



UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
(Baba Sahib Ambedkar Road, Jammu-180006 (J&K))

Academic Section

Email: academicsectionju14@gmail.com

NOTIFICATION (24/ April /Adp./02)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the following

- a. the Continuation of the existing Syllabi and Courses of Study of the subject of **Zoology** of Master Degree Programme for semester Ist and IInd under the Choice Based Credit System for the examinations to be held in the year as given below:-

Semester	For the examinations to be held in the year
Semester-I	December 2023, 2024 and 2025
Semester-II	May 2024, 2025 and 2026

- b. Adoption of the revised Syllabi and Courses of Study of the subject of **Zoology** of Master Degree Programme for semester IIIrd and IVth under the Choice Based Credit System (as given in annexure) for the examinations to be held in the year as given below:-

Semester	For the examinations to be held in the year
Semester-III	December 2024, 2025 and 2026
Semester-IV	May 2025, 2026 and 2027

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

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/24/ 539-545

Dated: 11-4-24

Copy for information and necessary action to:

1. Dean, Faculty of Life Sciences
2. HOD/Convener, Board of Studies in Zoology
3. Programmer, Computer Section, Examination Wing
4. Incharge, University Website for Uploading of the notification

Sumitasharma
Deputy Registrar (Academic) 8/4/2023
SS 8/4/24
Pal 8/4/24
108/4/24

UNIVERSITY OF JAMMU
COURSE STRUCTURE FOR MASTERS
DEGREE PROGRAMME IN ZOOLOGY

The Courses of study prescribed for 1st to 4th semesters/ Master's Degree Programme under CBCS in the subject of Zoology (Session 2023-25)

Semester	Course Code	Course Title	Credits	Nature of Course	% of Change
I	PSZOTC-101	Ecology & Environmental Biology	4	CORE	-
	PSZOTC-102	Fundamentals of Genetics	4	CORE	-
	PSZOTC-103	Ichthyology	4	CORE	-
	PSZOTC-104	Immunology	2	CORE	-
	PSZOTC-105	An Introduction to Insect Diversity	2	CORE	-
	PSZOPC-106	Lab Course -I	4	PRACTICAL	-
	PSZOPC-107	Lab Course -II	4	PRACTICAL	-
	Total credits			24	
PSZOPC-106 Based on Theory Course No.101 & 103 PSZOPC-107 Based on Theory Course No.102, 104 & 105					
II	PSZOTC-201	Cell Biology & Research Instrumentation	4	CORE	-
	PSZOTC-202	Functional Anatomy of Animals	4	CORE	-
	PSZOTC-203	Basic Endocrinology	4	CORE	-
	PSZOTC-204	Biotechnology	2	CORE	-
	PSZOTC-205	Biodiversity, Conservation & Management	2	CORE	-
	PSZOPC-206	Lab Course -I	4	PRACTICAL	-
	PSZOPC-207	Lab Course -II	4	PRACTICAL	-
	Total credits			24	
PSZOPC-206 Based on Theory Course No.201 & 203 PSZOPC-207 Based on Theory Course No. 202, 204 & 205					
III	PSZOTE-301	Limnology	4	ELECTIVE	-
	PSZOTE-302	Fish & Fisheries	4	ELECTIVE	-
	PSZOTE-303	Molecular Genetics & Cytogenetics	4	ELECTIVE	-
	PSZOTO-304	*MOOC through SWAYAM portal	4	MOOC	-
	PSZOTC-305	Fundamentals of Biochemistry	4	CORE	-
	PSZOTC-306	Biosystematics, Taxonomy & Evolution	4	CORE	-
	PSZOPC-307	Lab Course -I	4	PRACTICAL	-
	PSZOPC-308	Lab Course -II	4	PRACTICAL	-
	PSZOTE-309	Eco-friendly pest management	2	VALUE ADDED COURSE	-
	PSZOTE-310	Aquarium fish keeping	2	SKILL COURSE	-
	Total credits			28	
PSZOPC-307 Based on Theory Course No.301/302/303 PSZOPC-308 Based on Theory Course No.305 & 306					
IV	PSZOTC-401	Reproductive & Developmental Biology	4	CORE	-
	PSZOTC-402	Aquaculture	2	CORE	-
	PSZOTC-403	Applied Microbiology	2	CORE	-
	PSZOTC-404	Animal Physiology	4	CORE	-
	PSZOPC-405	Lab Course -I	4	PRACTICAL	-
	PSZOPC-406	Lab Course -II	4	PRACTICAL	-
	PSZODC-407	Dissertation	6	FIELDPROJECT/ DISSERTATION	-
	PSZOTO-408	*Biological Anthropology	4	OPEN	-
	Total credits			30	
PSZOPC-405 Based on Theory Course No. 401 & 402 PSZOPC-406 Based on Theory Course No. 403 & 404					
Total credits earned by the students			106		

