - 1.1.2 Pneumonia
  - 1.1.3 Diptheria
- 1.3 Food/ water/ Soil borne diseases
  - 1.2.1 Typhoid fever
  - 1.2.2 Cholera
  - 1.2.3 Tetanus
- 1.4 Viral diseases
  - 1.3.1 Hepatitis
  - 1.3.2 H1N1 infection
  - 1.3.3 Rabies
  - 1.3.4 Japanese Encephalitis
  - 1.3.5 HIV AIDS

#### **UNIT-II Industrial Microbiology**

**(10hrs)**

- 2.1 Microbial Fermentation
- 2.2 Products of microbial fermentation
  - 2.2.1 Milk products – cheese, yogurt
  - 2.2.2 Beverages – wine and beer
- 2.3 Other microbial products
  - 2.3.1 Antibiotics
  - 2.3.2 Organic acids
  - 2.3.3 Enzymes
  - 2.3.4 Probiotics
  - 2.3.5 Microbiome



**Unit-III Agricultural Microbiology**

- 3.1 Agricultural microbiology: Introduction
- 3.2 Soil microbiology – Microbes in soil – 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. WulfCrueger and AnnelieseCrueger. (2005). *Biotechnology: A text book of Industrial Microbiology 2<sup>nd</sup> 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 & Paniker's. (2009). *Textbook of Microbiology*. Univ. Press Pvt. Ltd. Himayatnagar, Hyderabad.
13. Gerard, J. Tortora, Berdell R. Funke & Christine L. Case. (2011). *Microbiology: An Introduction 9<sup>th</sup> Ed*, Pearson Education.
14. Pedro Escoll (2017). *Bacterial evasion of the host immune system*. Caister Academic Press.
15. Luke Moore (2019) *Infectious diseases, Microbiology and Virology*: Cambridge University Press.

**C. No. PSZOTC-403, Microbiology (2023-25)**

**List of Practicals**

**Course code: PSZOPC-409**

(Based on Theory Course No. 401, 402 & 403)

- ❖ To study the various bio-safety levels to be used in laboratory.
- ❖ To study the working principle of autoclave.
- ❖ To study the working principle of laminar air flow.
- ❖ To carry out gram staining of bacteria present in given material (Curd).
- ❖ To study gram staining of bacteria from human throat.
- ❖ To isolate and study bacteria from given sample of soil using serial dilution, pour plate and spread plate method.
- ❖ To study different techniques of streaking.

**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, 2023, May, 2024 and May, 2025.**

### **Course Outcomes**

**Students would develop an understanding with respect to**

- ❖ **CO1:** limnological aspects of inland freshwater resources.
- ❖ **CO2:** relation of inland water resources with the terrestrial ecosystem.
- ❖ **CO3:** biological diversity of lentic and lotic water bodies.
- ❖ **CO4:** conservation, management and rehabilitation aspects of wetlands.

### **SYLLABUS**

#### **UNIT -I**

- 1.1 Limnology (12hrs)**
- 1.1.1 History and scope
  - 1.1.2 Limnology in India
- 1.2 Water bodies (Lentic and lotic): 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**

- (13hrs)**
- 2.1 Estuaries:**
- 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**

- (12hrs)**
- 3.1 Plankton: Definition & Classification**
- 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 features of Freshwater system (13hrs)
- 4.1.1 Light
- 4.1.2 Turbidity
- 4.1.3 Currents
- 4.2 Chemical features:
- 4.2.1 PH
- 4.2.2 DO
- 4.2.3 FCO<sub>2</sub>
- 4.3 Bottom: Composition, sources and diversity
- 4.4 Thermal stratification

**UNIT-V**

(12hrs)

- 5.1 Wetland
- 5.1.1 Introduction & Characteristics
- 5.1.2 Management techniques
- 5.2 Translocations
- 5.3 Acidification
- 5.4 Dwindling Freshwater Resources: 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. McGraw 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 3<sup>rd</sup> Ed.
12. Wetzel, R.G. (2001). Limnology (3<sup>rd</sup> 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 (4<sup>th</sup> 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
23. Jocelyne Hughes (2019) Freshwater Ecology and Conservation: Oxford University Press

**List of Practicals**

**Course code: PSZOPC-410**

(Based on Theory Course No. 404, 405, 406 & 407)

- To compare the physical characteristics of water from different water bodies.
- To compare the physical characteristics of soil.
- Measurement of common pollutants like oil, grease and fluorides.
- Qualitatively analyze the water samples for phytoplankton.
- Quantitatively analyze the water samples for phytoplankton.
- Qualitatively analyze the water samples for Zooplankton.
- Quantitatively analyze the water samples for Zooplankton.
- Collection of macrobenthic fauna.
- Quantitative and qualitative analysis of benthic macroinvertebrates.
- Local fish identification based on morphometric characteristics.
- Comparative estimation of amount of FCO<sub>2</sub> in water samples.
- Comparative estimation of amount of DO in water samples.
- Comparative estimation of Carbonate and bicarbonate.
- Comparative estimation of Ca<sup>++</sup> and Mg<sup>+1</sup>.
- Estimation of sulphate in water sample.
- Estimation of Phosphorus in water sample.
- Estimation of Silica in water sample.
- Estimation of Nitrates in water sample.
- Sediment analysis (Na, K, Ca, Mg, Phosphorus, Nitrate)
- Study of Macrophytes.
- Field trip report/Project report.....10 marks

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, 2023, May, 2024 and May, 2025.

