THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(MASTER OF SCIENCE) – 2022-2023 onwards

Programme Objectives:

1. To achieve excellence in education and Research field of Zoology.
2. To develop the quality performance in Zoology.
3. To provide Higher education and Research.
4. To motivate self-employment programmes and organize extension activities.
5. To provide opportunities for professional and personal development through curricular and co-curricular activities.

Programme Educational Objectives:

1. To provide quality education in the branch of Biological Sciences.
2. To facilitate Higher Education in Research field in Zoology.
3. To provide quality education offering skill based programmes.
4. To inculcate the value based education among the students.
5. To understand the classification of higher taxa molecular biology, genetics and field of Biotechnology.

Programme Specific Outcomes:

1. PSO1: Students can be educated by Taxonomical, Developmental, Genetical and Molecular level of animals.
2. PSO2: To create knowledge among students to analyse problems through Biostatistics and Computational Management.
3. PSO3: Students can understand various tools regarding search engines in Bioinformatics.
4. PSO4: Students gain knowledge about the principle and applications of Bioinstrumentation in Biological Sciences.
5. PSO5: Students can understand the applications of biological sciences in Apiculture, Aquaculture, Endocrinology and Biochemistry.
6. PSO6: Students can gain knowledge about agricultural based self-employment programme by Sericulture, Apiculture, Vermiculture, Pearl Culture and Aquarium Fish Keeping to up come entrepreneurs.

Programme Outcomes:

1. PO1: To gain knowledge and skill in the field of animal science and evolutionary significance of animal kingdom.
2. PO2: To describe the interrelationship between various animal phylum.
3. PO3: To understand the structure and function of cell and how they control the metabolic activities.
4. PO4: To educate the students in evolutionary significance of animals and their behaviour and hormone related development in animals.
5. PO5: To gain knowledge of organ and organ system of animals.
6. PO6: To understand the genes and their inheritance.
7. PO7:To understand the knowledge about technology based biological innovation in Agriculture, Medicine for Human Health.
8. PO8: To create awareness in immune and immune systems of human beings.
9. PO9: To understand analytical techniques, literature collection formulating hypothesis, thesis writing and publication in reputed journals.
10. PO10: To create awareness in student minds to save the flora and fauna of the environment.

INTERNAL ASSESMENT GUIDELINES:

The following teaching, learning and evolution process may be brought under internal assessment system. Interested teachers can choose one or more innovative methods.

a. Book review and research paper review, syllabus and curriculum review.
b. Data collection and paper writing practices: books level, field study level. Using the course content for society and nature development – exercise.
c. Workshops, preparing technical term dictionaries from text books and reference books.
d. Preparing question paper by the candidates: objective type, descriptive type, training given by the teacher
e. Forming digital library: collecting text and reference books, course material.
f. Preparing course material.
g. Following eminent intellectuals and research institutions in global level.
h. Open book examination
i. For application oriented study: Villages, Institutions, various people groups may be adopted by the departments of the colleges for practicing their theoretical study. Innovative methods may be implemented in the practices and report can be written for documentation, further discussion and research.
j. Extracurricular activities may be framed through their syllabus content.
k. Grouping students for self discussion, self learning and self evaluation process.

THIRUVALLUVAR UNIVERSITY
MASTER OF
SCIENCE
M.Sc. ZOOLOGY
DEGREE COURSE
UNDER CBCS

(With effect from 2020-2021)

The Course of Study and the Scheme of Examinations

S.No	Study Components / Course Title		Ins. Hrs /Week	Credit	Title of the paper	Maximum Marks		
SEMESTER I						**CIA**	**Uni. Exam**	**Marks**
1	Core	Paper-1	5	4	Life and Diversity of Invertebrates	25	75	100
2		Paper-2	5	4	Life and Diversity of Chordates	25	75	100
3		Paper-3	5	4	Cell and Molecular biology	25	75	100
4	Practical I	Paper-1	9		Life and diversity of Invertebrates, Life and diversityof Chordates and Cell and molecular Biology	-	-	-
5	ELECTIVE	Paper-1	3	3	(A) Aquaculture and Farm management (B) Biostatistics and Bioinformatics	25	75	100
6	OPEN ELECTIVE (Non-Major)	Paper-1	3	3	(A) Apiculture (B) Public Health and Hygiene	25	75	100
			30	**18**		**125**	**375**	**500**
SEMESTER II						**CIA**	**Uni. Exam**	**Marks**
7	Core	Paper-4	4	4	Genetics	25	75	100
8		Paper-5	4	4	Environmental Biology	25	75	100
9		Paper-6	4	4	Biotechnology	25	75	100
10	Practical I	Paper-I	-	4	Life and diversity of Invertebrates, Chordates, Cell and molecular Biology.	25	75	100
11		Paper-II	10	4	Genetics, Environmental Biology and Biotechnology	25	75	100
12	Compulsory Paper		2	2	Human Rights	25	75	100
13	ELECTIVE	Paper-2	3	3	(A) Endocrinology (B) Bio-Chemistry	25	75	100
14	OPEN ELECTIVE Non-Major	Paper-2	3	3	(A) Vermiculture (B) Wild Life Management and Conservation	25	75	100
			30	**30**		**225**	**675**	**900**

SEMESTER III						CIA	Uni. Exam	Marks
15.	Core Theory	Paper-7	4	3	Animal Physiology	25	75	100
16.	Core Theory	Paper-8	4	3	Developmental Biology	25	75	100
17.	Core Theory	Paper-9	4	3	Immunology	25	75	100
18.	Core Practical	Paper-3	12	-	Animal Physiology, Developmental biology and Immunology	-	-	-
Internal Elective for same major students								
19.	Core Elective	Paper-3	3	3	**(to choose one out of 2)** (A) Bioethics and Biosafety (B) Biophysics	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
20.	Open Elective	Paper-3	3	3	**(to choose one out of 2)** (A) Aquarium fish keeping (B) Medical Laboratory Technology	25	75	100
21.	Field Study			2		25	75	100
22.	MOOC Course		-	2		-	-	100
			30	**17**		**125**	**375**	**600**
SEMESTER IV								
23.	Core Theory	Paper-10	5	4	Research Methodology	25	75	100
24.	Core Theory	Paper-11	5	4	Entomology	25	75	100
25.	Core	Project	5	5	Project with viva voce (Compulsory)	100(75 Project+ 25 Viva)		100
26.	Core Practical	Paper-3	-	4	Animal Physiology, Developmental Biology and Immunology	25	75	100
27.	Core Practical	Paper-4	9	4	Research Methodology and Entomology	25	75	100
Internal Elective for same major students								
28.	Core Elective	Paper-4	3	3	**(to choose one out of 2)** (A) Sericulture (B) Microbiology	25	75	100
External Elective for other major students (Inter/multi disciplinary papers)								
29.	Open Elective	Paper-4	3	3	**(to choose one out of 2)** (A) Sericulture (B) Pearl Culture	25	75	100
			30	**27**		**175**	**525**	**700**
				92				**2700**

THIRUVALLUVAR UNIVERSITY

MASTER OF SCIENCE

M.Sc. ZOOLOGY

SYLLABUS
UNDER
CBCS
(With effect from 2020-2021)

Semester: I **Paper type:** Core Paper 1
Paper code: DZO11 **Name of the Paper:** LIFE AND DIVERSITY OF INVERTEBRATES
Credit: 4 **Total Hours per Week:** 5

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Course Objectives

1. The program provides the student with an introduction to the recent advances in zoology
2. Compare and contrast the major groups of marine protozoans and invertebrates
3. Completion of the courses students will be able. CO1- To classify Phylum Porifera with taxonomic Keys.
4. Demonstrated a broad understood of animal diversity, including knowledge of the scientific classification
5. Students gain knowledge and skill in the fundamentals of animal sciences, understands thecomplex interactions among various living organisms
6. Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment
7. Apply the knowledge and understanding of Zoology to one's own life and work
8. Understands the complex evolutionary processes and behaviour of animals
9. Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
10. Describe Phylum Nematoda and give examples of pathogenic Nematodes
11. Classify Protista up to phylum using examples from parasitic adaptation
12. Pathology associated with various diseases

UNIT-I

Broad Classification of the Animal Kingdom – Concepts of species, hierarchial taxonomy.

Protozoa

Feeding - Locomotion, Reproduction and Parasitic adaptations of Rhizopoda, Mastigopora, Ciliophora, Saprozoans and Mycetozoa with suitable examples.
Economic importance with respect to Health aspect of Soil, Fresh water and Marine Protozoans, Osmoregulation in Protozoa.
Theories on Origin and evolution of Metazoa – Syncytial, Colonial and Polyphyletic theories.

Porifera

Functional morphology of freshwater sponges with suitable example. Inter relationship betweendifferent classes.
Marine sponges.

Reproduction – Asexual and Sexual, Regeneration in sponges.Systematic position and Affinities of sponges.

UNIT-II

Coelenterata

Origin and evolution of Coelenterata, Polymorphism, Reproduction and Metagenesis ofCoelenterata. Corals and Coral reefs, Types of theories.
Systematic position of Ctenophora.

Helminthes

Platyhelminthes - Functional morphology and adaptive Biology for parasitic mode of life.Aschelminthes - Functional morphology and adaptive Biology for parasitic mode of life.

Helminthes in human diseases.
Life cycle of Wuchereia bancrofti

UNIT-III

Annelida

Archiannelida, Interrelationship between different classes of Annelida.Evolutionary significance of Trochophore Larva.
Origin and evolution of coelom. Adaptive radiation in Annelida. Origin of Metamerism in Annelida.

Arthropoda

Xiphosura-structure and affinities.Onychophora.
Origin and Evolutionary significance of Crustacean Larvae. Sense organs in Arthropoda, Tagmatization, Crustacean parasites, Mouth parts in insects. Commercial products of insects. Economic importance of insects. Arthropod vectors.

UNIT-IV

Mollusca

Torsion and Detorsion in Gastropoda - Adaptive radiation in Mollusca. Shell in different classes of Mollusca. Foot in Mollusca. Economic importance of Mollusca. Photoreceptors in Mollusca. Larval forms in Mollusca. Pearls producing Marine and Fresh Water Molluscans.

Echinodermata

Origin and evolutionary significance of Echinodermata. Water vascular system in Echinodermata. Pedicellariae of Echinodermata. Feeding mechanism in Echinodermata. Origin and evolutionary significance of Echinoderm larva.

UNIT-V

Minor Phyla

Structural peculiarities and affinities of Ctenophores, Acanthocephala, Nematomorpha, pogonophora.
Invertebrate fossils: Trilobites, Brachiopoda, cephalopoda and Echinodermata.

Course Out Comes (five outcomes for each units should be mentioned)

1) **After studied unit-1, the student will be able to understand**
   - Basic Concepts of Species
   - Hierarchial taxonomy
   - Importance of Parasitic Protozoan
   - Economic importance of Protozoan and Porifera
   - Systematic position and Affinities of sponges

2) **After studied unit-2, the student will be able to understand**
   - Origin and evolution of Coelenterata.
   - Corals and Coral reefs.
   - Systematic position of Ctenophora.
   - Helminthes in human diseases.
   - Life cycle of Wuchereria bancrofti.

3) **After studied unit-3, the student will be able to understand**
   - Origin and Evolution of Annelida
   - Evolutionary significance of Trochophore Larva
   - Adaptive radiation in Annelida
   - Origin and Evolutionary significance of Crustacean
   - Economic importance of insects

4) **After studied unit-4, the student will be able to understand**
   - Torsion and Detorsion in Gastropoda
   - Economic importance of Mollusca
   - Pearls production.
   - Water vascular system
   - Evolutionary significance of Echinoderm larva

5) **After studied unit-5, the student will be able to understand**
   - Structural peculiarities and affinities of Acanthocephala
   - Structural peculiarities and affinities of Nematomorpha, Brachiopoda
   - Structural peculiarities and affinities of Chaetognatha and Echiuroidea
   - Invertebrate fossils: Trilobites, Brachiopoda
   - Invertebrate fossils: Mollusca and Echinodermata.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	No	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	No	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours: 1**

- To understand the broad classification of the Animal Kingdom
- To learn the concepts of species, hierarchial taxonomy.
- By learning the feeding, locomotion and economic importance of health aspects of different protozoa.

Unit-2: (50 to 100 contents) **Teaching Hours: 1**

- To study origin and evolution of Coelenterata.
- To understand thepolymorphism and reproduction.
- To acquire the knowledge of Metagenesis of Coelenterata.

Unit-3: (50 to 100 contents) **Teaching Hours: 1**

- To study about the segmented worms.
- To study the Interrelationship between different classes of Annelida and Arthropoda.
- To learn and acquire the knowledge in helminthes.

Unit-4: (50 to 100 contents) **Teaching Hours: 1**

- To learn in human diseases and understand the origin and evolutionary significance of Mollusca and Echinodermata.
- To learn and understand the Fresh water molluscans and water vascular system in Echinodermata.

Unit-5: (50 to 100 contents) **Teaching Hours: 1**

- To learnStructural peculiarities and affinities of Minor Phyla.
- To learn the characteristic feature of fossils.

Text Books

1. Barnes. R.D. 1974. Invertebrate Zoology. W.B. Saunders Co.,Philadelphia.
2. Hyman L.H. 1951 The Invertebrata, Vol I to VI. Mc Graw – Hill Book Co., New York.
3. Barrington, E.J. W. 1969. Invertebrate Structure and Functions. English LanguageBook Society.
4. Hyman, L. H. 1940. The Invertebrates (6 volumes) New York: McGraw-Hill. A classic work.
5. Kotpal R.L. (2014) Modern text book of zoology: Invertebrates: animal diversity- I.11th Edition. Meerut: Rastogi Publications.

Reference Items: books, Journal

1. Jordan E. L. and Verma P.S. (2001) Invertebrate Zoology Revised Edition, Published by S. Chand Publications.
2. Kotpal R. L. (2014) Modern Text Book of Zoology: Vertebrates. Rastogi Publications.
3. Kotpal R.L. (2014) Modern text book of zoology: Invertebrates: animal diversity- I. 11th Edition. Meerut: Rastogi Publications.
4. Animal Kingdom D. Bhaskara Rao – 2010
5. Chemical zoology. Vol. II. Porifera, Coelenterata and Platyhelminthes. M Florkin, BT Scheer 1968.
6. Hyman, L. H. 1940. The Invertebrates (6 volumes) New York: McGraw-Hill. A classic work.
7. Anderson, D. T. (Ed.). (2001). Invertebrate zoology (2nd ed.). Oxford: Oxford University Press.
8. Brusca, R. C., & Brusca, G. J. (2003). Invertebrates (2nd ed.). Sunderland, Mass.: Sinauer Associates.
9. Miller, S.A., & Harley, J.P. (1996). Zoology (4th ed.). Boston: WCB/McGraw-Hill.
10. Pechenik, Jan A. (2005). Biology of the invertebrates. Boston: McGraw-Hill, Higher Education. pp. 590 pp. ISBN 978-0-07-234899-6.
11. Ruppert, E. E., Fox, R. S., & Barnes, R. D. (2004). Invertebrate zoology: a functional evolutionary approach. Belmont, CA: Thomas-Brooks/Cole.
12. Adiyodi, K.G. & Adyiodi, R.G. (Eds) 1983- . Reproductive Biology of Invertebrates. Wiley, New York. (Many volumes.)
13. Giese, A.G. & Pearse, J.S. (Eds) 1974- . Reproduction of Marine Invertebrates. Academic Press, New York. (Many volumes.)
14. Advances in Invertebrate Reproduction. Elsevier Science, Amsterdam. (Five volumes.)

E- Materials

- https://books.google.co.in/books?id=k6l9FGcjM_EC&pg=PA5&dq=Classification+Binomial+Nomenclature+animal+kingdom&hl=en&sa=X&ved=0ahUKEwj57P7Qxv7nAhW8IbcAHQ9LB6sQ6AEIMjAB#v=onepage&q=Classification%20Binomial%20Nomenclature%20animal%20kingdom&f=false
- http://tnschools.gov.in/media/textbooks/11_Zoo_Vol_2___EM.pdf
- https://biologydictionary.net/taxonomy/
- https://books.google.co.in/books?id=TAkrDAAAQBAJ&pg=PA94&dq=animal+kingdom+phylum+protozoa+and+porifera+invertebrates&hl=en&sa=X&ved=0ahUKEwjqybztx_7nAhVJ6XMBHUFVBtQQ6AEIMDAB#v=onepage&q=animal%20kingdom%20phylum%20protozoa%20and%20porifera%20invertebrates&f=false
- https://www.askiitians.com/revision-notes/biology/animal-kingdom/phylum-protozoa-and-porifera.html
- https://www.pmfias.com/classification-animalia-animal-kingdom/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Core Paper 2
Paper code: DZO12 **Name of the Paper:** LIFE AND DIVERSITY OF CHORDATES
Credit: 4 **Total Hours per Week:** 5

Course Objectives

1. To understand the taxonomy of vertebrates
2. To inculcate the importance of taxonomy and animal diversity
3. To teach the functional morphology and adaptive radiations
4. To explicit the evolutionary significance and affinities of chordates
5. To understand the phylogeny of chordates

UNIT - I

Principles of Taxonomy: Nomenclature – Binominal and Trinominal nomenclatureSuffix as for

super family name (oidea), family name (idae)

Use of suffixes 'i', 'orum', 'ae' 'arum', 'ensis' and 'iensis'.

Tautonyms, Synonyms and Homonyms.

New Trends in Taxonomy: Ecological approach, Ethological approach, Cytological approach,Biochemical approach and Numerical taxonomy.

Taxonomic key: Indented, Simple non-Bracket, Grouped type, Combination

Pictorial: Branching type, Circular and Box-type of keys.

UNIT - II

Prochordata: Systematic position and Phylogeny of Prochordates.

Ostracoderms: Silurian and Devonian Ostracoderms and their evolutionaryposition.

Placoderms: Origin of Jaws- Structural peculiarities of Cyclostomata.

UNIT-III

Chondrichthyes: Fossil history of Chondrichthyes, tendencies in Elasmobranch evolution.

Actinopterygii: Origin and evolution, Adaptive radiation of bony fishes.

Amphibia: Origin and evolution of Amphibia.

UNIT-IV

Reptilia: Evolution of Reptilia. Saurischian and Ornithischian Dinosaurs -Rhyncocephalia -Adaptive radiation of Reptiles.

Aves: Birds as glorified reptiles. Fossil history of birds. Palate in Birds. Adaptive radiation inbirds.

Mammal: Evolution of Mammals, Structural peculiarities of Prototheria, Metatheria andEutheria.

UNIT-V

Comparative anatomy: Origin and evolution of the vertebrate integumentary system, Paired finsand limbs, heart and brain of vertebrates.