*For students of other Departments.

DAC members

1.



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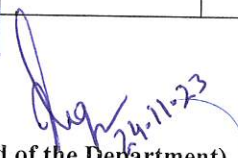
3.



4.



(Head of the Department)



Course No. PSZOTE- 301
 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
 December, 2024, December 2025 and December 2026.**

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

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

UNIT-III

- 3.1 Plankton: Definition & Classification (12hrs)
- 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 FCO₂
- 4.3 Bottom: Composition, sources and diversity
- 4.4 Thermal stratification

UNIT-V

- 5.1 Wetland (12hrs)
- 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

- Major test will have two sections (A & B)
- Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- 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

- Cole, A.A. (1974). Text book of Limnology. The G.V. Mosby Company Saint Louis.
- Hutchinson, G.E. (1975). Limnological Botany John Willey and Sons, New York
- Hutchinson, G.E. (1977). A treatise on Limnology Vol. I John Willey and Sons, New York
- Hutchinson, G.E. (1977). A treatise on Limnology Vol. II John Willey and Sons, New York.
- Hutchinson, G.E. (1977). A treatise on Limnology Vol. I John Willey and Sons, New York
- Olepper, H. (1979). Careers in conservation. A Ronaldn Press publication John Wiley and Sons, New York.
- Hybes, H.B. N. (1979). 'The Ecology of running waters. Liver Pool University Press.
- Jhingran, V.G. (1982). Fish and Fisheries of India. Hindustan Publishing corporation, India.
- Goldman, C.R. and Horne, A.J.(1983).Limnology. McGraw Hill International Book Company,New Delhi .
- Davies, B.R. and Walker, K.F. (1986). The Ecology of River Systems. Dr. W. Junk Publishers, Bostan
- Brian Moss. Blackwell Science. (1998). Ecology of Freshwaters 3rd Ed.
- Wetzel, R.G. (2001). Limnology (3rd edition). Publishers-Academic press year
- G.E. Hutchinson. (2004). A Treatise on Limnology. John Willey & Sons, Canada.
- Arvind Kumar. (2005). Fundamentals of Limnology
- Rotipeax Author-Martens. (2005). K ed Publisher- Springer
- Jorgenson, S.E., Loffler, H, rast, W and Straskraba, M. (2005). Lakes and Reservoir Management.
- Welch, P.S. (2011). Limnology.N.H.P.
- Agarwal. (2014). Limnology (2 copies). Publishers-Apm
- Cola, Gerald. (2015). Textbook of Limnology (4th edition). CBS Publishers
- Hosetti, B.B. (2016). A textbook of applied aquatic Biology.Daya publishers
- Welch, P.S. (2018). Limnology.Narendra Publishers
- Biju, A, (2018). Marine zooplankton Publisher-NPH
- Jocelyne Hughes (2019) Freshwater Ecology and Conservation: Oxford University Press

List of Practicals Course code: PSZOPC-307

(Based on Theory Course No. 301)

- 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_2 in water samples.
- Comparative estimation of amount of DO in water samples.
- Comparative estimation of Carbonate and bicarbonate.
- Comparative estimation of Ca^{++} and Mg^{+1} .
- 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.
- ~~Preparation of report/Project report.~~

4

Course No. PSZOTE- 302
 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
 December, 2024, December 2025 and December 2026.