## Course Outcomes

Students would develop an understanding with respect to

- ❖ CO1: present status and future potential of fish resources of India.
- ❖ CO2: fish: its biotic and abiotic environment.
- ❖ CO3: fish breeding: culture and captive breeding techniques.
- ❖ CO4: fish nutrition: requirements, processing and preservation techniques .
- ❖ CO5: fishaquarium : setting and health management .

## 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. Riverine: resources, characteristics and production.
- 1.5. Marine: resources, characteristics and production

### 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 CO<sub>2</sub>: sources, methods of determination and significance.
  - 2.1.5 DO : sources, methods of determination 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 in fishery.

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

- 3.1 Biochemical Composition of fish and their nutritional value.
- 3.2 Fish spoilage and and processing.
  - 3.2.1. Rigor mortis and factors affecting it.
  - 3.2.2. Chemical spoilage
  - 3.2.3. Microbial spoilage.
  - 3.2.4 Fish microbes.
- 3.3 Post harvest technology
  - 3.3.1 Fish sanitation and handling
- 3.4 Fish processing techniques
  - 3.4.1. Drying
  - 3.4.2. Salting
  - 3.4.3 Icing and Refrigeration

**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. 2<sup>nd</sup> 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.

**List of Practicals**

**Course code: PSZOPC-410**

(Based on Theory Course No. 404, 405, 406 & 407)

- ❖ To study the morphometric characters of fishes.
- ❖ To identify given fish through morphometric analysis and draw diagram of the same.
- ❖ To study the external morphology and sexual dimorphism of freshwater crab.
- ❖ To identify the given specimen of prawn found in local water bodies of Jammu region.
- ❖ Qualitative analysis of zooplankton in provided water sample.
- ❖ To study various fish diseases caused by bacteria and viruses.
- ❖ To study various parts and accessories of aquaculture.
- ❖ To study different ornamental fishes-both freshwater and marine.
- ❖ To study inland and marine fish resources of India through maps. .
- ❖ To study different Fishing methods used in inland and marine waters
- ❖ Estimation of amount of FCO<sub>2</sub> in water samples.
- ❖ Estimation of amount of DO in water samples.
- ❖ AAS based estimation of mineral constituents (Ca, Mg, Fe, etc. from exoskeleton of shell fishes).
- ❖ Biochemical analysis of fish and shellfish tissue samples using automated bio-chemical analyser.
- ❖ Field trip report/Project report.....10 marks



Course No. PSZOTE-406

Title: Molecular Genetics &amp; 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, 2023, May, 2024 and May, 2025.**

### Course Outcomes

**Students would develop an understanding with respect to**

- ❖ **CO1:** analysis of human chromosomes by using classical and advanced cytogenetic techniques.
- ❖ **CO2:** genetics of human disorders by Pedigree analysis and karyotyping
- ❖ **CO3:** genetic and molecular basis of human genetic diseases.
- ❖ **CO4:** human genome project, human cloning, single gene and multifactorial disorders.

### 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 R- Banding
  - 1.1.4 High resolution Banding
  - 1.1.5 Q-Banding
  - 1.1.6 Significance and applications of chromosome banding techniques
- 1.2 Advanced Cytogenetic Techniques
  - 1.2.1 In- situ hybridization (ISH)
  - 1.2.2 Fluorescent in situ hybridization (FISH) and its types (Q FISH and F FISH)
  - 1.2.3 Comparative genomic hybridization (CGH)
  - 1.2.4 Spectral karyotyping
  - 1.2.5 Molecular correlation of band
  - 1.2.6 Multi colour karyotyping
- 1.3 Computer Assisted Chromosome Analysis
- 1.4 Light microscopy, fluorescence microscopy and confocal microscopy

**(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, orthologs and contings
- 2.4 Repetitive DNA and its types
- 2.5 Evolution of human nuclear genome

#### **Unit III Genetic diagnosis and treatment of genetic diseases**

**(12hrs)**

- 3.1 DNA based diagnosis
- 3.2 Biochemical diagnostics
- 3.3 Pre-implantation diagnosis
- 3.4 Population screening

### C. No. PSZOTE-406, Molecular Genetics & Cytogenetics (2023-25)

- 3.5. Prenatal diagnosis:
  - 3.5.1 Invasive techniques: CVS, amniocentesis, fetoscopy
  - 3.5.2 Non invasive techniques: ultrasonography, fetal cells in maternal blood, maternal fetal serum
- 3.6 Treatment of genetic diseases