Course Out Comes (five outcomes for each units should be mentioned)

1. **After studied unit-1, the student will be able to …..**
    - Understand the principles of taxonomy
    - Acquire knowledge on nomenclature
    - Realize the importance of suffix used in taxonomy
    - Know the trends in taxonomy
    - Understanding the different taxonomical keys used for identifying the species

2. **After studied unit-2, the student will be able to …..**
    - Know the primitive forms of chordates
    - Understand the systematic position of the primitive forms
    - Acquire knowledge on Silurian and Devonian Chordates
    - Realize the importance evolutionary significance
    - Understanding the origin of Jaw and structural peculiarities of the species

3. **After studied unit-3, the student will be able to …..**
    - Understand the fossil history of Chondrichthyes
    - Know the tendencies of elasmobranch evolution
    - Acquire knowledge on origin and evolution of Actinopterygii
    - Understand the adaptive radiation and evolution of bony fishes
    - Know the origin and evolution of Amphibia

4. **After studied unit-4, the student will be able to …..**
    - Acquire knowledge of evolution of Reptilia and adaptive radiations and the evolution of Saurischian and Ornithischian Dinosaurs
    - Know the fossil history of birds and why it is called as glorified reptiles?.
    - Understand the adaptive radiation of birds and palate in birds
    - Acquire knowledge on evolution of Mammals
    - Grasping the structural peculiarities of Prototheria, Metatheria and Eutheria

5. **After studied unit-5, the student will be able to …..**
    - Acquire knowledge on Comparative anatomy of vertebrates
    - Understand the origin and evolution of vertebrate integuments
    - Know the evolution of paired fins and limbs
    - Acquire knowledge on the evolution of heart and aortic arches
    - Grasping the development of brain in vertebrates

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours: 1**

Principles of Taxonomy:Nomenclature – Binominal and Trinominal nomenclatureSuffix as for super family name (oidea), family name (idae)
Use of suffixes 'i', 'orum', 'ae' 'arum', 'ensis' and 'iensis'.Tautonyms,
Synonyms and Homonyms
New Trends in Taxonomy:Ecologic approach, Ethological approach, Cytological approach,Biochemical approach and Numerical approach.
Taxonomic key: Indented, Simple non-Bracket Grouped type, combination Pictorial: Branching type, Circular and Box-type of keys.

Unit-2: (50 to 100 contents) **Teaching Hours: 1**

Prochordata: Systematic position and Phylogeny of Prochordates.
Ostracoderms: Silurian and Devonian Ostracoderms and their evolutionary position.Placoderms: Origin of Jaws- Structural peculiarities of Cyclostomata.

Unit-3: (50 to 100 contents) **Teaching Hours: 1**

Chondrichthyes: Fossil history of Chondrichthyes, tendencies in Elasmobranch evolution. Actinopterygii: Origin and evolution, Adaptive radiation of bony fishes.
Amphibia: Origin and evolution of Amphibia.

Unit-4: (50 to 100 contents) **Teaching Hours: 1**

Reptilia: Evolution of Reptilia. Saurischian and Ornithischian Dinosaurs -Rhyncocephalia -Adaptive radiation of Reptiles.
Aves: Birds as glorified reptiles. Fossil history of birds. Palate in Birds. Adaptive radiation inbirds.
Mammal: Evolution of Mammals, Structural peculiarities of Prototheria, Metatheria and Eutheria.

Unit-5: (50 to 100 contents) **Teaching Hours: 1**

Comparative anatomy: Origin and evolution of the vertebrate integumentary system, Paired finsand limbs, heart and brain of vertebrates.

Text Books

1 Kapoor, V.C., 1998. Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
2 Colbert, E.H., 1969. Evolution of Vertebrates. John Wiley and Sons Inc., New York.
3 Hobart M. Smith, 1960. Evolution of Chordate Structure. Holt, Rinehart and Winston, Inc., New York.
4 Waterman, A.J., 1971.Chordate structure and function. McMillan Co., London
5 Jolie, M. 1968. Chordate Morphology. East West Press, Pvt., Ltd.,
6 Young, J.Z., 1969. Life of Vetebrates. Clarendon Press, Oxford.
7 Holstead, 1969. The pattern of Vetebrate Evolution. Freeman and Co. San Francisco, USA.
8 Waterman, A.J., 1971.Chordate structure and function. McMillan Co., London
9 P.S. Verma and V. K. Agarwal, Cell Biology,Genetics, Molecular Biology, Evolution and Ecology. S. Chand Publishing Corporation Ltd.,
10 Mohan P. Arora, 2010. Organic Evolution. Himalaya Publishing House, Pvt., Ltd., New Delhi.
11 Romer, A.S. and T. S. Parson, 1978. Vetebrate Body. W.B. Saunders Co., Philadelphia. Subramanian, M.A., 2013. Chordate evolution. MJH Publishers, Chennai.
12 Hyman, L.H., 1966. Comparative Vertebrate Anatomy. The University of Chicago Press, Chicago.

Reference Items: books, Journal

1 The behavior of Animals: Mechanism, Function and Evolution (ed. Johan J. Bolhuis, Luc-Alain Giraldeau), 2004, Wiley Publishers
2 The Growth of Biological Thought: Diversity, Evolution, and Inheritance by Ernst Mayr. The Belknap Press of Harvard University Press.

E- Materials

- eBook: *Cell Biology*, *Genetics*, *Molecular Biology*, *Evolution and Ecology* (Multicolour Edition) P.S. Verma.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Core Paper 3
Paper code: DZO13 **Name of the Paper:** CELL AND MOLECULAR BIOLOGY
Credit: 4 **Total Hours per Week:** 5

Course Objectives

To understand the structure and molecular basis of cellular interactions, energy transformation, regulation and control of genes, cell cycle and information transfer.

UNIT-I: STRUCTURE AND FUNCTIONS OF CELL ORGANELLES

Plasma membrane: Structure, Membrane receptors, Membrane transport - Membrane Potentials.Secondary active transport – ion – selective channels.

Endoplasmic reticulum – structure and functions of Endoplasmic Reticulum.Mitochondria - Energetics –

functions of mitochondria.

UNIT-II: NUCLEUS

Structure and function of Nuclear membrane, Structure and function of Nucleolus.

Structure and function of Chromatin - Euchromatin and heterochromatin - Polytene and lampbrush Chromosomes

UNIT-III: CELL CYCLES AND CANCER CELL

Cell cycles – Molecular M-Cdk inactivation and creation of G_1 phase, cell growth and cell cycleprogression, genetics of cell cycle.

Cancer cell: Characteristics of – possible causes of carcinogenesis (Theories) - Oncogenes -Environmental factors inducting cancer. Hormones in relation to Cancer.

UNIT-IV: CHEMISTRY OF NUCLEIC ACIDS

Chemistry of DNA - DNA replication – Experimental proof of semiconservative replication – enzymes in replication.

Chemistry of RNA - Different types of RNA and their functions.

UNIT-V: INFORMATION TRANSFER

Information transfer in Prokaryotes and Eukaryotes. Transcription - Promotors - Initiators and terminators – post transcriptional modifications. Trimming of introns and splicing of exons. RNA processing

Course Out Comes (five outcomes for each units should be mentioned)

1. **After studied unit-1, the student will be able to**
    - Explain the structure of membrane and intercellular components and related to the function.
    - Summarizing the energy transduction in cells.

2. After studied unit-2, the student will be

- Exhibiting knowledge in structure and function of Nuclear membrane.
- Understanding the properties of polytene chromosome.
- To study the structure and function of Nucleolus.

3. After studied unit-3, the student will be

- Demonstrate the knowledge of cell cycle and M-Cdk inactivation.
- To understand the creating G1 phase and cell cycle progression.
- To acquire the knowledge in hormonal activity and cancer.

4. After studied unit-4, the student will be

- Understand the chemistry of DNA
- They acquire the knowledge of describing the structure, replication of DNA
- To explain the post of transcriptional and transduction of DNA.

5. After studied unit-5, the student will be

- To know the information transfer in prokaryotic and eukaryotic.
- The student can able to understand the about the specificity of exon and introns.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours: 1**

- Understand the history of cytology, draw the structure of plasma membrane and locate its function.
- Understand and appreciate the diversity of use as it is evolved overtime by the process of mutation, selection and genetic change.
- Acquire the knowledge of energetics.

Unit-2: (50 to 100 contents) **Teaching Hours: 1**

- To learn and understand the structure of chromatin and euchromatin.
- Enable the students to describe the structure of polytene chromosomes.
- Explaining the process of Nuclear membrane structure and function etc.

Unit-3: (50 to 100 contents) **Teaching Hours: 1**

- Describing the events of each phase of eukaryotic cell cycles.
- Describing and understanding the mitotic phase, nuclear and cell division
- Describing cell cycle progression cell cycle regulation.
- Describing the cell cycle maturation promoting factor MPE and cycle dependent kinaseand G1 phase

Unit-4: (50 to 100 contents) **Teaching Hours: 1**

- Analysing the DNA Chemical modification and impact on chromatin remodelling andregulation of gene expression.
- Describing semi conservative replication
- Explaining the process of semi conservative replication.

Unit-5: (50 to 100 contents) **Teaching Hours: 1**

- Explaining the nucleic acid transcription, promoters, initiators and terminators.
- Learn the post transcriptional modifications.
- Acquire the knowledge of trimming of introns and splicing.

Text Books

1. 1.Verma Agarwal, 2014. Chand & Co Private Limited, New Delhi
2. Avers. C.J., 1976. CellBiology. Van Nostrand Company, New York.
3. Korenberg. A. 1974. DNA Replication. Dorothy- W.H. Freeman and Company,
4. San Francisco.
5. 6. Hawkins, J.D.1996. Gene Structure and Expression, Cambridge University Press, London.
6. 7. Ajoy Paul, 2011. Text book of Molecular Biology, Book and Allied Private limited, Kolkata.

Reference Items: books, Journal

1. De Robertis. E.D.F. and De Robertis. E.M.F. 2001. Cells and Molecular Biology, B.I Publications Pvt Ltd, India. 2. Lewin, B.2000 Genes VII. Oxford University Press, New York.
2. Howland J.L. 1973. Cell Physiology, McMillan Publishing Co., New York.
3. De Witt, 1977. Biology of the cell. An evolutionary approach. Saunders Company. 5. Karp, G. 1979. Cell Biology. McGraw Hill Ltd., Japan.
4. Avers. C.J., 1976. CellBiology. Van Nostrand Company, New York.
5. Korenberg. A. 1974. DNA Replication. Dorothy- W.H. Freeman and Company, San Francisco.
6. Hawkins, J.D.1996. Gene Structure and Expression, Cambridge University Press,London.
7. Ajoy Paul, 2011. Text book of Molecular Biology, Book and Allied Private limited,Kolkata.

E- Materials

- http://www.freebookcentre.net/Biology/Cell-Biology-Books.html
- https://books.google.co.in/books/about/Cell_And_Molecular_Biology.html?id=iXeQ1Bi9P7cC

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Core Elective Paper 1
Paper code: DEZO14A **Name of the Paper:** A. AQUACULTURE AND FARM MANAGEMENT
Credit: 3 **Total Hours per Week:** 3

(to Choose either A (or) of B)

Course Objectives

1. To obtain knowledge on cultivable fin and shell fish resources
2. To understand the culture practices of fin and shell fishes and their management practices
3. To know the commercially important candidate species for culture practices
4. To understand the distribution of seaweeds and their culture methods
5. To know the employment opportunities in aquaculture industry

UNIT-I:

Introduction to Aquaculture: Importance of Aquaculture, Global Scenario, Present Status in India - Prospects and scope.

Aquaculture Farms: Site selection, topography, water availability and supply, Soil conditions and quality. Design and layout, structure and constructions.

UNIT II:

Cultivable species and their culture system:

Species selection–Culture of Seaweeds (Gracilaria), Crustaceans (Prawns – Litopenausvannamei & Macrobrachium rosenbergi), Molluscs (Edible Oysters and Pearl Oyster) and Fishes (Seabass & Catla)

UNIT-III:

Survey of seed Resources and Live Feed Production:

Distributions and abundance seed resources of natural system, collection methods and segregation. Artificial breeding under controlled conditions, induced breeding technique, larval rearing, packing and transportation.
Live feed –Culture of Microalgae, Rotifer and Artemia - Feed formulations.

UNIT-IV:

Type of Culture systems and Employment opportunity

Traditional, Extensive, Semi-intensive and Intensive systems, composite fish culture, sewage water fish culture, paddy-cum-fish culture, integrated fish culture, raceway culture, cage, pen and rack culture. Employment opportunities in aquaculture industry.

UNIT-V:

Farm Management:

Water quality management – (temperature, salinity, pH, O_2, nutrients); Feed management;Control of parasites, predators and weeds.
Disease diagnosis: ELISA, Western Blotting

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to …..

- Know what are Aquaculture and their importance?
- Gain knowledge on Global scenario and Indian status
- Understand the prospects and scope of aquaculture
- Acquire knowledge on farm design, structure and construction
- Realize the importance of farm management

2. After studied unit-2, the student will be able to …..

- Acquire knowledge on cultivable species
- Understand the culture system of the species
- To gain the knowledge of culture practice of seaweeds, prawns, molluscs and fishes
- Realize the importance of physico-chemical parameters in the culture
- Gain knowledge on management aspects of farm

3. After studied unit-3, the student will be able to …..

- Understand the seed resource availability in the natural system
- Know the methods of How to collect seeds from wild environment?
- Acquire knowledge on artificial breeding techniques and induced breeding methods
- Gain knowledge on packing and transportation of seeds
- Learn information on the culture of live feed organisms and feed formulations

4. After studied unit-4, the student will be able to …..

- Know the traditional culture system followed in our country
- Understand the intensive culture system practices in our country
- Realize the importance of culture system of fishes
- Why the integrated aqua farming of fishes practiced?
- Understand the employment opportunity in the aquaculture industry

5. After studied unit-5, the student will be able to …..

- Understand the role of environmental factors in the culture system
- Gain knowledge on feed management in the culture system
- Acquire knowledge on Control of parasites and predators in the culture system
- Know the eradication techniques of weeds in the farm
- Procure knowledge on disease diagnosis and the methods used for diagnosis.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To study and learn the importance of aquaculture, global scenario, present status in India - prospects and scope.
- To understand the aquaculture farms:site selection, topography, water availability and supply, soil conditions and quality. design, layout, structure and constructions.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To learn and understand the cultivable species and their culture system: species selection and culture of seaweeds (gracilaria), crustaceans (prawns – litopenaus vannamei & macrobrachium rosenbergi).
- To learn the molluscs (edible oysters and pearl oyster) and fishes (seabass & catla)

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To understand the survey of seed resources and live feed production: distributions and abundance of seed resources of natural system, collection methods and segregation.
- To learn the artificial breeding under controlled conditions, induced breeding technique, larval rearing, packing and transportation.
- To acquire the knowledge of live feed - culture of microalgae, rotifer and artemia - feed formulations.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the type of culture systems and employment opportunity: traditional, extensive, semi-intensive and intensive systems.
- To understand the composite fish culture, sewage water fish culture, paddy-cum-fish culture. To learn astudy, the integrated fish culture, raceway culture, cage, pen and rack culture. employment opportunity in aquaculture industry.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To understand the farm management: water quality management – (temperature, salinity, pH, O_2, nutrients); feed management;
- To study the control of parasites, predators and weeds in the farm.
- To learn the disease diagnosis: elisa, western blotting

Text Books

1. Site selection and Farm Design. 1997. CIBA, Chennai.
2. Principles and Practices of Pond Aquaculture (Aennan, J.F., R.O. Smiterman and G. Tehebenoglosus (eds.), Oregan State University, U.S.A., 1983.
3. Biswas, K.P. A text book of Fish, Fisheries and Technology. Narmada Publishing House, New Delhi.
4. The giant freshwater Prawn *Macrobrachium rosenbergii* (De Man).1990. Kerala Agricultural University, College of Fisheries, Kochi.
5. Freshwater fishes. 1992. Hand Book on Aquafarming. MEPDA, Kochi.
6. Bhamrah, H.S. and Juneja, K. An Introduction to Fishes (K. Balvinder, ed.,). Anmol Publications Pvt. Ltd.,
7. Hand Book on Aquafarming. 1992. Oceanic Cage Culture: Sea Fishes, Shrimp, Lobster and Mud Crab. MPEDA, Kochi.
8. Bhamrah, H.S. and Juneja, K. An Introduction to Fishes (K. Balvinder, ed.,). Anmol Publications Pvt. Ltd.,
9. Biswas, K.P. A text book of Fish, Fisheries and Technology. Narmada Publishing House, New Delhi.
10. Artificial Reproduction – FAO
11. Production of live feeds- FAO
12. Live Feeds - an overview | Science Direct Topics
13. Rajan, R. 2018. Training Manual on Live Feed Production for Marine Finfishes
14. Pillai, T.V.R., 1990. Aquaculture. Principles and Practise. Fishing News Books, Blackwell Publishing Ltd., 575pp.
15. Aquaculture and the Environment (ed. T.V.R. Pillay), 2004. Blackwell Publishing Ltd.,
16. Pillai, T.V.R., 1990. Aquaculture. Principles and Practise. Fishing News Books, Blackwell Publishing Ltd., 575pp.
17. Aquaculture and the Environment (ed. T.V.R. Pillay), 2004. Blackwell Publishing Ltd., Aquaculture Development, Health and Wealth - FAO

Reference Items: books, Journal

1. Jhingran, V. G., 1982. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
2. Principles and Practices of Pond Aquaculture (Aennan, J.F., R.O. Smiterman and G. Tehebenoglosus (eds.), Oregan State University, U.S.A., 1983.
3. Hand Book on Aquafarming.1992. Oceanic Cage Culture: Sea Fishes, Shrimp, Lobster and Mud Crab. MPEDA, Kochi.
4. Site selection and Farm Design. 1997. CIBA, Chennai.
5. The giant freshwater Prawn *Macrobrachiumrosenbergii* (De Man).1990. Kerala Agricultural University, College of Fisheries, Kochi.
6. Freshwater fishes. 1992. Hand Book on Aquafarming. MEPDA, Kochi.
7. Bhamrah,H.S. and Juneja, K.An Introduction to Fishes (K. Balvinder, ed.,). Anmol Publications Pvt. Ltd.,
8. Biswas, K.P. A text book of Fish, Fisheries and Technology. Narmada Publishing House, New Delhi.

9. Aquaculture and the Environment (ed. T.V.R. Pillay), 2004. Blackwell Publishing Ltd.,
10. Aquaculture Journal
11. Aquaculture Research Journal
12. Aquaculture Disease Diagnosis and Health Management. 10.1007/978-81-322-2271-2_23

E- Materials

- www.fao.org-Production of live feeds - FAO
- http://eprints.cmfri.org.in/id/eprint/7787 - Live feed production for marine aquaculture status, problems and prospects
- www.sciencedirect.com - Live Feeds - an overview
  www.researchgate.net › publication › 215799508 - Production and Utilization of Marine Copepods as Live feed for Larval Rearing of Tiger Shrimp *Penaeus monodon* with Special Emphasis on Astaxanthin.
- www.researchgate.net › publication › 261994048 - Induced_Breeding

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Core Elective Paper 1
Paper code: DEZO14B **Name of the Paper:** B. BIOSTATISTICS AND BIOINFORMATICS
Credit: 3 **Total Hours per Week:** 3

Course Objectives

- To understand the basic concepts of biostatistics and bioinformatics.
- To solve biological problems through computational management.

UNIT-I: INFERENTIAL STATISTICS

Introduction: Definition of statistical population and sample in biological studies. Variables: qualitative and quantitative, Discrete and continuous.
Probability; Basic principles - apriori and aposteriori probabilities - addition and multiplication rules of probability. Conditional probability. Theoretical distribution, normal binomial and Poisson - application (computation required).

UNIT-II

Hypothesis testing - Null hypothesis - levels of significance - degrees of freedom - type I and type II errors.
Test of significance: Chi-square test for goodness of fit, homogeneity and association between attributes (Problem relating to Genetics, patterns of distribution etc. to be worked out.
Test of significance for large and small samples - comparison of sample mean with population mean comparison of two - sample (computation required)

UNIT-III: CORRELATION AND REGRESSION

Correlation: definition and types - simple, multiple -partial, linear, nonlinear, mutual, cause and effect etc. Uses of scatter diagram and correlation graph in the study of correlation between two variables. Computation of Karl Pearson's co-efficient of correlation - testing its significance, Interpretation.
Regression analysis, derivation of regression equation between two variable regression coefficient - construction of regression lines - properties - application. ANOVA
Population Statistics -Vital statistics - natality and morality rates. Population estimation - population growth.