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 Abiotic
 - 2.1.1 Temperature: effect on vital biological processes and thermal stratification
 - 2.1.2 Light: Sources, factors influencing light penetration, methods of measuring penetration and its relationship with aquatic organisms.
 - 2.1.3 pH - definition, distribution and significance.
 - 2.1.4 CO₂ : sources, methods of determination and significance.
 - 2.1.5 DO : sources, methods of determination and significance.
- 2.2 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 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. 2nd Ed. Wiley Blackwell, U.K.
9. S.S. Khanna and H.R. Singh (2014). A Textbook of Fish Biology and Fisheries of India. Hindustan Publishing House.
10. Rahul P. Parihar. (2014). Fish Biology and Indian Fisheries.
11. Heimo Mikkola (2017). Fisheries and aquaculture in the modern world.

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List of Practicals Course code: PSZOPC-307

(Based on Theory Course No. 302)

- ❖ 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 FCO₂ 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.
- ❖



Course No. PSZOTE-303
 CREDITS: 4
 Time Duration: 2hrs and 30 mins.

Title: Molecular Genetics & Cytogenetics
 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, 2024, December 2025 and December 2026.

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

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

(12hrs)

C. No. PSZOTE-303, Molecular Genetics & Cytogenetics (2024-26)

- 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 Thalassemia
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-303, Molecular Genetics & Cytogenetics (2024-26)

List of Practicals Course code: PSZOPC-307

(Based on Theory Course No. 303)

- ❖ 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 on the topic: Cytogenetics



Course No. PSZOTC-305
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, 2024, December 2025 and December 2026.

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 Quaternary.
 - 1.2.4.1 Fibrous protein (Specialized proteins)
- 1.3 Protein metabolism
 - 1.3.1 Catabolism of Amino Acid Nitrogen.
 - 1.3.2 Transamination & Deamination.
 - 1.3.3 Formation of Ammonia and its transport.
 - 1.3.4 Biosynthesis of Urea, Uric Acid & Creatinine
- 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
- 2.6 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

- 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
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- 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 5th Ed.
3. Horton Moran, Scrimgeour Perry Rawn. (2006). Principles of Biochemistry : Pearson International Fourth Edition.

C. No. PSZOTC-305, Fundamentals of Bio-chemistry (2024-26)

4. Donald Voet, Judith, G. Voet, Wiley Plus Charlotte, W. Pratt. (2008). Principles of Biochemistry
5. Murray, Bender, Botham, Kennelly Rodwell,(2009). Harper's Illustrated Biochemistry, Mc. Graw Hill Publ. House.
6. Lehninger, Michael M. cox and David L. Nelson. W.H. Freeman & Co. N.Y. (2010). Principles of Biochemistry
7. R. Hannah Sulochana, (2010). Principles of Biochemistry.
8. Thomas M. Devlin. (2011). Text book of Biochemistry, 7th Edition
9. John, L. Tymoczko, Jeremy M, Berg & Lubert Stryer (2013). Biochemistry, 2nd Ed.
10. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. (2013). Biochemistry 7th Edition.
11. Jeremy M. Berg, John L. Tymoczko, Gatto J. Gregory and Lubert Stryer (2019) Biochemistry 8th Edition.
12. Manjeshwar R. Prasad (2019) Textbook of Biochemistry 5th Edition.



List of Practicals

Course code: PSZOPC-308

(Based on Theory Course No. 305)

- 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 -306

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, 2024, December, 2025 and December, 2026.

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, cytotoxonomy 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-306, Biosystematics, Taxonomy & Evolution (2024-26)

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 Pulknap 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.

List of Practicals Course code: PSZOPC-308

(Based on Theory Course No. 306)

- 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. PSZOTE-309
 CREDITS: 2
 Time Duration: 2Hrs

Title: Ecofriendly pest 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
 December 2024, December, 2025 and December, 2026

Course Outcomes

Students would develop an understanding with respect to:

- CO1: The basic concepts of Nematology
 CO2: Nematodes as biological control agents
 CO3: Integrated pest management
 CO4: Commercial nematode formulations
 CO5: Diseases caused by nematodes

SYLLABUS

Unit-1 Introduction to Nematology

- 1.1 General characteristics of Nematodes
 - Occurrence
 - Habit
 - Habitat
- 1.2 Classification of Nematode upto family level
- 1.3 Nematode Morphology and reproductive structures
 - Size, shape, body wall, cuticle, stylet, body regions
 - Spicules, Gubernaculum, Bursa.
- 1.4 Diseases and symptoms caused by-
 - Root Knot Nematode
 - Soybean Cyst Nematode
 - Lesion Nematode
 - *Trichinella spiralis*
 - *Ascaris*