#### Unit IV Human Genome project and genetic counseling (13hrs)

- 4.1 Human genome project
  - 4.1.1 History, organization and goals of human genome project
  - 4.1.2 Human genome project: ESLI
- 4.2 Genetic counselling
  - 4.2.1 Purpose of counselling
  - 4.2.2 Eugenics
  - 4.2.3 Euphenics
- 4.3 Gene and environmental interactions : complex diseases
- 4.4 DNA fingerprinting : principle and applications
- 4.5 Epigenetics

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

- 5.1 Stem cell research and therapeutic cloning
  - 5.1.1 Stem cell basics: types, potency
  - 5.1.2 Source and isolation of stem cells
  - 5.1.3 Use of stem cells in human welfare
- 5.2 Therapeutic Cloning
- 5.3 Ethical Issues in therapeutic cloning
- 5.4 Gene therapy
- 5.5 Genetic basis of following:
  - 5.5.1 Huntington's disease
  - 5.5.2 Cystic fibrosis
  - 5.5.3 Thalassaemia
  - 5.5.4 Haemophilia
  - 5.5.5 DMD
  - 5.5.6 Fragile-X

#### 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. Motulsky. (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
- 9) Thomas Mueller-Reichert and Paul Verkade (2017) Methods in Cell Biology: Academic Press Books-Elsevier.

**C. No. PSZOTE-406, Molecular Genetics & Cytogenetics (2023-25)**

**List of Practicals**

**Course code: PSZOPC-410**

(Based on Theory Course No. 404, 405, 406 & 407)

- ❖ To study the different symbols used in pedigree analysis.
- ❖ To prepare the pedigree of your own family.
- ❖ Pedigree analysis of various inheritance patterns.
- ❖ Study of inheritance pattern of various genetic diseases through micro-photographs.
- ❖ To study the AluIndel polymorphism in humans.
- ❖ To detect the human specific Alu elements by using polymerase chain reaction.
- ❖ Study the Hardy-weinberg analysis in human population.
- ❖ To prepare the karyotype of various human genetic syndromes viz. Down's syndrome, Klinefelter syndrome, Turner syndrome etc.
- ❖ To prepare karyotype of normal male and female.
- ❖ Field trip report / project report.....10 marks

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, 2023, May, 2024 and May, 2025.

### Course Outcomes

Students would develop an understanding with respect to

- ❖ **CO1:** importance of beneficial and non-beneficial insects.
- ❖ **CO2:** applied aspects of insects and their services to human welfare .
- ❖ **CO3:** insect behaviour, insect plant interactions ,insect pest management and their control measures.

### 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, filariasis
- 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

**C. No. PSZOTE-407, Entomology (2023-25)**

- 3.2 Insect Plant Relationship:  
3.2.1 Host selection and plant characteristics in host plant selection  
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  
5.2 Behavioural & structural defense  
5.3 Chemical defense  
5.4 Coloration defense  
5.5 Mimicry

**(12hrs)**

**Note for Paper Setting**

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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, 2023, May, 2024 and May, 2025.**

### **Course Outcomes**

**Students would develop an understanding with respect to**

- ❖ **CO-1:** biological anthropology: historical background ,scope and application .
- ❖ **CO-2:** history of human evolution / principles and processes of human evolution.
- ❖ **CO-3:** human biology; genetics, epidemiology and susceptibility to various diseases.

### **SYLLABUS**

#### **Unit-I Introduction to Anthropology (12hrs)**

- 1.1 Definition, nature and 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 (13hrs)**

- 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 (12hrs)**

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

#### **UNIT- IV Human Variations (13hrs)**

- 4.1 Human races and racial classification
  - 4.1.1 Skin colour
  - 4.1.2. Hair texture
  - 4.1.3. Eye colour

### C. NO. PSZOTO-408, Biological Anthropology (2023-25)

- 4.2 Concept of culture: society and civilization
- 4.3 Basic concepts of population structure
  - 4.3.1 Composition: age and sex
  - 4.3.2 Natality, mortality and morbidity
  - 4.3.3 Fecundity and fertility

#### UNIT- V Human Health

(13hrs)

- 5.1 Epidemiology and susceptibility to various diseases
- 5.2 Infectious diseases : causes, symptoms and diagnosis
  - 5.2.1. Bacterial: tuberculosis, cholera, typhoid
  - 5.2.2. Viral: AIDS, zika virus
- 5.3. Communicable diseases: Causes, symptoms, diagnosis
  - 5.3.1. diabetes, cardiovascular
  - 5.3.2. Genetic: cancer, sickle cell anemia.
- 5.4. Late onset Diseases
  - 5.4.1 Alzheimers's disease
  - 5.4.2. Parkinson's disease

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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 Nerriou (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. 2<sup>nd</sup> 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.