UNIT-IV: BASIC BIOINFORMATICS

Bioinformatics - Biological /Specialized Database - Servers for Bioinformatics (NCBI, EBI, Genoment) Virtual Library - Data mining - Data Warehousing - Searching techniques - Genomics - Proteomics.

UNIT-V: ALGORITHM IN BIOINFORMATICS

Algorithm and tools sequence analysis - Similarity Search - Genetic algorithm - Gene finding - Protein prediction - Biomolecular visualization - Phylogenetic analysis - Drug designing.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to …..

- Compute basic probabilities as used in statistical applications by demonstrating the elementary rules of probability
- prove an understanding of discrete probability distributions by assembling a discrete probability distribution
- Solving binomial distribution problems that require the use of a discrete binomial distribution
- Planning and proposing the uses of the Poisson distribution for solving problems

2. After studied unit-2, the student will be able to …..

- Show a working knowledge of sampling, sampling distributions, and confidence intervals by constructing a sampling distribution of the sample mean.
- The use and application of hypothesis testing
- Understand the applications of Chi-square

3. After studied unit-3, the student will be able to …..

- Understand how to apply linear regression to analyze problems
- Understand how to design an experiment by ANOVA.

4. After studied unit-4, the student will be able to …..

- Understand the basic concepts of Bioinformatics and its significance in Biological data analysis.
- Understand various techniques used in genomics and proteomics

5. After studied unit-5, the student will be able to …..

- Understandthe various techniques, algorithms and tools used for Phylogenetic Analysis

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To study about the inferential statistics.
- To learn the statistical population and sample in biological studies.
- To understand the Variables, qualitative, quantitative and Discrete and continuous.
- To study the probability and basic principles.
- To study the apriori and aposteriori probabilities and addition and multiplication rules of probability.
- To understand the Conditional probability.
- To learn the Theoretical distribution, normal binomial and Poisson - application (computation required).

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To acquire the knowledgehypothesis testing and null hypothesis.
- To study the levels of significance, degrees of freedom and type I and type II errors.
- To learn and understand the Test of significance: Chi-square test for goodness of fit, homogeneity and association between attributes (Problem relating to Genetics, patterns of distribution,
- To understand and learn the Test of significance for large and small samples and comparison of sample mean with population mean comparison of two - sample (computation required)

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To study the correlation and types of simple, multiple -partial, linear, nonlinear, mutual, cause and effect etc.
- To understand the graphs and uses of scatter diagram and correlation graph in the study of correlation between two variables.
- To learn the Computation of Karl Pearson's co-efficient of correlation.
- To study the testing its significance, Interpretation.
- To learn and understand the regression analysis, derivation of regression equation between two variable regression coefficient.
- To learn the construction of regression lines - properties - application.
- To understand and study the ANOVA.
- To learn the Population Statistics and Vital statistics.
- To learn the natality and morality rates. Population estimation - population growth.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the basic concepts of bioinformatics.
- To learn and study the Biological /Specialized Database.
- To understand and study the Servers for Bioinformatics (NCBI, EBI, Genoment) Virtual Library Data mining - Data Warehousing.
- To learn the Searching techniques.
- To study the Genomics and Proteomics.

Unit-5: (50 to 100 contents)

- To understandthe algorithm in bioinformatics.
- To learn the Algorithm and tools sequence analysis.
- To study the Similarity Search,Genetic algorithm, Gene finding, Protein prediction and Biomolecular visualization
- To learn the Phylogenetic analysis and Drug designing.

Text Books

1. Gupta, S.P. 1988. An easy approach to statistics. Chand & Co., New Delhi.
2. Pillai, R.S.N. and Bagawathi, V.2005 Statistics. S. Chand & Co.Ltd, New Delhi.
3. Mahajan, B.K. 1984. Methods in Biostatistics for Medical students and researchWorkers. Smt. Indu Mahajan, New Delhi.
4. Westhead, D.R., Parish, J.H. and Tugman, R.M. 2003 Bioinformatics. Viva Books Pvt. Ltd., New Delhi
5. Arthur, M.L. 2003. Introduction to Bioinformatics Oxford University Press, New Delhi.
6. Higggins D.and Taylor, W. 2000 Bioinformatics: Sequence, Structure and Databanks. Oxford University Press, New Delhi.

Reference Items: books, Journal

1. Milton, J.S 1992 Statistical Methods in Biological and Health Science. McGraw-Hill Inc, New York.
2. Schefler, W.C. 1963 Statistics for biological sciences. Addition - Wesely Publication Co., London.
3. Snedecor, G. Wand Cocham, W. G. 1967 Statistical Methods. Oxford Publication Co., New Delhi.
4. Spiegel, M.R. 1981 Theory and problems of statistics, Schaum's Outline Series McGraw - Hill International Book Co., Singapore.
5. Stansfield,W.O. 1984 Theory and Problems of genetics(including 600 problem) Schaum's outline series.McGraw - Hill Book, Co., New York.
6. Sokal,R.R.and Rohlf, F .J 1969 Biometry.The Principles and Practice of Statistics in Biological Research.W.H.Freman and Co.,San Francisco.
7. Durbin, R., Eddy, S.R., Krogh, A. and Mitchison, G. 1998. Biological sequence Analysis.Cambridge University Press, Cambridge, U.K.
8. Baxevanis, A. and Ouellette, B.F. 1998. Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley Interscience, Hoboken, New Jersey, USA.
9. Arthur M. Lesk. 2006. Introduction to Protein structure. Oxford University Press, New Delhi.

E- Materials

- http://www.freebookcentre.net/Biology/BioInformatics-Books.html
- http://www.biostat.jhsph.edu/~iruczins/teaching/misc/notes.bio.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Open Elective (Non Major) Paper 1
Paper code: DOZO15A **Name of the Paper:** A. APICULTURE (BEE KEEPING)
Credit: 3 **Total Hours per Week:** 3

(to Choose either A or B)

Course Objectives

1. To provide direction of higher education towards social utility (benefit).
2. To equip the students with latest technologies in emerging area.
3. To extend the knowledge from laboratory to field.
4. To provide skills and job oriented techniques to the students.
5. To understand the basic life cycle of the honeybee.
6. Learn to manage the beehives for honey production and pollination.

Unit I

Introduction of Modern bee keeping- Importance of beekeeping - Scope of beekeeping - Bee species- Cast differentiation, Colony organization - Division of labor in honeybee - Life cycle of honeybee and nuptial flight

Unit II

Scientific bee keeping- Beekeeping equipments- Equipments for improving efficiency of honeybees - Equipments for improving efficiency of bee's keepers - Equipments for improving hygienic conditions - Methods of Swarm Capturing- Capturing a Swarm from a tree branch - Capturing a Swarm from Ground - Inspection and Handling the Colony - Hiving by dividing an established colony - Establishment, Seasonal Management of apiary and inspection of bee colonies.

Unit III

Apiculture in Agriculture -Bee plants and floral calendar- Importance and qualities of good bee flora - Pollination, Need of bee pollination - Management of honeybees for pollination - Migratory beekeeping.

Unit IV

Honeybee products -- Honey- Its constituents, methods of collection and uses - Importance of other bee products to mankind - Pollen –Method of collection, constituents, uses - Royal jelly- Method of collection, constituents, uses - Propolis - Method of collection, constituents, uses - Bee wax- Method of collection, constituents, uses - Bee venom- Method of collection, constituents, uses.

Unit V

Problems of beekeeping industries, Natural Climate Condition, natural enemies, pest and diseases, human activities and Apiary and Hive Hygiene.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

- Identify different types of species.
- Ascertain different roles played in different species of bees.
- Ascertain importance of economic aspects of honeybees.

2. After studied unit-2, the student will be able to

- Identify the need of improving efficiency of bee keepers.
- Understanding the biology and the behavior.
- Manage insect's diseases and nuisances in beehive.

3. After studied unit-3, the student will be able to

- Identify common Indian tests stored in combs built by bees.
- Enable to learn the management techniques.

4. After studied unit-4, the student will be able to

- Learn and understand the local skills, knowledge and traditions.
- Acquire knowledge of integration into forming system.
- To learn different types of products and its uses.

5. After studied unit-5, the student will be able to

- To Acquire the knowledge of beekeeping industries.
- To learn and understand the natural climate condition, natural enemies, pest and diseases, human activities.
- To study and learn the apiary and hive hygiene.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Understand the general discipline of bees.
- Identify different species of bees.
- Understand the different cast of bees and their role in colony.
- Get acquainted in the communication skill methods used to buy bees.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Understand the factors to be considered for site selection.
- Selective sites for hive installation.
- Perform inspection of colonies.
- Manage the colonies of beehive

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Identifying different types of floral calendar.
- Understand the methods of bee pollination.
- Acquiring knowledge about migratory.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Extract honey using appropriate procedure.
- Understanding of harvesting royal jelly, propolis, pollen and bee venom.
- Understand the methods of harvesting honey.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To Acquire the knowledge of beekeeping industries.
- To learn the natural climate condition, natural enemies, pest and diseases, humanactivities.
- To study the apiary and hive hygiene.

Text Books

1) Introduction to disease of bee –Bailey, L
2) World of honeybee –Butter C. G.
3) Beekeeping in India –Sardar Sing (ICAR**)**

Reference Items: books, Journal

1) Introduction to disease of bee –Bailey, L
2) World of honeybee –Butter C. G.
3) Beekeeping in India –Sardar Sing (ICAR**)**
4) The Principle of Insect Physiology-Wigglesworth, V.S.
5) Applied Zoology- B. B. Waykar, A. Y. Mahajan, B. C. More. (Prashant Publication Jalgaon

E - Materials

- http://www.digitalbookindex.org/_search/search010agriculturebeekeepinga.asp
- http://library.uniteddiversity.coop/Beekeeping/A_Practical_Manual_of_Beekeeping.pdf
- https://thebeeyard.org/ebooks/

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: I **Paper type:** Open Elective (Non Major) Paper 1
Paper code: DOZO15B **Name of the Paper:** B. PUBLIC HEALTH AND HYGIENE
Credit: 3 **Total Hours per Week:** 3

Course Objectives

- To impart awareness on public health, Hygiene and diseases. To educate and emphasize on preventive measures of diseases. To create knowledge on Health Education.

UNIT – I

Scope of Public Health and Hygiene – Nutrition and health – classification of foods – Balanced Diet – malnutrition - Nutritional deficiencies – Vitamin deficiencies. Nutritional requirements of special groups.

UNIT – II

Environment and Health Hazards – Environmental degradation – pollution and associated health Hazards – Health problems due to industrializations – Hospital waste management.

UNIT – III

Communicable diseases and their control measures such as Measles, Polio, Chikungunya, Rabies, Plague, Leprosy and AIDS.

UNIT – IV

Non – communicable diseases and their preventive measures such as Hypertension, Coronary Heart Diseases, Stroke, Diabetes, Obesity and Mental ill – Health. Alcoholism and drug dependence.

UNIT – V

Health Education and Health programmes in India – WHO programmes – government and voluntary Organizations and their health service – Precautions first Aid and awareness on sporadic diseases.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

- Describe under connected relationships among physical social and environmental healthand diseases.
- Students comes to know the about the role of multiple determination of health acrossdiverse population.

2. After studied unit-2, the student will be able to

- Describe the environmental pollution and health hazards.
- To study and able to understand hospital applications, health problems due toindustrialization.

3. After studied unit-3, the student will be able to understand

- The major themes for life skill based hygiene education.
- Student acquire knowledge about communicable diseases.

4. After studied unit-4, the student will be able to understand

- How to take precautionary steps for communicable diseases and sporadic diseases.
- Student can able to learn the demerit's and alcoholism and drug dependence.
- To learn the remedy for obesity mental illness and health problems.

5. After studied unit-5, the student will be able to understand

- To know the government and voluntary organizations and their health service of India.

Understand the health programme in India.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents)

- To give a better understanding about yourself.
- Understand the nutrition, health, nourishment of children.
- To acquire the knowledge about nutritional requirements, vitamins deficiencies, and balanced diet.

Unit-2: (50 to 100 contents)

- To understand the pollution and health hazards.
- By learning the health problems and due to industrialization.
- To understand the Hospital waste management.

Unit-3: (50 to 100 contents)

- By learning the communicable diseases and control measures.
- To know about the disease of the Measles, Polio, Chikungunya, Rabies, etc.
- To know completely about, HIV and Leprosy.

Unit-4: (50 to 100 contents)

- By learning the Non-communicable diseases and preventive measures.
- Learning about obesity and mental ill health problem.
- Understand about, alcoholism and drug dependence.

Unit-5: (50 to 100 contents)

- To thoroughly know the WHO programmes.
- To study the government service helpline to create awareness on alcoholism and drug dependence.

Text Books

- Park and Park, 1995: Text book of preventive and social medicine – Banarsidas Bhanot Publ. jodhpur- India.
- Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.
- Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology – S. Chand & co. Publ. New Delhi– India.

Reference Items: books, Journal

- Park and Park, 1995: Text book of preventive and social medicine – Banarsidas Bhanot Publ. jodhpur- India.
- Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.
- Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology – S. Chand & co. Publ. New Delhi– India.

E-Materials

- http://www.digitalbookindex.org/_search/search010homeecohygienesanitationa.asp

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Core Paper 4
Paper code: DZO21 **Name of the Paper:** GENETICS
Credit: 4 **Total Hours per Week:** 4

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Course Objectives

1. To understand the fine structure of genetic materials.
2. To acquire the knowledge of Regulation of gene action.
3. To know the chromosomal basis of genetic disorders.
4. To understand the development and differentiation of genes.
5. To know the importance of population genetics.
6. To understand the nuances of genetic engineering and applied genetics.

UNIT-I: MOLECULAR STRUCTURE OF GENETIC MATERIAL

Molecular structure of DNA and RNA - Replication, theories, Gene concept - One gene one polypeptide concept.

Identification of DNA and RNA as the genetic material.

Microbial Genetics - Conjugation, transformation and transduction and Sexduction.
Chromosome mapping in prokaryotes (Virus, Bacteria), Gene mapping by human pedigree analysis, synteny.

UNIT-II: REGULATION OF GENE ACTION

Enzyme regulation of gene action.Gene regulation of gene action - Operon concept - GAL and LAC Operon system. Evidence of regulation of gene action.

Genes and metabolism.Inborn errors of metabolism in Man(With reference to protein, carbohydrates, Lipid and nucleic acid).

UNIT-III: CHOROMOSOME AND GENETICS DISODERS

Applied Genetics - Application of genetics in animal breeding. Application of genetics in Crime and Law - DNA fingerprinting, Genetic basis of inteiligence. Studies on Twins.
Sex chromosomes. Dosage compensation- X inactivation. Genomic imprinting.
Human Genetics: Variations in karotypes (autosomal and sex chromosomal) with special reference to Klinfelters, Turners and Down's syndromes in man. Genetic counselling - Objectives, ethics and principles.

UNIT-IV: GENES IN DEVELOPMENT, RADIATION GENETICS AND POPULATIONGENETICS

Genes in development and differentiation Mechansim of chromosomal breakage - physical chemical and biological factors or agents. Mutagens and mutagenesis and carcinogenesis – genetics effects of radiation.
Population genetics:
Population and gene pool. Hardy Weinberg Law-Genetic equilibrium.
Calculation of gene frequencies for Autosomal (Complete dominance, codominance and multiple alleles) and sex linked genes. Factors affecting Hardy Weinberg equilibrium.

UNIT-V: GENETIC ENGINEERING AND APPLIED GENETICS

Genetic Engineering – Techniques of genomic sequencing - Recombinant DNA techniques. Applications of Recombinant DNA technology.

Applied Genetics - Application of genetics in animal breeding. Application of genetics in Crime and Law - DNA fingerprinting, Genetic basis of intelligence. Studies on Twins.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

- Describe the structure of nucleic acid and polypeptide concept.
- Tthey can able to understand the bacterial genetics and family history.

2. After studied unit-2, the student will be able to

- Discuss the mechanisms of genetic regulation.
- To understand the knowledge of operon systems and metabolic errors.

3.After studied unit-3, the student will be able to

- Describe the mutation of dosage compensation and imprinting.
- To study the syndromes of sex & autosomal chromosomes in human.

4.After studied unit-4, the student will be able to

- To understand the genes and development, chromosomal breakage , mutagenesis and carcinogenesis
- Understand the insight into the mathematical, statistical and computational basis of genetic analysis.

5.After studied unit-5, the student will be able to

- To analyse the function of applied genetic research in technology, nature, and society.
- They access the impact of genomics, proteomics and bioinformatics on society.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To understand molecular structure of genetic material.
- To acquire the knowledge of replication theories identification.
- To Understand the principles of gene mapping mechanisms.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To Study the enzyme regulation of gene action.
- To enable the students to understand the operon concepts, metabolic disorders.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To understand how the mutation can affect gene dosage, X inactivation chromosomal aberrations.
- To discuss the human genome structure in the context of physiological function and disease.
- To analyse epigenetic modification and imprinting in the role of disease.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the development of genes and breakage, to understand the knowledge of radiation procedure and effects of radiations.
- Describing population structure in terms of genetic variation.
- Evaluating the principles to describe the genetics profile of populations as specified by Hardy Weinberg Law.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Analyzing the function of applied genetic research in technology, nature, and society.
- Assessing the impact of genomics, proteomics and bioinformatics on society.
- Identifying ethical issues related to gene manipulation and analysis.

Text Books

1. Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand & Co, New Delhi – 110 055.580pp.
2. Verma, P.S. and V.K. Agarwal, 2009.9th edition, S. Chand & Co, New Delhi.
3. S.C. Rastogi Biotechnology, Principles and Applications 2007 Narosa Publishing house, Pvt.Ltd.
4. Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand & Co., New Delhi .
5. Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics,Jaiprakash Nath and Company., Meerut.

Reference Items: books, Journal

1. Watson. J.D. Hopkins, N.H.., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1987 Molecular Biology of the Gene. W.A. Benjamin/Cummings Co., New York.
2. Sinnot. E.W., Dunn. L.C., Dobzhansky, T.H. 1973. Principles of Genetics. McGraw Hill Co., New Delhi.
3. Daniel L. Hartl. 1994. Geneties. Jones and Barflaff Publishing, Boston.
4. Lewin, B. 2000. Genes VII. Oxford University Press, New York.
5. Ayala, F. I. and Kieger, J.A. Jr., 1980, Modern Genetics. The Benjamin Publishing Co. London,
6. Goodenough, U. 1984. Genetics. Saundes College Publishing Co., London.
7. Curs Sten 1973 Principles of Human Genetics. W.H. Freeman and Co., New York.
8. Jenking, J.B. 1983. Human Geneties. The Benjamin Cummings Publishing& Co., Londan.
9. Market, C.L. & Ursprung, 1973. Development Genetics, Prentice Hall.
10. Gardner E.J. Simmons, M.J. and Snustad, D.P.1991 John Wiley & Sons, New York.

E- Materials

- http://www.agrimoon.com/principles-of-genetic-pdf-book/
- http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl_Jones_Genetics.pdf
- http://gsi.semmelweis.hu/files/ebook/Genetics%20genomics_en.pdf
- http://www.freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html
- http://web.iitd.ac.in/~amittal/SBL101_Essentials_of_Genetics.pdf
- https://epdf.pub/principles-of-genetics.html

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Core Paper 5
Paper code: DZO22 **Name of the Paper:** ENVIRONMENTAL BIOLOGY
Credit: 4 **Total Hours per Week:** 4

Course Objectives

- To generate up-to-date knowledge on environmental conservation and management through a comprehensive understanding of the components of ecosystem, biological cycles, habitat ecology, resource ecology, pollution and its management.