Unit-II Entomopathogenic nematodes (EPNs)

- 2.1 Nematodes as biological control agents
 - Symbiotic relation between Nematode and Bacteria
- 2.2 Life cycle of EPNs, First generation male female, second generation male female and Infective Juveniles (IJs)
- 2.3 EPN formulations and application strategies
 - Aqueous suspension, Synthetic sponges, Gels, Clay and powder.
- 2.4 Case studies of EPNs application in
 - Horticulture
 - Floriculture
 - Medicinal plants

Unit-III Integrated pest Management strategies

- 3.1 Introduction to Integrated pest management (IPM)
 - Advantages and disadvantages of IPM

C. No. PSZOTE-309, Ecofriendly pest management (2024-26)

- 3.2 Goals and steps in implementation of IPM
- Inspection, planning preventive strategies, analysis, treatment selection, monitoring and documentation
- 3.3 Non-chemical control methods for pest management
- Spring traps, pheromone traps, sticky traps, fly and wasp traps
- 3.4 Disadvantages of chemical control of insect pests

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. Hunt, D. J., & Nguyen, K. B. (2016). *Advances in entomopathogenic nematode taxonomy and phylogeny*. Brill.
2. Grewal, P. S., Ehlers, R. U., & Shapiro-Ilan, D. I. (Eds.). (2005). *Nematodes as biocontrol agents*. CABI.
3. Zuckerman, B. (Ed.). (2012). *Plant parasitic nematodes*. Elsevier.
4. Sivaramakrishnan, S., & Razia, M. (2021). *Entomopathogenic Nematodes and Their Symbiotic Bacteria*. Springer.
5. Perry, R. N., Hunt, D. J., & Subbotin, S. A. (Eds.). (2020). *Techniques for Work with Plant and Soil Nematodes*. CABI

List of Practicals

- ❖ General Morphology of entomopathogenic nematodes (EPNs).
- ❖ Life cycle of EPNs.
- ❖ Types of EPN formulations & their applications.
- ❖ Diseases caused by Nematodes in Plants and animals
- ❖ Beneficial nematodes and their host range
- ❖ Reproductive structures of EPNs

Course No. PSZOTE-310
CREDITS: 2

Title: Aquarium fish keeping
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 2024, December 2025 and December 2026

Students would develop an understanding with respect to:

CO1: set home, outdoor & public aquarium

CO2: manage the home as well as public (commercial) aquariums

CO3: learn to handle different aquarium tools accessories

CO4: determine appropriate species of fishes and plant life to be introduced into an aquarium and will identify common health problems with fish in an aquarium

Unit-I Construction, setting and maintenance of aquaria

(10hrs)

- 1.1 Fabrication: frame - glass, size, thickness etc.
- 1.2 Setting and selection of site
- 1.3 Stocking capacity
- 1.4 Aquarium accessories: Heaters, thermostat, aerators, water filters etc.
- 1.5 Aquarium decoratives
- 1.6 Regular maintenance schedule of aquarium

Unit-II Water quality and fish health management

(10hrs)

- 2.1 Abiotic components
 - 2.1.1 Dissolved oxygen
 - 2.1.2 pH
 - 2.1.3 Carbondioxide
 - 2.1.4 Ammonia
- 2.2 Biotic components
 - 2.2.1 Aquarium plants : Rooted, Branched, Floating
- 2.3 Aquarium fish diseases (symptoms and treatment)
 - 2.3.1 White spot
 - 2.3.2 Gill flukes
 - 2.3.3 Fin rot
 - 2.3.4 Mouth fungus

Unit-III Biology of ornamental fishes

(10hrs)

- 3.1 Biological notes on fresh water ornamental fishes.
 - 3.1.1 General characteristics
 - 3.1.2 Identification
 - 3.1.3 Feeding habits
 - 3.1.4 Breeding and spawning behavior
- 3.2 Biological notes on marine water ornamental fishes.