UNIT-I:
PRINCIPAL AND SCOPE OF ENVIRONMENTAL BIOLOGY

Ecology and Environment: an introduction - Earth, Man and Environment Relationship - Importance of biological cycles in the environment. Principal and Scope of environmental biology – Environmental health, education and Public understanding. Natural and Man-made ecosystem, Marine environment an analysis. Food chain and food web, Energy flow - Trophic structure and levels – Pyramids, ecological efficiencies. Classification of ecosystem: Fresh water, marine, estuarine and terrestrial ecosystems. Primary and secondary production – definition, measurement of productivity in terrestrial and aquatic pathways in ecosystem; Basic laws of energy flow; energy flow models, nature and flux of energy through communities. Influence of competition, predation and disturbances - Community succession - homeostasis.

UNIT-II:
COMMUNITY, POPULATION AND BIOLOGICAL CYCLES

Community ecology: types of community, succession process, competition and coexistence, types of interactions: predation, parasitism, antibiosis, commensalism, cooperation and mutualism, population growth. Social and Economic impact of environmental policies. Classification of biomass, major biotic elements of each biome and their characteristics, Community succession and climax stage.

Population ecology: Structure and distribution of population - Growth curves - Groups, Natality, Mortality - Density indices, Life study tables - factors affecting population growth - Carrying capacity. Fluctuation and regulation Population regulation and human population control. Complete and incomplete biogeochemical cycles - Sedimentary cycle - Recycle pathway of elements - Cycling of non - essential and organic nutrients.

UNIT-III:
HABITAT AND RESOURCES ECOLOGY

Biomass, Adaptations with reference to physico - chemical features of environment of terrestrial, freshwater, estuarine, marine habitats. Unique features of Coral Reefs, Seaweeds, Sea grasses and Mangroves. Renewable and non - renewable resources - animal resources. Conventional and non - conventional energy sources. Natural resources and their conservation.

UNIT-IV:
ENVIRONMENTAL CONSERVATION, DISASTER AND MANAGEMENT

Principles of conservation - Rain water harvesting - Soil health and fauna inputs in agriculture Biosphere reserves - wildlife conservation, forest conservation and management. Biodiversity - Germplasm conservation and cryopreservation. Social forestry - tribal welfare. Fossil fuel and the environments. Environmental Disaster and Management: Effect of climate change, global warming and its effect on living organisms – Tsunami, Cyclone Earth Quake, Flood: Causes, consequences, control and management. War and its impact on environment. Remediation and reclamation of the Environment-Role of microbes in bioremediation.

UNIT-V:
POLLUTION AND MANAGEMENT

Environmental Pollution: Types of environmental pollution and their biological effects. Air, soil, noise, Radioactive and water pollution - causes, effects and control. Hazardous solid waste. Industrial disaster and pollution - Case studies-chemical Industries - Pesticide Industries - Bhopal Disaster, Chernobyl accident, Love canal Disaster, Exxon Oil Disaster, Impact and Remedial Measures - Labeling - Laws and Regulations - Pollution Control Board. Thermal Pollution, Marine Pollution – Biological indicators and their role in environmental monitoring. Environmental education and awareness - Organizations involved in environmental protection - Principles of conservation: Application of ecological principles - germplasm conservation. Global Environmental Issues and Human Health Environmental Impact Assesment, Policy and Laws.

Course Out Comes (five outcomes for each units should be mentioned)

1. **After studied unit-1, the student will be able to understand**
   - Asses necessary scientific concepts and data.
   - They establish integral cultural context.
2. **After studied unit-2, the student will be able to understand**
   - Acquire the knowledge and still to view the self and social situation in the ecological and cultural and social context.
   - Acquire the knowledge skill necessary to achieve and understanding environmentalproblems.
3. **After studied unit-3, the student will be able to understand**
   - Appreciate attributes of natural resources and management.
   - Appreciate the ideas of unsustainable development.
4. **After studied unit-4, the student will be able to understand**
   - Competent in basic forest management principles and evaluation of forest stands forhealth, wild life habitat.
   - Identifying soli type how they are formed and ways to modify soil structure and improvedsoil fertility.
5. **After studied unit-5, the student will be able to understand list out major places and**
   - Describing the effects of air pollution and their management.
   - Know about the global environmental issues.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Environmental studies will be able to recognize the physical, chemical, and biological components of earth system.
- Understanding the classification of Ecosystem.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Understand the social and economic impact of the environment.
- Understand the detailed explanation of population and distribution.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Study the various habitats of environments.
- Acquire knowledge in renewable and non-renewable sources.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Studying the disaster management.
- Understand the definition of Tsunami, Cyclone, earth quake and how it occurs.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Understand the types of pollution causative factors, and control.
- Understand the importance of the non-polluting sources of energy to the energy.

Text Books

1. Odum F.P. 1983 Basic Ecology, Saundrs College Publication 613 papers.
2. Odum, Eugene D. 2004 Fundamental of ecology.Brooks college 5th edition 624 pages.
3. Rastogi V.B and Jayaraj.M.S Animal Ecology and distribution of animals.

Reference Items: books, Journal

1. Alpha Soli, I. Arceivala.1998. Wastewater treatment for pollution control - Second Ed. Tata McGraw Hill Publication Company Ltd., New Delhi.
2. Asthana, D.K. and Asthana, M.2001. Environmental Problems and Solutions. S. Chand and Co., New Delhi.
3. Bandopadhyay, J.1985. India's Environment Crisis and response. Nataraj Publishers,Dehra Dun.
4. Berwer. A.1988.The Science of ecology. Saunder's college publishing.
5. Cain ML, Bowman WD and Hacker SD (2011) Ecology, Sinauer Associates Publishers.
6. Clark RS (2001) Marine Pollution, Clanderson Press Oxford, New York
7. Henry M and Stevens H (2009) A Primer of Ecology with R, Springer.
8. Ismail, S.A.1997. Vermicology, Biology of Earthworms. Orient Longman, Chennai.
9. Krebs CJ (2008) Ecology: The Experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings.
10. Kudesia, V.P and Ritu Kudesia (1992) Water Pollution, Pragati Prakashan Publication, Meerut.14
11. Kurnarasawmy, K., A. Alagappa Moses and M. Vasanthy (2004) Environmental Studies (A Text Book for All Under Graduate Students) Bharathidasan University Publications.
12. Molles MC (2013) Ecology: Concepts and Applications, McGraw-Hill Publishers, UK
13. Odum. E.P. 1996 Fundamentals of Ecology. Nataraj Publishers, Dehra Dun.
14. Odum EP (2008) Fundamentals of Ecology, Cengage Learning (Thompson), USA.
15. Rao, M. N and H.V.N. Rao (1993) Air Pollution, Tata McGraw -Hill Publishing Company Limited. New Delhi.

16. Sawyer, C. N., P.L McCarty and G.F. Perkin (1994) Chemistry for Environmental Engineers, "Edition. McGraw-Hill.
17. Sharma, B.K and H.Kaur (1994) Soil and Noise Pollution. God Publishing House, Meerut.
18. Smith TM and Smith RL (2008) Elements of Ecology (7th Edition), Benjamin Cummings.
19. Smith, R.L.1986. Elements of Ecology. Harpet and Row Publishers, New York.
20. Stiling P (2014) Ecology, McGraw-Hill Publishers, UK
21. Trivedi, P.R.and Gurdeepraj, K. 1992. Environmental Biology. Akashdeep Publishing House New Delhi
22. Swarup, R.,Mishra, S.N. and Jauhari,V.P. 1992. Encyclopodia of Ecology. Mittal Publications, New Delhi.

E-Materials

- https://open.umn.edu/opentextbooks/textbooks/environmental-biology.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Core Paper 6
Paper code: DZO23 **Name of the Paper:** BIOTECHNOLOGY
Credit: 4 **Total Hours per Week:** 4

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Course Objectives

- To familiarize the use of the data and techniques in Biotechnology in living organisms. To find solution of problems concerning human activities including agriculture, medical treatment, industry and environment.

UNIT-I:

GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY

Gene cloning - the basic steps - various types of restriction enzymes - ligase linkers and adaptors - c DNA - transformation - Selection of recombinants.

Gene probe - Molecular finger printing (DNA finger printing) - RFLP - the PCR techniques - Genomic library - Blotting techniques - Southern blotting - Northern blotting - Western blotting

UNIT-II:

CLONING VECTORS

Bacterial plasmid vectors PBR 322 and PUL 19 – Bacteriophage vectors – phage λ –phage M13 - cosmids – phagemids – yeast plasmid vectors – Y1p, yEp – Transposons – shuttle vectors.

UNIT-III:

ANIMAL BIOTECHNOLOGY

In vitro fertilization (IVF) technology - Dolly - embryo transfer in human.

Human gene therapy – stem cell therapy – genes for vaccines – legal and ethical issues in biotechnology.

UNIT-IV:

MICROBIAL BIOTECHNOLOGY

Fermentation - bioreactor - Microbials products - Primary & Secondary Metabolites - Biopolymers, Biopesticides and Biofertilizers. Biological control – microbial inoculants.

UNTI-V:

ENVIONMENTAL BIOTECHNOLOGY AND APPLICATIONS OF BIOTECHNOLOGY

Bioremediation - bioremediation of hydrocarbons - Industrial wastes - Heavy metals – Xenobiotics - bioleaching - biomining - biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) - GM foods. Biotechnology & biosafety – IPR – Patent.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand

- The tools and strategies used in genetic engineering.
- The applications of recombinant DNA technology and genetic engineering.

2. After studied unit-2, the student will be able to understand

- The Bacterial plasmid vectors PBR 322 and PUL 19.
- Bacteriophage vectors

3. After studied unit-3, the student will be able to understand

- Biotechnological techniques like embryo transfer and in vitro fertilization

4. After studied unit-4, the student will be able to understand

- Critically evaluate the role of micro-organisms in specific biotechnological processes

5. After studied unit-5, the student will be able to understand

- The applications of biotechnology in agriculture, medicine and food science.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To study about the gene cloning techniques
- To learn the various type of restriction enzyme technology.
- To study the ligase linker and adaptors.
- To study the c DNA - transformation - Selection of recombinants.
- To understand the Gene probe - molecular finger printing (DNA finger printing), RFLP Techniques.
- To learn the genomic library.
- To learn the PCR blotting techniques.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To acquire the knowledge of Cloning Vectors such as bacterial plasmid vectors PBR 322 and PUL 19.
- To study the bacteriophage vectors – phage λ –phage m13 - cosmids – phagemids.
- To study Yeast plasmid vectors – y1p, yep – transposons – shuttle vectors.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To understanding thoroughly the Animal biotechnology like In vitro fertilization (IVF) technology - Dolly - embryo transfer in human.
- To understand the human gene therapy, stem cell therapy and gene vaccines.
- To learn the legal and ethical issues in biotechnology.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To study the fermentation and bioreactor techniques.
- To understand the microbial product of Primary and Secondary Metabolites.
- To learn the Bio-polymers, Bio-pesticides and Bio-fertilizers.
- Attaining knowledge in Biological control – microbial inoculants.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To understand the environmental and applications of biotechnology.
- To study the Bioremediation of hydrocarbons.
- To learn the Industrial wastes and Heavy metals.
- To study the Xenobiotics, bioleaching, biomining, biofuels.
- To learn the applications of biotechnology in agriculture, medicine and food science.
- To study the Genetically modified organism (GMO'S) - GM foods.
- To understand the Biotechnology & biosafety – IPR – Patent.

Text Books

1.Gupta, P.K. 2004. Biotechnology and Genomics. Rastogi Publications, Meerut.

2.R.C.Dubey 2001 A text book of biotechnology. Rajendra Ravindra Printer. New Delhi.

3.Chopra, V.L. and Nanin, A.1992. Genetic Engineering and Biotechnology.

4.Oxford and I BH Publishing Co., New Delhi.

Reference Items: books, Journal

1. Purohit, S.S. and S.K.Mathur. 1999. Biotechnology Fundamentals and Application. Agro Botanica, New Delhi.
2. Alan Scragg. 1999. Environmental Biotechnoogy, Longman Publication.
3. T.A. Brown 2004 Gene cloning and DNA analysis. Blackwell Science, Osney Mead, Oxford.
4. Dawson, M.T., Powell.R, and Gannon, F. 1996. Gene Technology. Bios Scientific Publishers.
5. Marx, J.L.1989 A Revolution in Biotechnology. Cambridge University, Press, Oxford.
6. Old, R.W.and Primrose, S.B.1985 Principlesof Gene Manipulations. An introduction to Genetic Engineering. Oxford Blackwell Publishers, London.
7. Winnacker, E.L. 2003. From Genes to Clones. Panima Publishing Corporation, New Delhi.
8. Das, H.K. 2004. Text Book of Biotechnology. Wiley Dreamtech India Pvt. Ltd., New Delhi.

E.Materials

- https://www.ebooks.com/en-us/subjects/science-biotechnology-ebooks/114/
- https://library.umac.mo/ebooks/b2805507x.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Core Practical 1
Paper code: DPZO26 **Name of the Paper:** LIFE AND DIVERSITY OF INVERTEBRATES AND CHORDATES AND CELLAND MOLECULAR BIOLOGY
Credit: 4 **Total Hours per Week:** 9

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INVERTEBRATA (Slides / Specimens / Xerox)

1. Identification and study of selected Protozoans and Helminthes of medical importance. (Any Two)
2. Identification and study of sections of available animals from Cnidaria, Aschelminthes and Annelida to understand the evolution of /different types of coelom.
3. Identification and study of larval forms from all major phyla of Invertebrates. (Any Four)
4. Identification and study of types minor phyla.
5. Identification and study of Invertebrate fossils
6. Dissection of digestive system of any insect, pila/sepia
7. Dissection of nervous system of Prawn, any insect, Pila/Sepia
8. Dissection of reproductive system of any insect.
9. Mounting of:
    a. Appendages or Prawn
    b. Radula of Pila
    c. Sting of Honeybee
    d. Pedicellaria of Sea urchin - Demonstration
    e. Aristotle's lantern of sea urchin - Demonstration
10. Study of prepared slides of mouth part of Honey bee, Housefly, Mosquito, Bed bug and Butterfly to relate structure and function.

CHORDATA (Slides / Specimens / Xerox)

1. Study of the following specimen to bring out their affinities:

a. Amphioxus

b. Balanogossus

c. Ascidian

d. Peteromyzon

2. Study of the following specimens with reference to their adaptive features for their respective modes of life

a. Echeneis

b. Ichthyophis / Uraeotyphlus

c. Hyla

d. Draco

e. Pigeon

f. Bat

3. Study of the following skull types with reference to jaw suspensions

a. Fish

b. Frog

c. Calotes

d. Snake

e. Rat/Rabbit

4. Dissection of aortic arches in Teleost

5. Dissection and display of IX^{th} and X^{th} Cranial nerves of cat fish

6. Demonstration of portal system of Rat

CELL AND MOLECULAR BIOLOGY

CYTOLOGICAL TECHNIQUES

Micrometry – measurements using ocular and stage micrometers – measurements of cell from any prepared slide. Vital staining – Buccal smear stained with Methylene blue. CHROMOSOME Chromosome preparation – procedure. Preparation of meiotic chromosomes from any fish – (demonstration) MOLECULAR BIOLOGY TECHNIQUES (Demonstration only) Centrifuge, Isolation of DNA from Liver – Isolation of RNA – Denaturation of DNA – measurement of spectrophotometry – Isolation and analysis of proteins – electrophoresis.

Semester: II **Paper type:** Core Practical 11
Paper code: DPZO27 **Name of the Paper:** GENETICS, ENVIRONMENTAL BIOLOGY AND BIOTECHNOLOGY
Credit: 4 **Total Hours per Week:** 10

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GENETICS

1. Preparation of culture medium Culture of Drosophila. Methods of maintenance. Sex identification. Identification of four mutants.
2. Identification of blood groups A, B, ABO and Rh
3. Mounting of salivary glands of Chironomus larva. Analysis of banding pattern
4. Preparation of Buccal smear to show squamous epithelial cells.
5. Karyotyping using human metaphase chromosome plates (Giemsa stained). Identification of syndromes (Down, Klinefelter and Turner) from Karyotype Photographs showing clinical features of each syndrome case.
6. Problems relating to the application of binominal theorem in population genetics with reference to P.T.C. and Earlobe attachment.

ENVIRONMENTAL BIOLOGY

1. Estimation of Aquatic - Primary productivity - Dark and Light bottle.
2. Estimation of Dissolved oxygen, Salinity, Nitrites, Phosphates, Calcium, Silicates and Alkalinity in water samples.
3. Analysis of Industrial effluent - TDS, TSS, BOD, (COD - Demonstration).
4. Collection, isolation and identification of Plankton.
5. Study of sandy, muddy and rocky shore fauna with special reference to the adaptation to the environment.
6. Animal Association - parasitism, mutualism and commensalisms.

8. An educational tour to:-

a). Drinking water treatment plant.

b). Effluent treatment plant

c). Sewage treatment plant.

d). Sandy, Muddy and Rocky Shores.

BIOTECHNOLOGY

Visit to Biotechnology Laboratory to observe the demonstration of,

1. Tissue culture.
2. Titration and preparation of virulent phage.
3. Isolation of DNA from the plasmids.
4. Restriction enzymes digestion of DNA.
5. DNA electrophoresis in Agarose gel.

Necessary books may be referred to learn the techniques and to be recorded in the record Note books. Observation of photographs of different instruments used in Biotechnology, their principles and applications.

Semester: II **Paper type:** Core Elective 2
Paper code: DEZO24 **Name of the Paper: A.** ENDOCRINOLOGY
Credit: 3 **Total Hours per Week:** 3

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(to Choose either A or B)

Course Objectives

- To understand the objectives of endocrinology. To study the comparative account and functions of endocrine glands of vertebrates Hormone receptors / receptor biology, Molecular biology, Hormonal assays

UNIT-I: Hormones and Hormone Action

Principles of Endocrinology - The endocrine patient - Principles of Hormone Action - Health Care Reform, Population Health, and the Endocrinologist - Laboratory Techniques for Recognition of Endocrine Disorders.

UNIT-II: Hypothalamus and Pituitary

Neuro-endocrinology and Disorders of the Neuro-hypophysis - Pituitary Physiology and Diagnostic Evaluation - Pituitary Masses and Tumors - Posterior Pituitary Gland.

UNIT-III: Thyroid

Thyroid Physiology and Diagnostic Evaluation of Patients with Thyroid Disorders - Hyperthyroid Disorders - Hypothyroidism and Thyroiditis - Nontoxic Diffuse Goiter, Nodular Thyroid Disorders, and Thyroid Malignancies - Sick euthyroid syndrome.

UNIT-IV: Reproduction

Endocrine changes in pregnancy - Endocrinology of fetal development - Normal and aberrant growth. Puberty, ontogeny, physiology disorders - Hormonal Contraception and fertility control - Testicular Disorders and male reproductive tract - Sexual Dysfunction in Men and Women - Menstrual Disorders and Pelvic Pain - The Menopause Transition and Postmenopausal Hormone Therapy - Hirsutism and Virilization - Gynecologic Malignancies.

UNIT-V: Polyendocrine and Neoplastic Disorders

Pediatric Disorders of Sex Development - Normal and Aberrant Growth in Children - Physiology and Disorders of Puberty - Hormones and Athletic Performance - Endocrinology and Aging - Multiple Endocrine Neoplasia. The Immunoendocrinopathy Syndromes - Endocrinology of HIV/AIDS - The Long - Term Endocrine Sequelae of Multimodality Cancer Therapy.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand

- Understanding the function of endocrine organs, metabolisms and their effects on their body.
- Knowledge the pharmacology and use of insulin.
- Understand the endocrine problems.

2. After studied unit-2, the student will be able to understand

- Ability to analyse the related to hormone
- Ability to analyse pituitary disorders.
- Learning the deficiency hypothalamus.