- 3.2.1 General characteristics
- 3.2.2 Identification
- 3.2.3 Feeding habits
- 3.2.4 Breeding and spawning behavior

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%	2 hrs	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. Sanjib Saha, Concept of Aquarium Fish Keeping - 2/edition
2. A.D. Dholakia, Ornamental Fish Culture and Aquarium Management, Daya Publishing House
3. Marina Costantino, Your Freshwater Aquarium. Menakabooks Publishers
4. Mathur Sarvesh et al, Handbook of Freshwater Ornamental Fishes, Yash Publishing House

LIST OF PRACTICALS:

1. Comparative estimation of amount of FCO_2 in water samples
2. Comparative estimation of amount of DO in water samples
3. Comparative estimation of amount of NH_3 in water samples
4. Study various fish diseases
5. Study different ornamental fishes-both fresh and marine water
6. Study different aquarium plants
7. Identification of common Aquarium fishes
8. Study of slides of parasites and diseases
9. Setting up of an aquarium
10. Aquarium accessories (Heaters, thermostat, aerators, water filters)
11. Biological notes on fresh water ornamental fishes
12. Biological notes on marine water ornamental fishes



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, 2025, May, 2026 and May, 2027

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 Structure and Function of Mammalian Gonads

- 1.1 Histomorphology of mammalian Gonads (12hrs)
- 1.2 Hormones of reproduction
- 1.2.1 Gonadotropin: types and functions
- 1.2.2 Sex steroids : structure, Biosynthesis & Role in Reproduction
- 1.3 Corpora lutea, their structure and function
- 1.4 Atresia: formation and significance

UNIT-II Gametogenesis and Fertilization

- (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 (2025-27)

UNIT-IV Embryonic Development

(13hrs)

- 4.1 Cleavage and blastulation
 - 4.1.1 Characteristics and Mechanism of cleavage
 - 4.1.2 Patterns of cleavage
 - 4.1.3 Types of blastula, factors involved in shaping the blastula (Blastulation in sea urchin, frog, chick, mammals)
- 4.2 Gastrulation
 - 4.2.1 Presumptive 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 Organogenesis

(12hrs)

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

Note for Paper Setting

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

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

Books Recommended

1. Pattern B.M. Carlson, B.M. (1977). Foundation of Embryology. T.M.M. edition
2. Blinsky, B.I. (1981): Introduction to Embryology, Saunders College Pub. Philadel
3. Saunders, J. W. (1982): Dev. Biology Patterns, Principles, Problems, Macmillan Pub. Co. Inc. New York
4. Berrill N.J: Developmental Biology. McGraw Hill, New Delhi.
5. McEwen, Vertebrate Embryology.
6. Alferd Kuhn: Lectures on Developmental Physiology. 18.J.W. Saunders, Jr. Animal Morphogenesis.
7. C.R. Martin: Endocrinology. Oxford University Press
8. R.H. Williams. Text book of Endocrinology. W.B. Saunders
9. Scott F, Gilbert: Developmental Biology (6th Ed.) NCBI Bookself
10. Bruce, M. Carlson (2013): Human Embryology and Developmental Biology.
11. Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias 5th Ed. (2015) Principles of Development Oxford University Press
12. Michael J F Barresi and Scott F, Gilbert 12th Ed. (2019) Developmental Biology: Oxford University Press.



List of Practicals Course code: PSZOPC-405
(Based on Theory Course No. 401)

- ❖ 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, 2025, May, 2026 and May, 2027
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 (2025-27)

Note for Paper Setting

Examination Theory	Syllabus to be covered in examination	Time allotted for Exam	% weightage (marks)
Minor Test I	upto 20%	1 hr.	10
Minor Test II	21% to 40%	1 hr.	10
Major Test	41% to 100%	2hrs.	30

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

Books Recommended:

1. Bardack edition, (1979), Aquaculture-The faring and Husbandry of freshwater and marine organisms John Wiley and Sons New York.
2. Boyd, (1982), Water quality management for land fish culture, CE Elsevier Scientific publishing company.
3. Pillay, T.V.R. (1993), Aquaculture principles and practices.
4. Robert R. Stickney, (1994), Principles of Aquaculture, John Wiley and sons Inc.
5. De Silva, S.S, Anderson, T.A, (1994), Springer Netherlands.
6. Rath R.K,(2002), Freshwater aquaculture.
7. Srivastava, C.B.L. (2006), Atext book of Fishery Science and Indian Fisheries.
8. Ayyapan, T.V.R (1993) Aquaculture principles and practices.
9. John S. Lucas, (2013), Aquaculture farming aquatic animals and plants, FFishing new books
10. Handbook of fisheries and Aquaculture 2nd edition (2013), ICAR New Delhi.
11. R.R. Sticking, (2017), Aquaculture introductory (3rd edition), CAB International U.K.
12. Jesse Trushenski (2019) Understanding Aquaculture: 5m Publishing House.

List of Practicals

Course code: PSZOPC-405

(Based on Theory Course No., 402)

- ❖ 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: Applied 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, 2025, May, 2026 and May, 2027

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.
 - 1.2.1 Tuberculosis
 - 1.2.2 Pneumonia
 - 1.2.3 Diptheria
- 1.3 Food/ water/ Soil borne diseases
 - 1.3.1 Typhoid fever
 - 1.3.2 Cholera
 - 1.3.3 Tetanus
- 1.4 Viral diseases
 - 1.4.1 Hepatitis
 - 1.4.2 H1N1 infection
 - 1.4.3 Rabies
 - 1.4.4 Japanese Encephalitis
 - 1.4.5 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

(10hrs)

- 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 2nd Ed.* Panima Publ. Corporation, New Delhi.
10. Male D, Brostoff J, Roth DB & Roitt. (2006). *Immunology*. Elsevier.
11. Jay, J.M. (2008) *Modern Food Microbiology* (Sixth Edition). Aspen Publishers, Inc, Gaithersburg, Maryland.
12. Gerard, J. Tortora, Berdell R. Funke & Christine L. Case. (2011). *Microbiology: An Introduction 9th Ed*, Pearson Education.
13. Pedro Escoll (2017). *Bacterial evasion of the host immune system*. Caister Academic Press.
14. Luke Moore (2019) *Infectious diseases, Microbiology and Virol*: Cambridge University Press.

List of Practicals

Course code: PSZOPC-406
(Based on Theory Course No. 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. PSZOTC-404
 CREDITS: 4
 Time Duration: 2Hrs and 30 Mins.

Title: Animal Physiology
 MAXIMUM MARKS : 100
 a) Minor Test I : 20
 d) Minor Test II : 20
 e) Major Test : 60

Syllabus for the examination to be held in
 May, 2025, May, 2026 and May, 2027

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 Respiratory and Excretory Physiology

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

- 3.3 Excretory physiology (in mammals)
- 3.3.1 Detailed structure of nephron
- 3.3.2 Glomerular functions
- 3.3.3 Tubular functions
- 3.3.4 The rennin angiotensins
- 3.3.5 Aldosterone system

UNIT IV Neurophysiology

- 4.1 General neuroanatomy
- 4.1.1 Brain, brain regions, brain connections
- 4.1.2 Spinal Cord
- 4.2 Neurophysiology
- 4.2.1 Structure and function of neuron and its organization
- 4.2.2 Nerve impulse origin and propagation
- 4.2.3 Ion channels, structure of synapse and
- 4.2.4 Synaptic transmission and neurotransmitters
- 4.3 Neurological disorders
- 4.3.1 Neurodevelopmental disorders
- 4.3.2 Neuropsychological disorders
- 4.3.3 Neurodegenerative diseases

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

- Major test will have two sections (A & B)
- Section A is compulsory comprising of 10 questions of 1.5 marks each and be spread over entire syllabus
- 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

- Dennis, W. Wood .(1970). Principles of Animal Physiology. Arnold, Publ. Ltd., London.
- Malcolin&Gorden. (1977). Animal Physiology: Principles and Adaptation. Macmillan Publ. Co. New York.
- 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, 7th edition.
8. Linda S. Costanzo (2018) Physiology 7th Edition Publisher: Wolters Kluwer
9. S. C Rastogi (2019) Essentials of Animal Physiology. Publisher: New Age Internationals.



List of Practicals

List of Practicals Course code: PSZOPC-406
(Based on Theory Course No. 404)

- 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.