3. After studied unit-3, the student will be able to understand

- Learning and acquiring the
- Studying hypo and hyper thyroidsism.
- Understanding the diagnosis of thyroid gland function.

4. After studied unit-4, the student will be able to understand

- Acquiring knowledge about reproduction system.
- Learning the reproduction anatomy of physiology.
- Acquire the knowledge of gonadal hormones of physiology.

5. After studied unit-5, the student will be able to understand list out major places.

- Enable them to understand child disorders.
- Learning the athletic performance by hormone test.
- Learning about different types of neoplasma and learn about multimodality cancer therapy.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Learning the principles of Endocrinology.
- Studying the function of endocrine glands and vertebrate's hormones.
- Learning and acquiring knowledge of hormonal assay.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Acquire knowledge of neuro endocrines.
- Function of hormone action and healthcare.
- Studying the recognition disorders.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Understanding thoroughly the physiological function of thyroid gland.
- Deficiencies of thyroid disorders.
- Learning the cancer tissues of thyroid.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Study the reproductive biology of embryo.
- Attaining knowledge in fertility control and male and female disorder.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Study the Pediatric disorders.
- Learning natural and absent growth in children.
- Understanding the knowledge of immune endocrinopathy syndromes.

Text Books

1. Barington (1979) Hormones and evolution Vol I&II Academic press, New York.
2. John F- Laycock and Peter H. Wise, Essential of Endocrinology
3. Wiliaimas R.H.(1974). Textbook of Endocrinology V.Ed. Saunders Press, London.
4. Endocrinlogy- Hadley
5. General endocrinology Bagrara and Tumer, W.B. Saunders.
6. The Physiology of Reproduction, Vol I& II E.K.Nobil and JU. D.Neil, Raven Press,New York, 1988.
7. Benjamin Levin-Gene VII, Oxford University Press.
8. Lodish et al Molecular Cell Biology

Reference Items: books, Journal

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitory Gland. S. Chand and Co.,
2. Bentley, P.J. 1985. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster Company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders International Student edition. Toppan Company Limited. Tokyo.
6. Barrington, E.J.W. 1985. An introduction to general and comparative endocrinology. Claredon Press Oxford.

E-Materials

- https://www.ebooks.com/en-us/subjects/medicine-endocrinology-metabolism-ebooks/1069/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Core Elective 2
Paper code: DEZO24 **Name of the Paper:** B. BIOCHEMISIRY
Credit: 3 **Total Hours per Week:** 3

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UNIT-I:
WATER AND ANALYTICAL BIOCHEMISTRY
Water - Biological importance, pH and Acid - Base balance. Henderson Hasselbach equation. Buffers - Biological importance. Acidosis, Alkalosis. Electrolyte and water balance - Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes. Collection and processing of blood and urine samples, Anticoagulants, Preservative for blood and urine, Transport of biological samples.

UNIT-II:
BIOMOLECULES
Digestion of dietary proteins; Absorption of amino acids; General reactions in the degradation of amino acids; Deamination and transamination reactions; Urea cycle; Glucogenic and ketogenic amino acids; Fate of the carbon skeleton of individual amino acids; Carbohydrate metabolism- Introduction - Normal, fasting and post prandial level, maintenance of blood glucose concentration-hypo and hyperglycemia, renal threshold value. Diabetes Mellitus: types, clinical features, metabolic defects, complications, GTT, galactosemia, fructosuria, glycogen storage diseases. Protein - structure, classification, Properties of protein and biological significance.variation of plasma and serum protein; Clinical features of phenylketonuria, alkaptonuria, albinism and tyrosinosis; Disorders in urea cycle. Lipids - hyper triacylglyceridemia, hypo and hyperlipoproteinemia; Atherosclerosis - clinical features and complications; Lipid storage disease, fatty liver.

UNIT-III:
BIOENERGETICS
Bioenergetics:Laws of thermodynamics; Concept of free energy, and standard free energy change; Determination of free energy change for a reaction; Equilibrium constant and standard free energy change; Biological oxidation-reduction reactions; Standard reduction potential and its relationship with free energy change. Metabolic pathways:Characteristics of metabolic pathways; Strategies used to study metabolic pathways. High energy compounds:ATP as universal energy currency in biological systems; Processes that generate and utilize ATP in the cell; other high-energy compounds; Role of NADH and NADPH in metabolism. Carbohydrate - structure, classification and biological significance. Lipid - Structure classification and biological significance MATABOLISM 1. Glycogenesis, 2. Glycogenolysis, 3. Glyconeogenesis, 4. Glycolysis, 5. Hexose mono phosphate shunt. Biosynthesis and Oxidation of Fatty Acids. Energetics.

UNIT-IV:
HORMONES/ SIGNALING MOLECULES
General characteristics of hormones and other signaling molecules; Classification - Steroid Hormones, Protein Hormones, Tissue Hormones, functions, Vasoactive Peptide Synthetic Hormones, mechanism of action and abnormalities of the hormones of thyroid, pancreas, hypothalamus, pituitary and gonads; Hormone replacement therapy; Plant hormones with specific reference to Auxins; Pheromones: types and functions.

UNIT-V:

VITAMINSAND CLINICAL BIOCHEMISTRY

Water and Lipid Soluble Vitamins - structure, classification, sources and deficiencies. Biochemical functions, requirements and deficiency diseases associated with vitamin B complex, C and A, D, E & K vitamins in man. Disorders of Carbohydrate Metabolism, Lipids – Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea. Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance. Abnormalities in Nitrogen Metabolism - Blood Clotting: Disturbances in blood clotting mechanisms – haemorrhagic disorders – haemophilia, Von Willebrand's disease, purpura, Rendu-Osler-Werber disease, thrombotic thrombocytopenic purpura, disseminated intravascular coagulation, acquired prothrombin complex disorders, circulating anticoagulants. Cancer – Cellular differentiation, carcinogens and cancer therapy.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

- Analyse buffer, electrolytes, and water balance.
- Student acquire knowledge to the experiments on blood and urine samples.
- Describe the transport of biological samples.

2. After studied unit-2, the student will be able to

- Describe the digestion of protein, absorption, degradation of aminoacids.
- Students can understand the deamination and transmination reactions.
- Student will use current biochemical techniques to plan and molecular techniques.

3. After studied unit-3, the student will be

- Exposed to wide range caries that combine biology and medicine.
- Student learn the biological significance of how macro molecules broken down into micro molecules.

4. After studied unit-4, the student will be able to understand

- Students were aware of tissues hormones and Synthetic hormones.

5. After studied unit-5, the student will be able to soluble vitamins.

- Student can be able to understand the disorders of carbohydrates metabolisms.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Understand the chemistry of water.
- Describe the chemistry of enzymes.
- Describe the classification of organization of proteins.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Understanding of fundamental biochemical principles, functions of biomolecules, metabolic pathways.
- Learning the regulation of biological and biochemical process.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, and their Biological importance.
- To learn understand concept and mechanisms of ATP Synthesis.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Learning different types of Hormones.
- Studying the structure of endocrine glands.
- Acquire knowledge of plant hormones and pheromons.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Learn the biochemical changes, deficiency disorders.
- Study the blood clotting mechanisms.
- Learn and study the digestive disease of liver and Kidney.

Text Books

1. Practical Clinical Biochemistry- Harold Varley, Fifth edition, CBS Publicationand Distributors, New Delhi.
2. Medical Biochemistry- Dr. M.N. Chattejee III Edition, 1998 JAYPEEBROTHERS, Medica publishers (p) LTD, New Delhi.
3. Essentials of Medical Physiology 7th Edition 2016 by K Sembulingam PremaSembulingam.
4. Biophysical chemistry- Principles and techniques- Upadhyay, Upadyay and NathHimalaya publication house Mumbai.

Reference Items: books, Journal

1. Textbook of Biochemistry for Medical Students by Vasudevan DM.
2. Murray, R. K, Granner, D.K. Maynes, P.A and Rodweli, V. W. 1998. Harper's Biochemistry. 25th Edition. McGraw Hill, New York.
3. Hames, B. D., Hoopa, N.M and Houghton, J.D. 1998. Instant notes in Biochemistry. Viva Books Pvt. Ltd. New Delhi.
4. Jain, J. L. Jain, S. and Jain N. 2005. Fundamental of Biochemistry, S. Chandra & Co. Ltd. New Delhi.
5. Vasudevan, D.M. and Sreekumar. S. 2000. Text of Biochemistry for Medical students. Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi.
6. Rama Rao, A.V.S.S. 1986. Text Book of Biochemistry. L.K. & S Publishers. A.P.
7. Ambika, S. 1990. Fundamentals of Biochemistry for Medical Students, Published by the author. Lehninger, A.L. 2004. Principles of Biochemistry. CBS Publishers, New Delhi.
8. Zubay, G.1989. Biochemistry. McMillan Publishing Co., New York.
9. Voct, D and Voct, J.G. 2004. Biochemistry. John Wiley and Sons, Inc.
10. Physical chemistry- Puri and Sharma, Pathania Vishal Publication and Co., Jalandhar.

E-Materials

- https://www.ebooks.com/en-us/subjects/science-biochemistry-ebooks/645/
- https://www.e-booksdirectory.com/listing.php?category=8

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Open Elective (Non Major) 2
Paper code: DOZO25 **Name of the Paper:** A. VERMICULTURE
Credit: 3 **Total Hours per Week:** 3

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(to Choose either A or B)

Course Objectives

1. To acquire knowledge of vermiculture
2. To get the thorough knowledge of making vermicompost and vermiculture
3. To create self-employment opportunity.

UNIT I

Earthworm taxonomy – Morphological and anatomical – Classification of earthworms – Food habits – Digestive system – Excretion – Reproduction and Life cycle – Earthworm asfarmer‟s friend.

UNIT II

Types of earthworm – Exotic and native species – South Indian and North Indian species used in Vermicomposting – Collection and Preservation of earthworms for vermicomposting – Culture techniques of earthworms – monoculture and polyculture techniques, factors affecting vermicomposting – pH, moisture, temperature etc.

UNIT III

Vermicompost production – Requirements – Different methods of Vermicomposting – Heap method – Pot method and Tray method – types of vermicomposting materials – general procedures in home – maintenance of vermicomposting beds – harvesting the worms – earthworm predators,parasites and pathogens.

UNIT IV

Role of Earthworms in soil fertility – Use of Vermicompost for crop production – Use of earthworms in land improvement and land reclamation – Economics of Vermicompost and vermiwash production. Earthworms as animal feed – Medicinal value of earthworm meal –Role of Earthworms in Solid Waste, Sewage waste management and Vermifilters. Earthworms as bioreactors.

UNIT V

Interaction of earthworms with other organisms – Influence of chemical inputs on earthworm activities – Large scale manufacture of Vermicompost, packaging of vermicompost and its marketing – Financial supporting – Government and NGOs for vermiculture work

Course Out Comes (five outcomes for each units should be mentioned)

1.After studied unit-1, the student will be able to

- Understand the worm forming in modern forming.
- Understand potential vermin compost as an alternative to chemical fertilizer.
- Acquire knowledge about the maintaining health of soil and humans.

2. After studied unit-2, the student will be able to

- Understand a important role in Economics.
- Understand the role of vermiculture in protecting the environment.
- Student can learn and get the knowledge of composting.

3. After studied unit-3, the student will be

- By using vermicompost in their field can incrase the crop yield.
- Student reriding near by the cities using vermicompost used in small scale for garden.
- By propogating vermicopostion.

4. After studied unit-4, the student will be

- The student enables to generate income by supplying worms, vermiwash and vermicompost.
- By developing propogating vermicomposting technology to present environmental pollution.
- Learn towords organic forming and healthy food.

5. After studied unit-5, the student will be

- To study the interaction of earthworm in the organisms.
- To learn the production of vermicompost for Agriculture.
- To understand the financial support of the Governments.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To understand the Earthworm taxonomy.
- To learn the classification of Earthworms.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To study the types of Earthworm species.
- Acquire knowledge in collection and preservation and cultural techniques.
- To learn the factors affecting the vermicomposting.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Study the methods of vermicomposting.
- Study the equipments of materials for compost materials.
- To study the earth worm predators, parasites and pathogens.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To study the role of earthworms in soils.
- To learn the land improvement techniques.
- To know the medicinal value of earthworms.
- Study the role of earthworm in sewage waste management and vermifilters.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Understanding the role of worms in modern forming.
- To understand the potential of vermicompost as an alternative to chemical fertilizer.
- To understanding the Economical value of vermicompost techniques and Financial support by governments.

Text Books

1. Edwards CA & Bater JE. 1977. Biology of Earthworms. Chapman & Hall.2.Edwards CA. 1998. Earthworm Ecology. CRC Press.
2. Sultan A Ismail. 1997. Vermicology-the Biology of Earthworms. Orient Longman.
3. Earthworm in Agriculture – S.C. Talashikar and Dosani, Agrobios Publications, Near Nasarani Cinema, Jodhpur, 342 002.
4. Vermicompost for sustainable Agriculture – P.K. Gupta Agrobios 2nd Edition.

Reference Items: books, Journal

1. Edwards CA & Bater JE. 1977. Biology of Earthworms. Chapman & Hall.
2. Edwards CA. 1998. Earthworm Ecology. CRC Press.
3. Sultan A Ismail. 1997. Vermicology-the Biology of Earthworms. Orient Longman.
4. Earthworm in Agriculture – S.C. Talashikar and Dosani, Agrobios Publications, Near Nasarani Cinema, Jodhpur, 342 002.
5. Vermicompost for sustainable Agriculture – P.K. Gupta Agrobios 2nd Edition.
6. Earthworm ecology – Clive A. Edwards St. Lucie press – CRC Press Washington DC.
7. Biology of Earthworm - Edward and Lofti – Chapman and Hall Publication.

E-Materials

- http://www.vermico.com/ebooks/
- https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf
- https://www.kobo.com/us/en/ebook/compost-vermicompost-and-compost-tea

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: II **Paper type:** Open Elective (Non Major) 2
Paper code: DOZO25 **Name of the Paper:** B. WILDLIFE MANAGEMENT & CONSERVATION
Credit: 3 **Total Hours per Week:** 3

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Course Objectives

- The Course is framed to train the student about various wildlife techniques.
- To train the students to find job opportunities as biologists in reserves.

Unit I

Introduction to Wildlife

Scope and opportunities of Wildlife Sciences – Major types of forest types of India -Protectedareas – Sanctuaries - National Parks – Tiger reserves – Biosphere Reserves and their role.

Unit II

Wildlife Conservation

IUCN Red Data list – CITES – Endangered Mammals of India & Conversation – Project Tiger &Project Elephant. Conservation of Indian rhino, lion &Thar. Importance of Zoo in Conservation

Unit III Ornithology

Terms used in description of Birds Plumage & parts – Types of Bills – Types of feet –Identification of birds in the field based on tail, bill, crest, leg &colour.

Unit IV

Indian Butterflies

Butterflies & Moths – Identification of types of Swallowtails: Club tails – Roses – Bird wings – Mime – Mormon – Raven - Helen - peacock – Jay – Blue bottles – Sword tails –Zebra. Whites, sulfurs and orange-tips.

Unit V

Important Reserves

History, Location, Habitats, Fauna and importance of Mudumalai Tiger Reserve –Sathyamangalam Tiger Reserve – KalakkadMundanthurai Tiger Reserve – Anamalai Tiger Reserve – Gulf of Mannar.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

- Understand the factors affecting the need to find sustainable practices for producing food.
- How the environment influences plant growth and crop field?
- Learn to modify soil structure and drainage to reduce erosion to reduce the soil erosion.

2. After studied unit-2, the student will be able to

- Students can evaluate the current status of endangered mammals.
- Students learn the information of project tiger and project elephant.
- Apply knowledge to solve problems related to wildlife conservation.

3. After studied unit-3, the student will be able to

- Identify species, characteristics, habited requirement and life cycle of bird.
- Learn how wildlife conservation and management relates to economy both currently and in future.
- Understand the structure and types of plumage.

4. After studied unit-4, the student will be able to

- Identify the types of butterflies.
- Identify the types of moths.

5. After studied unit-5, the student will be able to

- Gain awareness and understanding of international forestry.
- Develop skills geographical analysis, basic surviving, mapping.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Develop the knowledge of Ecology.
- Develop skill basis, Geological analysis and basic surviving.
- Understanding of forestry.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Understand the IUCN data list.
- Understand the conservation of endangered mammal.
- Learn the importance of zoo in conservation.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Description of bird plumage and parts.
- Learning of types of bills and types of feet.
- Identify the birds based on tail, bill and crest.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Studying the type and characteristics of butterflies.
- Learning the structure and varieties of Indian butterflies

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To learn the habitatsand importance of tiger reserve.
- Learn the forest management related to economy and environment.

Text Books

1. Ali S, Ripley SD. Handbook of the birds of India and Pakistan. Compact edition.Oxford University Press and BNHS, Mumbai. Ali, S. and SD Ripley.
2. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
3. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials andstatutes. New Delhi: Oxford University Press.
4. Kehimkar ID. Book of Indian butterflies. Oxford University Press; 2008.
5. Prater SH, Barruel P. The book of Indian animals. Bombay: Bombay Natural HistorySociety.

Reference Items: books, Journal

1. Ali S, Ripley SD. Handbook of the birds of India and Pakistan. Compact edition.Oxford University Press and BNHS, Mumbai. Ali, S. and SD Ripley.
2. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
3. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials andstatutes. New Delhi: Oxford University Press.
4. Kehimkar ID. Book of Indian butterflies. Oxford University Press; 2008.
5. Prater SH, Barruel P. The book of Indian animals. Bombay: Bombay Natural HistorySociety.
6. Sale JB, Berkmueller K. Manual of wildlife techniques for India.

E- Materials

- https://moodle.ufsc.br/pluginfile.php/822773/mod_resource/content/1/Wildlife%20Ecology%2C%20Conservation%20and%20Management%20-%20A.%20R.E.%20Sinclair%20J.%20M.%20Fryxell%20G.%20Caughley%20-%20Blackwell%20Publishing.pdf
- https://nndfw.org/Summit%20Presentations%202015/Intro%20to%20wildlife%20management_CSmith.pdf
- http://ifs.nic.in/Dynamic/book/page7.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Core Paper 7
Paper code: DZO31 **Name of the Paper:** ANIMAL PHYSIOLOGY
Credit: 3 **Total Hours per Week:** 4

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Course Objectives

1. To acquire knowledge on different organs, organ system in detail
2. To gain knowledge about functional system.
3. To understand about nutrient.
4. To understand the function of Heart, Heart muscle and Heart beat and its function

UNIT-I: NUTRITION

Nutrition - nutrients - digestion and absorption of proteins, carbohydrates and lipids. Role of gastrointestinal hormones in digestion. Essential Basal Metabolic Rate (BMR).

UNIT-II: RESPIRATION AND CIRCULATION

Physiology of respiration in Man. Respiratory Pigments, nervous and chemical control of respiration.

Circulation - types of hearts - physiology of cardiac muscle - heart beat and its regulation – Hemopoiesis, Blood coagulation.

UNIT-III: EXCRETION AND OSMOREGULATION

Excretion – Renal excretion in vertebrates - physiology of excretion in Man.

Osmotic and Ionic regulation in brackish water and fresh water animals (Fishes and Amphibians). Regulation of body fluids in Terrestrial animals (Crustaceans, Gastropods and Annelids).

UNIT-IV: ANIMAL AND REPRODUCTION

Neuro muscular co-ordination - types of neurons, transmissions of nerve impulse and reflex action. Chemical composition of muscle fiber and physiology of muscle contraction. Myoneural Junction. Endocrine glands in mammals. Physiology of mammalian reproduction - reproductive cycle - hormonal control of reproduction.

UNIT-V: BEHAVIOURAL PHYSIOLOGY

Bioluminescence - chemistry and functional significance. Behaviour (types - trophism, taxis, kinesis, reflex, learning). Temperature regulation: Poikilotherms, homeotherms and heterotherms - hibernation, aestivation - diapause.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- Able to understand clearly about the nutrient materials.
- Able to understand clearly about digestion.
- Able to understand clearly about absorption of proteins
- Able to understand clearly about carbohydrates and lipids
- Able to understand gastro intestinal hormones in digestion

2. After studied unit-2, the student will be

- Able to understand clearly about physiology of respiration.
- Able to understand clearly about respiratory pigments.
- Able to understand clearly about nervous, chemical and BMR
- Able to understand types of Heart, Heart beat in vertebrates
- Able to understand clearly about blood coagulation and theories.

3. After studied unit-3, the student will be

- Able to understand about excretion.
- Able to understand about metabolic waste products.
- Able to understand about metabolic waste products in relation to environment
- Able to understand osmoionic regulation in invertebrates and vertebrates.
- Able to understand clearly about physiology of excretion of man.

4. After studied unit-4, the student will be

- Able to understand about neuromuscular coordination.
- Able to understand about types of neuron, transmission of nerve impulse and reflex action.
- Able to understand about muscle fiber and physiology of muscle contraction.
- Able to understand about endocrine glands in mammals.
- Able to understand about physiology of mammalian reproduction and hormonal control of reproduction.

5. After studied unit-5, the student will be

- Able to understand bioluminescence.
- Able to understand the functional importance.
- Able to understand the different types of behavior.
- Able to understand the trophism, taxis, kinesis, reflex, learning.
- Able to understand poikilotherms, homeotherms and heterotherms.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To know about nutritional values.
- To understand different types of digestion.
- To know about absorption of proteins.
- To know about absorption of carbohydrates.
- To know about different gastro intestinal hormones.
- To know about role of hormones in digestion.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To understand clearly about physiology of respiration in man.
- To understand different respiratory pigments.
- To know about nervous control of respiration.
- To know about chemical control of respiration.
- To know about types of Heart, Heart beats and its regulation
- To gain knowledge about blood coagulation

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To gain knowledge about physiology of excretion in man
- To know about the metabolic waste products in relation to the environment.
- To know about osmoionic regulation in invertebrates
- To understand about osmoionic regulation in vertebrates.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To know about neuromuscular coordination.
- Types of neurons
- To understand about nerve impulse and reflex action
- To know about chemical composition of muscle fiber.
- To know about physiology of muscle contraction.
- To know about myoneural junction.
- To know about endocrine glands in mammals.
- To know about physiology of mammalian reproduction.
- To understand about hormonal control of reproduction

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To know about bioluminescence.
- To know about different behaviours of trophism, taxis, kinesis, reflex, learning.
- To know about poikilotherms, homeotherms, hibernation, aestivation and diapause.

Text Books

1. Herkat, P.C.and Mathur, P.N.1976. Text Book of Animal Physiology.S.Chand Co. Pvt, Ltd., New Delhi.
2. Agarwal, R.A, Anil K. Srinvastava and Kaushal Kumar, 1998. Animal Physiology and Biochemistry, S. Chand and Company Ltd, New Delhi.
3. Parameswaran, R, Ananthakrishnan, T.N, and Ananthasubramanian, K.S. 1998. Outlines of Animal Physiology, S. Viswanathan (Printers and Publishers) Pvt. Ltd.

Reference Items: books, Journal

1. Hoar, W.S.1991. General and Comparative Physiology. Prentice Hall of India, New Delhi.
2. Prosser, C.L. 1973. Comparative Animal Physiology, 3rd edn. W.B. Saunders & Co., Philadelphia.
3. Barrington, E.J.W.1975. An Introduction to General and Comparative Endocrinology. Clarendon Press, Oxford
4. Bentley, P.J.1971. Endocrine and osmoregulation, Springer Verlag, New York.

5. Palmen,J.D. Brown, I.R and Hastings, J.W.1970. Biological clocks, Academic Press, London.
6. Welson, A. 1979. Principles of Animal Physiology.McMillan Publishing Co. Inc. New York.
7. Schmidt Nelssen, K.1985. Animal Physiology. Adaptation and Environment Club, London.
8. Herkat, P.C.and Mathur, P.N.1976. Text Book of Animal Physiology.S.Chand Co. Pvt, Ltd., New Delhi.
9. Sobti, R.C. 2008. Animal Physiology, Narosa Publishing Home, New Delhi.
10. Parameswaran, R, Ananthakrishnan, T.N, and Ananthasubramanian, K.S. 1998. Outlines of Animal Physiology, S. Viswanathan (Printers and Publishers) Pvt. Ltd.
11. Agarwal, R.A, Anil K. Srinvastava and Kaushal Kumar, 1998. Animal Physiology and Biochemistry, S. Chand and Company Ltd, New Delhi.

E- Materials

- https://www.researchgate.net/publication/286456096_DrPBReddy's_TEXT_BOOK_OF_ANIMAL_PHYSIOLOGY
- https://craftx.org/sites/all/themes/craft_blue/pdf/Anatomy_and_Physiology_of_Animals.pdf
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1328089/
- http://www.freebookcentre.net/biology-books-download/ANIMAL-PHYSIOLOGY.html
- https://archive.org/details/cu31924000353601

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Core Paper 8
Paper code: DZO32 **Name of the Paper:** DEVELOPMENTAL BIOLOGY
Credit: 3 **Total Hours per Week:** 4

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Course Objectives

1. To gain knowledge about developmental stages in experimental aspects.
2. To know the role of organisers.
3. To acquire the knowledge of interaction in tissues.
4. To understand the development of Heart and Kidney in different mammals.
5. To know the genes and development under the process of differentiation.

UNIT-I: EARLY DEVELOPMENT

Gastrulation – Gastrulation in Amphioxus, Amphibians, Birds and Mammals – Morphogenetic movements – Chemical changes during gastrulation – Significance of gastrulation.

UNIT-II: ORGANOGENESIS

Development of Heart and Kidney – Differentiation – types of differentiation, Differentiation effected in the genome, Organizer, Inductive tissue interaction in developments.

UNIT-III: NUCLEOCYTOPLASMIC INTERACTION, NUCLEAR TRANSPLANTATION AND REGENERATION

Transplantation – Cytoplasmic influence of Nucleus – Nuclear transplantation experiments in Amphibians. Regeneration in invertebrates and vertebrates.

UNIT-IV: REGULATION OF DEVELOPMENT

Metamorphosis - morphological and biochemical changes during amphibian metamorphosis. Hormonal control of metamorphosis in amphibians - Neuro endocrine control of insect metamorphosis - Biochemistry and mechanism of action of hormones during metamorphosis.

UNIIT-V: EMBRYONIC NUTRITION

Nutritional requirements of Embryo- modes of embryonic nutrition –Food reserve and embryonic nutrition- embryonic nutrition from mother –physiology of placenta.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- Able to understand clearly about the different developmental stages.
- Able to understand gastrulation movements on the egg cortex.
- Able to understand cell communication.
- Able to understand chemotactic induced aggregation in sponges.
- Able to understand clearly development of echinoderms, amphibians and birds.

2. After studied unit-2, the student will be

- Able to understand Organ rudiments
- Able to understand development of Heart
- Able to understand development of Kidney in different mammals.
- Able to understand about organiser.
- Able to understand about tissue interactions in development

3. After studied unit-3, the student will be

- Able to understand nuclear transplantation in amphibians.
- Able to understand the results at the end of nuclear transplantation experiments.
- Able to understand role of genome in the transcription and translation levels.
- Able to understand genetic defects.
- Able to understand role of cell death during development.

4. After studied unit-4, the student will be

- Able to understand metamorphic changes.
- Able to understand metamorphic changes in amphibians
- Able to understand insect metamorphosis.
- Able to understand biochemistry of metamorphosis.
- Able to understand hormonal action during metamorphosis.

5. After studied unit-5, the student will be

- Able to understand nutritional requirements of embryo.
- Able to understand modes of embryonic nutrition.
- Able to understand transfer of food preserve from mother to embryo.
- Able to understand physiology of placenta.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Knowing the details of gastrulation
- Movement of cells on the surface egg cortex
- Chemotactic induced aggregation in sponges.
- Experimental analysis in the early development of echinoderms, amphibians and birds.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Formation of organ rudiments.
- To know about differentiation.
- Development of Heart and Kidney in different mammals.
- Tissue interaction in developments.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Nuclear transplantation.
- Cellular differentiation and protein synthesis.
- Differential activation.
- Genetic defects
- Role of cell death in development.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Different morphological and biochemical changes during amphibian metamorphosis
- Hormonal control in amphibians.
- Neuro endocrine control of insect metamorphosis.
- Mechanism of hormones during metamorphosis.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Different nutritional requirements of embryo.
- Different modes of embryonic nutrition.
- Food preserve and embryonic nutrition.
- Physiology of placenta.

Text Books

1. Majumdar, N.M. 1988. Text Book of Vertebrate Embryology, Tata Mc-Graw – Hill Publishing Company, Ltd, New Delhi.
2. Veer Bala Rastogi and Jayaraj, M.S. 1992. Developmental Biology, Kedar Nath Ram Nath, Meerut, New Delhi.
3. Majumdar, N.M. 1988. Text Book of Vertebrate Embryology, Tata Mc-Graw – Hill Publishing Company, Ltd, New Delhi.
4. Majumdar, N.M. 1988. Text Book of Vertebrate Embryology, Tata Mc-Graw – Hill Publishing Company, Ltd, New Delhi.

Reference Items: books, Journal

1. Balinsky, B.I.1981 An Introduction to Embryology. W.B Saunders Co., Philadelphia.
2. Karp,G. and Berrill,N.J.1981. Development. McGraw Hill, New York.
3. Saunders, J.W.1982. Developmental Biology. MacMillan Co., London.
4. Nagabhushanam,R. and Sarojini,R.2002 Invertebrate Embryology. Oxford and IBA Publishing Co.
5. Tyagi,Rajiv and Shukla,A.N.2002. Development of Fishes. Jaya Publishing House, New Delhi.
6. Browder, W.1984.Developmental Physiology. Saunders College Publishing, Rinchert and Winston.
7. Gilbert, S.F.2003.Developmental Biology. Sinamer Associates Inc. Saunderland, Massachusets, U.S.A.

8. Oppenheimer, S.B.1980.Introduction to Embryonic Development. Allyn and Bacon,Inc. U.S.A.
9. Mitra, S.1994. Genetics, A Blueprint of Life. Tata McGraw - Hill Publishing Company Ltd., New Delhi.
10. Veer Bala Rastogi and Jayaraj, M.S. 1992. Developmental Biology, Kedar Nath Ram Nath, Meerut, New Delhi.
11. Majumdar, N.M. 1988. Text Book of Vertebrate Embryology, Tata Mc-Graw – Hill Publishing Company, Ltd, New Delhi.

E- Materials

- https://epdf.pub/developmental-biology-9th-edition.html
- https://www.freebookcentre.net/Biology/Developmental-Biology-Books.html
- http://www.freebookcentre.net/medical_books_download/Developmental-Biology-Scott-F.-Gilbert.html
- https://www.ncbi.nlm.nih.gov/books/NBK9983/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Core Paper 9
Paper code: DZO33 **Name of the Paper:** IMMUNOLOGY
Credit: 3 **Total Hours per Week:** 4

Course Objectives

1. To Understand the Structural and functional basis of immunology and immune system.
2. To understand the mechanism of antigen-antibody reaction
3. To understand the organization and expression of immunoglobulin genes
4. To understand the B - cell receptors and T – cell receptors
5. To understand the Tumour Immunology
6. To understand the Transplantation immunology

UNIT-I: IMMUNE BIOLOGY

Immunity - Major Targets of Defence system, Types of Immunity, cellular constituents of the lympho reticular system-phagocytic cells-polymorpho nuclear neutrophils, mono nuclear phagocytes stem cells, eosinophils and lymphocytes. Lymphoid organs and Antigens.

UNIT-II: IMMUNOGLOBULINS

Immunoglobulins-structure, Properties, Function and Classes of Immunoglobulin, Isotypes and biological function. Antigenic determinant on immunoglobulin-isotype, allotype and idiotype. Immunoglobulin superfamily, monoclonal and polyconal antibodies. organization and expression of immunoglobulin genes. Synthesis of immunoglobulin and disorders of immunoglobulin synthesis.

UNIT-III: DETECTION AND APPLICATION OF ANITGEN AND ANTIBODY REACTION

Antigen-antibody reaction – Precipitation – Agglutination – Cytolysis – Complement Fixation – Flocculation – Opsonization _ Immuno assay using labelled reagents – Harmful effects of Antigen – Antibody reactions.

UNIT-IV: MECHANISM OF IMMUNE SYSTEM

Antigen-antibody interaction, MHC- Major Histocompatibility Complex, Function, Restriction Organization and Inheritance of MHC, Antigen processing and presentation HLA, Genetics of HLA. B - cell receptors, T – cell receptors, Cytokine, Adhesion molecules, Hypersensitivity reaction and Anaphylaxis – Tumour Immunology – Tumour Antigens, Immunotheraphy of Tumour.

UNIT-V: TRANSPLANTATION IMMUNOLOGY

Transplantation immunology. Types of Graft, Graft acceptance and rejection. Immuno deficiency diseases. Immuno prophylaxis. Immuno techniques. Immuno haematology.
Biosynthesis of Antibody.

Course Out Comes (five outcomes for each units should be mentioned)

1. **After studied unit-1, the student will be able to understand**
    - Major targets of defence system.
    - Phagocytic cells.
    - Polymorpho nuclear neutophils.
    - Lymphoid organs.
    - Antigens.

2. **After studied unit-2, the student will be able to understand**
    - Immunoglobulins.
    - Antigenic determinant.
    - Isotopes and biological function.
    - Monoclonal and polyconal antibodies.
    - Immunoglobulin and disorders.

3. **After studied unit-3, the student will be able to understand**
    - Antigen-antibody reaction.
    - Cytolysis.
    - Complement fixation.
    - Immuno assay.
    - Harmful effects of antigen.

4. **After studied unit-4, the student will be able to understand**
    - Antigen-antibody interaction.
    - Major Histocompatibility Complex.
    - Genetics of HLA.
    - Hypersensitivity.
    - Tumour Immunology.

5. **After studied unit-5, the student will be able to understand**
    - Transplantation immunology.
    - Graft acceptance and rejection.
    - Immuno deficiency.
    - Immuno techniques.
    - Biosynthesis of Antibody.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To study an d learn the Immunity,Major targets of defence system, types of Immunity, cellular constituents of the lympho reticular system-phagocytic
- To understand the cells-polymorpho nuclear neutrophils, mono nuclear phagocytes stem cells, eosinophils and lymphocytes.
- To acquire the knowledge of Lymphoid organs and Antigens.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To understand the Immunoglobulins-structure, Properties, and function and Classes of Immunoglobulin, and isotypes and biological function.
- To learn and understand the antigenic determinant on immunoglobulin-isotype, allotype and idiotype.
- To describe the Immunoglobulin superfamily, monoclonal and polyconal antibodies.
- To understand the organization and expression of immunoglobulin genes.
- To study the synthesis of immunoglobulin and disorders of immunoglobulin synthesis.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To learn and understand the antigen-antibody reaction, precipitation, agglutination, cytolysis and complement Fixation.
- To study the flocculation,opsonization.
- To learn the Immuno assay using labelled reagents.
- To acquire the knowledge of Harmful effects of Antigen – Antibody reactions.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the antigen-antibody interaction, MHC- Major Histocompatibility Complex, Function, Restriction Organization and Inheritance of MHC, Antigen processing and presentation HLA, Genetics of HLA.
- To learn the B - cell receptors, T – cell receptors, Cytokine, Adhesion molecules.
- To understand the Hypersensitivity reaction and Anaphylaxis.
- To study the Tumour Immunology – Tumour Antigens, Immunotheraphy of Tumour.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To understand thetransplantation immunology.
- To learn the Types of Graft, Graft acceptance and rejection.
- To understand the Immuno deficiency diseases, Immuno prophylaxis, Immuno techniques.and Immuno haematology.
- To learn and understand the Biosynthesis of Antibody.

Text Book

1. Roitt,I.M.1994. Essential Immunology. Blackwell Scientific, Oxford
2. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. Kuby Immunology.Freeman and Co., New York
3. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey
4. Paul,W.E.M.1989. Fundamentals of Immunobiology. Raven Press, New York
5. Champion,M.D. and Cooke,A.1987.Advanced Immunology. J.B.Lippincott Ltd., Philadelphia

Reference Items: books, Journal

1. Kuby Immunology W. H. Freeman & Company; 6th edition
2. Immunology Cancer Vaccines Experimental Methods in Immunology Goldsby RA, Kindt TK, Osborne BA and Kuby J (2003) Immunology, 5th Edition, W.H. Freeman and Company
3. Michael Behe presented with fifty-eight peer-reviewed publications, nine books, and several immunology textbook chapters about the evolution of the immune system

4. NIOSH Hazard Review: Carbonless Copy Paper/Other Publications Examined and Safety Letter, September, p. 22. American Academy of Allergy and Immunology, Executive Committee [1986]. Position statements: clinical ecology. J

E- Materials

- https://onlinelibrary.wiley.com/journal/13652567
- Journals in Immunology and Microbiology - Elsevierwww.elsevier.com › Life Sciences › Immunology and Microbiology
- http://www.elsevier.com/locate/molimm.Molecular Immunology - Journal - Elsevier
- Clinical Immunology - Journal - Elsevierwww.journals.elsevier.com › clinical-immunology
- https://bookauthority.org/books/new-immunology-books
- https://home.liebertpub.com/publications/viral-immunology/57/overview
- https://biolympiads.com/wp-content/uploads/2018/09/Immunology-Notes.pdf.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Core Elective 3
Paper code: DEZO34A **Name of the Paper:** A) BIO-ETHICS AND BIO-SAFETY
Credit: 3 **Total Hours per Week:** 3

Course Objectives

- To acquire knowledge on the ethical applications of biological principles.
- To acquire knowledge on the regulatory frameworks and good Laboratory practices for safety
- To Understand and make aware of the CPCSEA guidelines
- To learn the Intellectual Property Rights and patent filing.
- To learn the application of biotechnology in various fields.

Unit-I:Introduction to Bioethics and Bio-safety

Ethics in biotechnology- Positive effects – Negative effects - examples – Rice with Vitamin A - Slow Ripening Fruits - Saving the Banana - Virus Resistant Crops - Need for Fertilizers - Biological Pest Controls – Fast Growing Trees- Fast Growing fish - The Monarch Butterfly Story - Consumer traits – food safety- Environmental, Economic and Social Concerns.

Unit-II:Biotechnological Applications for Human Welfare

Production of secondary metabolites - Insulin, growth hormones and interferons. Production of biotechnological products - Food – SCP (algae, yeast, mushroom). Biofertiliser (Blue-green algae, Vesicular-arbuscular mycorrhiza) - Biopesticides (*Bascillus thruinginsis*).

Unit-III:Regulatory Framework and Good Laboratory Practices

Regulatory frameworks in USA and India - Good laboratory practice (GLP) - GLP authority functions - follow Good Laboratory Practices - The Aspiration – responsibility – Role of a Sponsor - Quality standards for Clinical Trials - Why is India a favorite destination for Clinical Trials world wide.

Unit-IV:CPCSEA (Committee for the Purpose of Control and Supervision of Experiments on Animals) Guidelines for Laboratory Animal Handling for Various Experiments

Veterinary care - Animal procurement - Quarantine, Sterilization and separation – Surveillance, diagnosis, treatment and control of disease - Animal care and technical personnel - Personal hygiene - Animal experimentation involving hazardous agent - Multiple surgical procedures on single animal - Duration of experiments - Physical restraint - Physical relationships of animal facilities to laboratories – Functional area - Physical facilities – Environment - Animal husbandry - Activity – Food - Bedding- Water- Sanitation and cleanliness – Waste disposal - Pest control - Emergency , weekend and holiday care.

Unit-V: Intellectual Property Rights

Origin of the Patent Regime – History of Indian Patent System - Indian Pharmaceutical Industry - The Present Scenario – Basis of Patentability –Patent Application Procedure in India - Patent Granted Under Convention Agreement - Who can apply for a patent - Patent Procedure – Opposition to Grant of Patent - Grant and Sealing - Exclusive Rights – Grant of Exclusive Rights - Special Provision for selling or distribution – Suits relating to infringements – Compulsory License - Termination of Compulsory License – Case study - Compulsory Licenses - Relief under Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement.

Course Out Comes (five outcomes for each units should be mentioned)

1. **After studied unit-1, the student will be able to understand**
    - Study the positive and negative effects of Bio-ethics.
    - Able to define Bio-ethics and explain the fundamental of ethical rights and principles that apply to
    - Student learn the ethics in rice, vegetable, fruits, resistance crops, consumer traits.
    - Environment and eco-safety makes the student to understand food school.
2. **After studied unit-2, the student will be able to understand**
    - To understand the production of secondary metabolites.
    - To understand the biotechnical food preparations.
    - To explain the microbial degradation pesticides and bio-fertilizer.
    - To know the practical use of biotechnology application medicine, agriculture, and food production.
3. **After studied unit-3, the student will be able to understand**
    - To describe the regulatory frameworks in India and USA.
    - To gain knowledge of the good laboratory practice.
    - To understand the awareness of the clinical trials.
4. **After studied unit-4, the student will be able to understand**
    - To understand the guide lines for laboratory animal handling.
    - To know the concerns of animal welfare.
    - To learn the condition and treatments which avoid mental suffering of test animals.
    - To learn the facilities, provide for the experimental animals.
5. **After studied unit-5, the student will be able to understand**
    - To encourage research scholarship and spirit of inquiry by generating new knowledge.
    - To facilitate the transfer of knowledge and technology to intending users to promote utilizing resource for benefit of society.
    - To create respect for other people IPR among the members of the institute.
    - To learn the awareness on IPR through conducting seminars.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To understand the Ethics, effects of the ethics.
- To learn the consumer traits.
- To acquire the knowledge about environmental, economical and social concern.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To study the secondary metabolites, growth hormones, and interferons.
- To acquire knowledge about the biotech food products.
- To learn the microbial degradation in Bioremediation process.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To study the good laboratory practical.
- To learn the quality standards of clinical trials.
- To acquire knowledge of the World Wide Clinical trials.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To study the CPCSEA guideline for handling Experimental animals.
- To learn the physical relationships of animal facilities and laboratories.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To learn the intellectual property rights and patent filing.
- To know the patent procedure in India.

Text Books

1. V. Srikrishna, 2007, Bioethics and Biosafety in Biotechnology, New Age International Publisher, New Delhi
2. Goel And Parashar, 2013, IPR, Biosafety and Bioethics, Pearson, Chennai.
3. Rajmohan Joshi, 2006, Biosafety and Bioethics, Gyan Publishing House, Delhi
4. V Sree Krishna, 2007, Bioethics and Biosfety in Biotechnology, New Age International, New Delhi.

Reference Items: books, Journal

1. Bioethics, by Shaleesha A. Stanley (2008). Published by Wisdom Educational service Chennai.
2. Dubey, R. C., 2008, A text book of Biotechnology, S. Chand Co., New Delhi
3. Gupta, P.K, 2008, Biotechnology and Genomics, Rastogi Publications, Meerut, India.
4. M. K. Sateesh, 2008, Bioethics and Biosafety, I. K. International Pvt Ltd, India
5. National Bioethics Committees in Action, 2010, United Nations Educational, Scientific and Cultural Organization, rue Miollis, 75732 Paris Cedex 15, France.
6. Henk ten Have, 2016, Encyclopedia of Global Bioethics. Springer.

E- Materials

- https://books.google.co.in/books/about/Bioethics_and_Biosafety.html?id=xP9dzbSBTZQC
- http://access.in.pearson.com/store/store/product/896-IPR,-Biosafety-and-Bioethics?s=HigherE

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Core Elective 3
Paper code: DEZO34B **Name of the Paper:** B. BIOPHYSICS
Credit: 3 **Total Hours per Week:** 3

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Course Objectives

1. To understand the principle and applications of various research instruments for Human life.
2. To understand the Biological importance of Biomolecules
3. To understand the Different types of Laws in Biophysics
4. To understand how the animals produce Bio-luminescence for food, protection and sexual attraction.
5. To understand how MRI scanner is working.
6. To understand the nuclear medicine for therapy, fiber optic endoscopy and mammography

UNIT-I: BIOMOLECULES AND BONDING

Electron configuration of an atom and Molecule. Bonds - Covalent bond, Ionic Bond, Hydrogen bond, Disulphide bond, Peptide bonds. Forces between Molecules - Electrostatic force, Van der Waal's forces - hydrophobic and hydrophilic - biological importance. Kinetic energy.

UNIT-II: THERMODYNAMICS AND BIOLOGICAL OXIDATION

Laws of Thermodynamics – First Law and Second Law - Concept of free energy and entropy - Exergonic and Endergonic reactions. Rate of reactions - Effect of sunlight and temperature on reactions. Energy of Activation - Arrhenius expression.

Diffusion - Fick's Laws, constant laws. Osmotic coefficient - Gibbs Donnan equilibrium.

Oxidation and reduction reactions - Redox potentials in biological system, High energy phosphate group. Bioluminescence – Extra cellular, Intra cellular and Symbiotic. Bioluminescence in bacteria and Fire Fly. Function of Bioluminescence – Food collection, Protection from Predators and Sexual attractions.

UNIT-III: MICROSCOPY

Principle and biological application of Light microscope, Electron microscope, Polarising microscope, Fluorescent microscope, Phase contrast microscope, Dark field microscope, Interference microscope and X-ray microscope.

UNIT-IV: PHOTO BIOPHYSICS

Electromagnetic spectrum - visible and invisible region. Principles involved in Photoelectric colorimetry. Principle of Spectroscopy - UV & IR Spectroscopy in biological investigation. Effects of UV on biological systems. Delayed effects of radiation - Ageing, reduction in life span, cancer. Radioactive isotopes - measurements - GM tubes, Liquid Scintillation counters. Autoradiography. Effects of radiation.

UNIT-V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY

Biophysical aspects of vision, hearing, nerve conduction and muscle contraction. Application of Radioimmuno assay (RIA) Magnetic Resonance Imaging (MRI) Laser Beam in Biology. Nuclear Medicine for Therapy, Fibre – Optic Endoscopy. Heart – Lung Machine (Cardio – Pulmonary Bypass (CPB)). Mammography.

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Course Out Comes (five outcomes for each units should be mentioned)

1.After studied unit-1, the student will be able to understand

- Electron configuration.
- Bonds.
- Electrostatic force.
- Hydrophobic and hydrophilic.
- Kinetic energy.

2.After studied unit-2, the student will be able to understand

- Laws of Thermodynamics.
- Concept of free energy.
- Rate of reactions.
- Bioluminescence.
- Fick's Laws.

3.After studied unit-3, the student will be able to understand

- Light microscope and Electron microscope.
- Polarising microscope and Fluorescent microscope.
- Phase contrast microscope and Dark field microscope.
- Interference microscope.
- X-ray microscope.

4.After studied unit-4, the student will be able to understand

- Electromagnetic spectrum.
- Principles involved in Photoelectric colorimetry.
- Principle of Spectroscopy and UV & IR Spectroscopy.
- GM tubes and Liquid Scientillation counters.
- Effects of radiation.

5.After studied unit-5, the student will be able to understand

- Biophysical aspects of vision, hearing and nerve.
- Application of Radioimmuno assay.
- Magnetic Resonance Imaging.
- Nuclear Medicine for Therapy.
- Mammography.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To understand the basic principle of an electron configuration of an atom and Molecules.
- To gain knowledge about Bonds - Covalent bond, Ionic bond, Hydrogen bond etc.,
- To know the principle and biological importance of kinetic energy.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To understand the basic principle and Laws of Thermodynamics.
- To learn the concept of free energy and entropy.
- To gain knowledge about Different types of Laws in Biophysics.
- To understand how the animals, produce Bio-luminescence for food, protection and sexual attraction

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To understand the basic Principle and biological application of microscopes.
- To aware the application of microscopes in biological science**s.**

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the principle and application of Electromagnetic spectrum.
- To know the principle and concept of Photoelctric colorimetry, Spectroscopy and its application in biological sciences.
- To learn the Effects of UV on biological system.
- To gain knowledge about radioactive isotopes.
- To understand the basic concept of Autoradiography and its application.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To understand the Biophysical aspects of vision, hearing, nerve conduction and muscle contraction.
- To understand the working principle and application of Radioimmuno assay (RIA) and Magnetic Resonance Imaging (MRI) Laser Beam in Biology.
- To know about various techniques involved in Nuclear Medicine for Therapy.
- To understand the objectives of Pulmonary Bypass ND Mammography.

Text Books

1. Bose, S. 1982. Elementary Biophysics. Jyoth Books
2. Bums, D.M. and MacDonald, S.G.G. 1979. Physics for Biology and Premedical students. ELBS and Addisson - Wesley Publishers Ltd., London
3. Das, D. 1982. Biophysics and Biophysical Chemistry. Academic Publishers. New Delhi.
4. Epstein, H.T. 1963. Elementary Biophysics, selected topics. Addisson - Wesley Publishing Company Inc. London
5. Palanichamy, S and Shanmugavelu, M. 1991. Priniples of Biophysics. Palani Paramount, Publication; Tamil Nadu.

Reference Items: books, Journal

- Rodney M. J. Cotterill (2002). Biophysics: An Introduction. Wiley. ISBN 978-0-471-48538-4.
- Sneppen K, Zocchi G (2005-10-17). Physics in Molecular Biology (1 ed.). Cambridge University Press. ISBN 978-0-521-84419-2.
- Glaser R (2004-11-23). Biophysics: An Introduction (Corrected ed.). Springer. ISBN 978-3-540-67088-9.
- Hobbie RK, Roth BJ (2006). Intermediate Physics for Medicine and Biology (4th ed.). Springer. ISBN 978-0-387-30942-2.
- Cooper WG (August 2009). "Evidence for transcriptase quantum processing implies entanglement and decoherence of superposition proton states". Bio Systems. 97 (2): 73–89. doi:10.1016/j.biosystems.2009.04.010. PMID 19427355.
- Cooper WG (December 2009). "Necessity of quantum coherence to account for the spectrum of time-dependent mutations exhibited by bacteriophage T4". Biochemical Genetics. 47 (11–12): 892–910. doi:10.1007/s10528-009-9293-8. PMID 19882244.
- Goldfarb D (2010). Biophysics Demystified. McGraw-Hill. ISBN 978-0-07-163365-9.

E- Materials

- https://epdf.pub/biophysics.html
- https://scholar.cu.edu.eg/?q=abdo_elfiky/files/dillon_p.f._biophysics.._a_physiological_approach_draft_cup_2012isbn_1107001447314s_b_.pdf
- http://www.freebookcentre.net/Physics/BioPhysics-Books-Download.html
- https://typeset.io/formats/springer/european-biophysics-journal/062e2ab131e74d7ab83a9eff3c450897
- Letter from the Archives of Biochemistry and Biophysics to Joshua Lederberg - Joshua Lederberg - Profiles in Science
- https://profiles.nlm.nih.gov/.../nlm:nlmuid-101584906X1406-doc
- https://profiles.nlm.nih.gov/.../nlm:nlmuid-101584906X1404-doc
- https://profiles.nlm.nih.gov/.../nlm:nlmuid-101584906X1408-doc
- https://www.cell.com/biophysj/home
- https://www.annualreviews.org/journal/biophys

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Open Elective Paper 3
Paper code: DOZO35A **Name of the Paper:** A. AQUARIUM FISH KEEPING
Credit: 3 **Total Hours per Week:** 3

(to Choose either A or B)

Course Objectives

1. To impart basic knowledge on aquarium fish keeping
2. To teach the various technology used in the aquarium fish keeping
3. To understand the characteristic features of aquarium fishes
4. To explain the biology of aquarium fishes
5. To motivate self-employment opportunity

UNIT- I

Scope of Aquarium Fish Industry: Aquarium as cottage industry - Exotic and Endemic species of Aquarium fishes. Constructions of home aquarium- materials used, aerators and filters, net and other equipments.

UNIT - II

General Characters and sexual dimorphism:

Freshwater and Marine water Aquarium fishes- Guppy, Molly, Sward tail, Gold fish, Angel fish, Blue Morph, Anemone fish and Butterfly fish. Freshwater aquarium plants - Secondary sexual characters, breeding habits, spawning and parental care.

UNIT – III

Food and Feeding of Aquarium Fishes:

Different kinds of feeds - Culture of live feed organisms and separation of formulated fish feeds – feeding methods.

UNIT – IV

Transportation of Aquarium fishes:

Aquarium fish habitats, Methods of collection from the wild, Fish handling, packing and transportation techniques.

UNIT – IV

Maintenance of Aquarium: Cleaning of aquarium tank - maintenance of water quality - control of snails and algal growth in aquarium tank – disease diagnosis and treatment.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to

a) Acquire basic knowledge about aquarium
b) Learn about the exotic and endemic aquarium fish species
c) Know about the construction of home aquarium
d) Understand the materials requirement for setting up home aquarium
e) Know the usage of minor equipment used in the aquarium

2. After studied unit-2, the student will be able to

a) Acquire knowledge on freshwater and marine water aquarium fishes
b) Know the fresh water aquarium plants used in the tank
c) Learn their secondary sexual characters
d) Know the breeding and spawning behavior of aquarium fishes
e) Understand the parental care present in the aquarium fishes

3. After studied unit-3, the student will be able to

a) Know the different kinds of feeds used for aquarium fish
b) Understand how to cultivate live feed organisms?
c) Learn the techniques of preparation of formulated feed
d) Acquire knowledge on feed conversion ratio of feeds
e) Know the feeding behavior of aquarium fishes

4. After studied unit-4, the student will be able to

a) Understand the aquarium fish habitat
b) Know the method of collection of aquarium fishes form wild
c) How to handle the aquarium fishes?
d) Acquire knowledge on packing of aquarium fishes
e) Learn techniques used for transportation of aquarium fishes

5. After studied unit-5, the student will be able to

a) Know the procedure of cleaning the aquarium tank
b) Understand the water quality parameters and its importance
c) Comprehend the control of snail and algal growth in the aquarium tank
d) Acquire knowledge on disease diagnosis
e) Get an idea of treatment of disease in aquarium fishes.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To study the scope of aquarium fish industry and aquarium as cottage industry and exotic and endemic species of aquarium fishes.
- To understand and study the constructions of home aquarium, materials, used, aerators, filters, net and other equipment.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To learn and understand thegeneral characters and sexual dimorphism, freshwater and marine water aquarium fishes- guppy- molly- sward tail- gold fish- angel fish- blue morph-anemone fish and butterfly fish.
- To understand the freshwater aquarium plants, secondary sexual characters, breeding habits-spawning - parental care.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- food and feeding of aquarium fishes: different kinds of feeds and culture of live feed organisms.
- To learn the preparation of formulated fish feeds – feeding methods.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To understand the transportation of aquarium fishes: aquarium fish habitats,
- To learn the methods of collection from the wild, Fish handling, packing, transportation techniques.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To learn and study the maintenance of aquarium:cleaning of aquarium tank –and maintenance of water quality - control of snails - algal growth in aquarium tank.
- To study the disease diagnosis and treatment.

Text Books

1) Coffey, D.J., 1977. Encylopedia of Aquarium Fishes in Colour. Acro Publications.
2) David Justin Smith- Introduction to Aquarium Keeping
3) Jhingran, V. G. 1982. Fish and Fisheries in India. Hindustan Publishing Corporation, New Delhi.
4) Shanmugam, K. 1992. Fishery Biology and Aquaculture. Leo Pathipagam, Chennai, India.
5) Mill Dick, 1993. Aquarium Fish. D.K. Publishing Corporation, New York, USA.
6) Yadav, B.N., 1997. Fish and Fisheries (Second Edition), Daya Publishing House, Delhi, India, pp. 366.
7) Day, F. 1978. Fishes of India, Vol. I & II. William Danisan & Sons, India.
8) Mill Dick, 1993. Aquarium Fish. D.K. Publishing Corporation, New York, USA.
9) Mill Dick, 1993. Aquarium Fish. D.K. Publishing Corporation, New York, USA.
10) The transport of live fish –A review - FAO
11) Fish Pathology - Fourth Edition (Roberts, R.J., ed.), 2012. Blackwell Publishing Ltd., UK. pp. 591.

Reference Items: books, Journal

1. David Justin Smith- Aquarium Keeping: The Aquarium Keeping Basics.
2. David Justin Smith- Aquarium Keeping: 25 Facts Every Aquarist Should know.
3. David Justin Smith- Aquarium Keeping: The Aquarium Keeping Guide Book.
4. David Justin Smith- Aquarium Keeping: The Aquarium Keeping Essentials.
5. Coffey, D.J., 1977. Encylopedia of Aquarium Fishes in Colour. Acro Publications.
6. Fish Pathology - Fourth Edition (Roberts, R.J., ed.). 2012. Blackwell Publishing Ltd., UK. pp. 591.
7. Jhingran, V. G. 1982. Fish and Fisheries in India. Hindustan Publishing Corporation, New Delhi.
8. Shanmugam, K. 1992. Fishery Biology and Aquaculture. Leo Pathipagam, Chennai, India.
9. Mill Dick, 1993. Aquarium Fish. D.K. Publishing Corporation, New York, USA.

10. Yadav, B.N., 1997. Fish and Fisheries (Second Edition), Daya Publishing House, Delhi, India, pp. 366.
11. Day, F. 1978. Fishes of India, Vol. I & II. William Danisan & Sons, India.

E- Materials

- www.fao.org - The transport of live fish –A review – FAO
- www.fisheriesjournal.com – The design and construction of Aquaria.
- www.instructable.com – How to build Aquarium- 6 steps- instructable

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: III **Paper type:** Open Elective 3
Paper code: DOZO35B **Name of the Paper**: B. MEDICAL LABORATORY TECHNOLOGY
Credit: 3 **Total Hours per Week:** 3

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Course Objectives

- To impart awareness on clinical lab-technology
- To create knowledge on self- employment opportunity

UNIT I

Medical Laboratory scope- general procedures- Laboratory requirements, Sterilization, Dry heat (Hot air oven), Moist heat (Autoclave, Pressure cooker), Laboratory equipments -Spectrophotometer, Incubator Refrigerator, Auto analyzer, Micro centrifuge, Automatic pipettes.

UNIT II

Collection of blood samples, Packed cell volume (PVC), Erythrocyte sedimentation Rate (ESR),RBC Count, WBC Count, Reticulocyte count, Total count, Differential Count, Pulse rate, Use of blood pressure Apparatus, Electrocardiogram, Echocardiogram, Estimation of Haemoglobin, Artificial pacemaker.

UNIT III

Blood cross matching – Hepatitis test – Haemolytic jaundice, ELISA, Estimation of blood glucose fasting two-hour post prandial – Diabetes mellitus, Estimation of blood Cholesterol, Blood Urea, Blood Uric Acid.

UNIT IV

Analysis of urine – Physical examination, Blood cells, Urine glucose, Urine albumin, Bile salts,
Ketone bodies, Urine culture – Antibiotic susceptibility test. Pregnancy Test (Detection of HCG). Analysis of faeces – Components of faeces their characteristics, factors affecting faeces.composition.Analysis of sputum – Pathological conditions that can be detected in sputum – their causes – Detection of Group A – Streptococcus.

UNIT V

Cerebrospinal fluid – Formation, Composition function, Conditions altering its composition –
their causes. Seminal fluid – Composition of seminal fluid, Sperm count, Abnormal sperms,
Common pathological conditions detected in semen – their causes. Aminotic fluid – Sex determination, Diagnosis of pathological conditions of developing foetusthrough analysis of amniotic fluid.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- To perform the basic analytical techniques.
- To demonstrate the appropriate use of laboratory instrumentations.
- To select the appropriate troble-shooting procedure.

2. After studied unit-2, the student will be

- To perform routine analysis of blood and body fluid samples.
- To demonstrate the ability to proper for the proper procedure for laboratory analysis.
- To learn and to understand the knowledge and skill in major areas of clinical laboratory diagnosis.

3.After studied unit-3, the student will be

- To understand and test the blood glucose estimation in diabetic patients.
- To study the process of immunohaematology trials.
- To learn and to understand the lab operations in blood culture, blood uric acid, etc.

4.After studied unit-4, the student will be

- To perform the analysis of Urine and blood.
- To understand the laboratory test diagnose treat the disease.
- To identify the immune haematology test.

5.After studied unit-5, the student will be

- To understand the clinical chemistry of CSF, SF, and amniotic fluid.
- To study the pathology conditions of the patients.
- To demonstrate a commitment to patients to the performance.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- To learn and study the laboratory equipment's.
- To understand the principles of Spectrometer, Refrigerator.
- To acquire the knowledge of dry heat and moist heat.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- To learn the blood parameters.
- To understand the medical application of the apparatus.
- To perform the routineanalysis of blood/ body fluids.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- To learn the laboratory procedures of blood cross matching, Hepatitis, Haemolytic jaundice.
- To learn the estimation of Blood glucose, Blood cholesterol.
- To understand the procedure of urea, Uric acid.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To analysis the laboratory procedure for urine examination.
- To understand the knowledge of antibiotic susceptibility and detection of HCG.
- To provide basic analytical techniques.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To identify the sources of pre analytic correlate the test result with disease process.
- To diagnosis the pathological conditions of developing embryo and aminotic fluid.
- To acquire knowledge about composition of abnormality in seminal fluid.

Text Books

1. Biswajit Mohanty and Sharbari Basu – Fundamentals of Practical Clinical Biochemistry, B.I. Publications PVT., LTD.,54, Janpath, New Delhi – 110001.
2. Estridge B.H. Raynold A.P and Walters N.J. Basic Medical Laboratory Techniques,4th edition, Thomson Delmar Learning, Eastern press (Bangalore)Pvt., Ltd., Boommasandra Industrial Area, Hosur Road, Bangalore – 562158.
3. Kannai, L. Mukherjee, Medical Laboratory Technology Vol - I, Vol - II and Vol - III. Tata MC Graw Hill Publishing Company Limited,No:444/1,Sri Ekambara Naicker Industrial Estate, Alapakkam, Porur, Chennai – 600116.

Reference Items: books, Journal

1. Ramnik Sood, Medical Laboratory Technology, Methods and Interpretations. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
2. Venkadesan, O. Essential of Medical Laboratory technology, Bicobas P.G and Research Department of Zoology, Loyola College, Madras – 60003

E- Materials

- https://libguides.utoledo.edu/medlabsci/books
- https://guides.lib.uiowa.edu/c.php?g=131963&p=863302

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:**
Paper code: DFS20 **Name of the Paper:** FIELD STUDY
Credit: 2 **Total Hours:** 30

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USRR (FIELD STUDY REPORT) GUIDELINES

Field Study and USRR (University Social Responsibility Report)

The aim of the Field Study is to help students connect with the society in the respective discipline. Following are the important features of the Field Study and the USRR:

1. Aim: The Field Study must aim at relating the subject of study with the society in so far as the application and the usefulness of the study are concerned

2. Topic selection: The topic for the Field Study must be chosen by the student in the second semester in the month of February; the process for the same shall begin on 1st February and shall end on the last working day of the month of February. Students are free to select the topic for the Field Study in consultation with the Experts and Faculty Members of their choice, both from within and outside the University

3. Period and duration: The Field Study shall be undertaken for a duration of 15 days in the summer vacation that falls immediately at the end of the second semester of the program and the same should be accounted for the Third Semester of the program

4. USRR: The USSR (University Social Responsibility Report) must be prepared by every student of the program written in 50 to 75 pages. The report shall be written based on the standard research methodology.

5. Review and evaluation schedule:

a. ***Reviewing the Field work:*** First week of July

b. ***Report Review:*** Second week of August

c. ***Report submission:*** First week of September

d. ***Report Evaluation:*** Third week of September

6. Faculty Composition: The following members may be nominated for confirming the topic and for evaluating the USRR:

a. Professor and Head of the concerned Department

b. One Faculty member with related field of specialization from the concerned Department

c. One senior faculty member from the Department of Sociology from other Institution

Semester: IV **Paper type:** Core Paper 10
Paper code: DZO41 **Name of the Paper:** RESEARCH METHODOLOGY
Credit: 4 **Total Hours per Week:** 5

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Course Objectives

- To make the students, learning statistical and bioinformatics tools.
- To make the students, understand spectroscopic principle and application.
- To make the students, know various bio-molecule separation techniques.
- To make the students, operate various microscopes.
- To make the students, get experienced in research paper writing and publication.

UNIT-I: BIOSTATISTICS & BIOINFORMATICS

Collection and analysis of biological data - mean, median, mode, Standard deviation, Standard error, Coefficient of variation, Student 't' test, Skewness,
Kurtosis, Chi - square, Correlation, Regression and ANOVA.
Internet - Worldwide Web - Search Engines - their functions. Boolean searching - file formats.
Biological data bases - sequence and structure – data retrieval - searching source data bases - sequence similarity searches - FASTA and BLAST, clustral and phylip.

UNIT-II: SPECTROSCOPY

Absorption and Emission principles - Principles and applications of UV-visible, Spectroflurometer, flame photometer, Atomic Absorption and emission spectrophotometers, NMR and Mass spectrometer.

UNIT-III: CHROMATOGRAPHY & ELECTROPHORESIS

Principles and Application of Chromatography: Paper, Thin layer, column, Ion Exchange, Gel filtration, Gas Liquid, HPLC and affinity chromatography.
Principles and Application of Electrophoresis: AGE, PAGE, 2D gel and Iso-Electric focusing.

UNIT-IV: MICROSCOPY

Principles, construction and biological uses of phase contrast, fluorescence, scanning and transmission electron microscopes.

UNIT-V: PREPARATION OF MANUSCRIPTS

Preparation of index cards - Reference collection - preparation of thesis - preparation of Scientific paper for publication in a Journal. Internet and e-journals. Computer aided techniques for data analysis, data presentation and power point preparation.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be learning statistical methods.

- The student can able to works on Computers for Projects and Research.
- Student can able to understand search engines, Boolean searching, file formats etc.
- By learning data base, student can analyses the sequence similarities of the FAST and BLAST etc.

2. After studied unit-2, the student will be able to

- understand the different types of Spectrometers.
- They learn the principles of Nuclear Magnetic Resonance to identify the atomic elements of chemicals.

3.After studied unit-3, the student will be

- Understand to the different types of Spectrometer.
- Able to understand the separation of protein and DNA through Elecrophoretic apparatus.

4. After studied unit-4, the student will be

- To understand principles, construction of different Microscope.
- Student can be able to understand the staining techniques.
- Student can be able to understand the diseases with live tissue by SEM and TEM microscopes.

5. After studied unit-5, the student will be

- To learn the principles of academic writing for scientific journals.
- To understand the knowledge of writing process selection of publication forum tips for writing.
- Student can be able to prepare their own scientific manuscripts.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours: 1**

- Perform statistical approach for Research.
- Describe analysis of Biological data.
- Learn the World Wide Web, search engines and file formats.
- To study the biological data bases, data retrieval, sequence sources.

Unit-2: (50 to 100 contents) **Teaching Hours: 1**

- Study the Instrumentation of Biology.
- To under the working principles and application of Spectroscopy.

Unit-3: (50 to 100 contents) **Teaching Hours: 1**

- To understand chromatography and its applications.
- To acquire the knowledge in separation of serum proteins.
- To understand the principles and application of Eletrophoreis.

Unit-4: (50 to 100 contents) **Teaching Hours: 1**

- To understand the Immuno cyto chemical techniques.
- Recognize the SEM, TEM, techniques.
- To study the types of Microscopes.

Unit-5: (50 to 100 contents) **Teaching Hours: 1**

- To study the scientific research down into core argument.
- To learn the preparation of thesis.
- To study and acquire knowledge about the Publications of Journals, Internet, e- journals.
- Learn data preparation and ppt by computer aided techniques.

Text Books

1. Gupta, S.P. 1988. An easy approach to statistics. Chand & Co., New Delhi.
2. Gurumani, N. 2006. Research Methodology for Biological Sciences. MJP Publishers, Chennai.
3. Veerakumari, L. 2006. Bioinstrumentation. MJP Publishers, Chennai.

Reference Items: books, Journal

1. Anderson, Durston and Polle.1970. Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford.1979. Writing scientific papers in English. Pitman Medical Publishing Co., London.
3. Ewing, G.W. 1988. Instrumental methods of chemical analysis, McGraw Hill Book Company.
4. Daniel, M. 1989. Basic biophysics for biologists. Agro-Botanical Publishers, India.
5. Skoog, A., Douglas, J. and Leary, J.J. 1992. Principles of Instrumental Analysis. Sanders Golden Sunberst Series, Philadelphia.
6. Day, R.A. 1994. How to write and publish a scientific paper. Cambridge University Press, London.
7. Palanichamy, S. and M. Shanmugavelu.1997. Research methods in biological sciences. Palani Paramount Publications, Tamil Nadu, India.
8. Wilson and Walker. 2000. Practical biochemistry - principles and techniques.
9. Cambridge University Press.
10. Milton, J.S. 1992. Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York.

E- Materials

- https://epdf.pub/research-methodology-methods-and-techniques.html
- https://stuvera.com/research-methodology-books-pdf-free-download/
- https://groups.google.com/forum/#!topic/klubs_mba/e24oSszYJPI

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:** Core Paper 11
Paper code: DZO42 **Name of the Paper:** ENTOMOLOGY
Credit: 4 **Total Hours per Week:** 5

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Course Objectives

1. To gain knowledge of insects and their significance
2. To understand the economic importance of insects in related to beneficial insects.
3. To acquire knowledge on classification of insects.
4. To understand insect's pest and their control.
5. To understand different productive insects and their management
6. To understand different vector borne diseases.

UNIT-I: CLASSIFICATION

Classification of insects upto order with examples.

UNIT-II: BENEFICIAL INSECTS

Productive insects, lac insects and their management.

UNIT-III: SERICULTURE

Prospects of sericulture, Biology of silkworm (Nutrition, Genetics, Endocrinology, Reproduction, Pest and Diseases).

UNIT-IV: INSECT PESTS AND THEIR CONTROL

Insects – Pests of crops: Types of injuries and loss caused to plants in general. Factors governing the outbreak of pests.

Principles and methods of pest suppression: Natural, Cultural, mechanical, physical, chemical, Biological and Integrated pest management.

UNIT-V: INSECTS AS VECTORS

Vector borne diseases: Method of transmission of parasitic agents with special reference to mosquitoes and houseflies.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- Able to understand classification of insects.
- Able to understand about orders.
- Able to understand clearly about resemblances and difference between insects.
- Able to understand economic importance of insects.

2. After studied unit-2, the student will be

- Able to understand the biology of honeybees.
- Able to understand about lac insects
- Able to understand the management of beneficial insects.

3. After studied unit-3, the student will be

- Able to understand biology of silk worm
- Able to understand about nutrition of silk worm
- Able to understand the genetical importance
- Able to understand endocrinology of silk worm
- Able to understand the reproduction, pest and diseases of silk worm

4. After studied unit-4, the student will be

- Able to understand different pest crops.
- Able to understand types of injuries.
- Able to understand the causes of plants in general.
- Able to understand the pest control.
- Able to understand the integrated pest management.

5. After studied unit-5, the student will be

- Able to understand the victor borne diseases.
- Able to understand the method of transmission of parasitic agent.
- Able to understand the special reference to mosquitoes and housefly.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours: 1**

- To acquire knowledge on classification of insects.
- To acquire knowledge on orders.
- To gain knowledge on 26 orders of insects.
- To know about different types of insects.
- To understand morphological and physiological significance of insects

Unit-2: (50 to 100 contents) **Teaching Hours: 1**

- To understand about beneficial insects.
- To understand honeybee significant.
- To know lac insect significance.
- To understand the management of insects.

Unit-3: (50 to 100 contents) **Teaching Hours: 1**

- To understand the biology of silk worm.
- To understand silk worm nutrition.
- To understand genetical changes
- To understand pest and diseases
- To understand endocrinology of silk worm

Unit-4: (50 to 100 contents) **Teaching Hours: 1**

- To know about pest crops.
- To know about types of injuries.
- To know about loss of pauses to plan in general.
- To know about different pest control.
- To know about integrated pest management.

Unit-5: (50 to 100 contents) **Teaching Hours: 1**

- To know about different vector borne disease.
- To know about method of transmission.
- To know the mode of transmission
- To understand the different parasitic agency.
- To know about mosquitoes and housefly

Text Books

1. Vanantharaj David, B and Kumaraswami, T, 1975. Elements of Economic Entomology, Popular Book Depot in Madras.
2. Ananthakrishnan, T.N. 2002. Insect Plant Interactions. Oxford and I.B.H, New Delhi.
3. P.G.Fenemore, Alkaprakash. 1992. Applied Entomology, Wiley Eastern Ltd., Delhi.
4. Nayar, K.K., Ananthakrishnan, T.N. and B.V.David. 1989. General and Applied Entomology. Tata McGraw Hill Publications, New Delhi.
5. Richards, O.W. and Davies, R.G. 1997. Imm's General Text Book of
6. Entomology Tenth Edition. Vol I and II. R.I Publications, New Delhi. Rajeev K.Upadhyay, Mukerjii K.G. Chanda, B.P. and Dubey, O.P. 1998. Integrated Pest and Disease Management. APH Publishing Corporation, New Delhi.
7. Saxena. A.B. 1996. Harmful Insects. Anmol Publications, New Delhi.
8. Patton. W.S. and Cragg F.W.1981. A Text Book of Medical Entomology. International Books and Periodicals Supply Service, New Delhi.
9. Rathinaswamy, T.K.1986. Medical Entomology. S.Viswanathan and Co., Madras.
10. Sundari, M.S.N. and Santhi, R. 2006. Entomology. MJP Publishers, Chennai.

Reference Items: books, Journal

1. William S. Romoser and John G. Stoffolano.W. M.1994. The Science of Entomology C.Brown Publishers, England.
2. Yataro Tazima, Kodarsha .1978. The silkworm. An important laboratory tool. Scientific Book Ltd., Japan.
3. Larry P.Pedigo. 1989. Entomology and Pest Mangement. Prentice Hall, New Jersey.

4. Metcalf, C.V. and Flint, W.P. 1979. Destructive and useful insects, their habitats and control. Tata McGraw Hill Publications, New Delhi.
5. Daniel Altman Robets. 1978. Fundamental of Plant Pest Control. C.R.S. Publishers and Distributors,Delhi,
6. Chapman, R.F.1988. The insect structure and Function. Cambridge University Press, U.K.
7. David B.V., Muralirangan M.C. and Meera Murali Rangan. 1992. Harmful and Beneficial Insects. Popular Book Depot, Chennai.
8. Ramakrishna Ayyar T.V. 1989. Handbook of Economic Entomology for South India. Books and Periodicals Supply Service, New Delhi.
9. Frost S.W.1994. General Entomology. Narendra Publishing House, Delhi.
10. Dennis S.Hill. 1993. Agricultural Insect Pests of the Tropics and their Control. Second Edition, Cambridge University Press, U.K.

E- Materials

- https://www.freebookcentre.net/biology-books-download/A-Textbook-of-Entomology-(PDF-762P).html
- http://www.freebookcentre.net/Biology/Entomology-Books.html
- http://www.programamoscamed.mx/EIS/biblioteca/libros/libros/Gullan%20P.J.,%20Cranston%20P.%20The%20Insects..%20line%20of%20Entomology%202010_.pdf
- https://www.agrifunda.com/2018/01/fundamentals-of-entomology-free-pdf.html
- http://www.bio-nica.info/Biblioteca/Gillott2005ntomology.pdf
- https://archive.org/details/textbookofentomo00pack/page
- https://www.iaritoppers.com/2019/06/fundamentals-of-entomology-icar-ecourse-pdf-download.html
- https://feener.biology.utah.edu/courses/5445/Lecture/Bio5445%20Lecture%2001.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:** Core Paper
Paper code: DPZO47 **Name of the Paper:** PROJECT
Credit: 5 **Total Hours per Week:** 5

PROJECT COMPULSORY

Objectives

To promote original thinking, insemination of knowledge, modulation and innovation of thought, as an exercise, in order to transport the young minds to the expanding horizon of their chosen area of knowledge and transform them into knowledge generators.

Project	**75 Marks**
Viva voce	**25 Mark**

Semester: IV **Paper type:** Core Practical 3
Paper code: DPZO45 **Name of the Paper:** ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY
Credit: 4 **Total Hours per Week:** 12

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PHYSIOLOGY

1. Estimation of RQ in Fish with reference to Light and temperature.
2. Salt loss and salt gain in fish
3. Estimation of Proteins, Carbohydrates and Lipids in the tissues of Fish
4. Estimation of Blood Urea and Cholesterol.
5. Blood Clotting Time, Bleeding Time, Rouleaux Formation, Preparation of Haemin Crystal.
6. Principle and Application of Sphygmomanometer, Kymograph, Electrophoresis, Haemoglobinometer, ESR.
7. Estimation of Haemoglobin and ESR.

DEVELOPMENTAL BIOLOGY

1. Different stages in development - frog (egg, cleavage, Blastula, Gastrula, Yolk plug stage.
2. Chick embryo – primitive streak, 13 hrs, 24 hrs,48 hrs,72 hrs and 96 hrs.
3. Development of chick stage - slide showing C.S.of heart, kidney lens and limb.
4. Study of different types of placenta
5. Amphibia - identification of developmental stages.

IMMUNOLOGY

1. Haemagglutination - Quantitative analysis - haemagglutination titration.
2. Preparation of Antigen - RBC - Demonstration.
3. Ouchterlony technique - Demonstration.
4. Immunoelectrophoresis - Demonstration.
5. Slides showing T.S of Spleen, Thymus, lymphnodes and Bones

Semester: IV **Paper type:** Core Practical 4
Paper code: DPZO46 **Name of the Paper:** RESEARCH METHODOLOGY AND ENTOMOLOGY
Credit: 4 **Total Hours per Week:** 5

RESEARCH METHODOLOGY

1. Problems relating to test of significance (Chi - square test and t - test)
2. Problems relating to correlation, regression and ANOVA.
3. Familiarization of biological and bioinformatics web sites.
4. BLAST search for similar nucleotide sequences.
5. Spectrophotometric estimation of any biological constituent.
6. Electrophoresis - Paper / Agarose gel / PAGE
7. Preparation of index and reference cards.

ENTOMOLOGY

1. Study of morphology of insect (local 2 insects to be used).
2. Dissection of digestive, nervous, excretory, reproductive systems of any two insects.
3. Mounting of different types of mouthparts.
4. a. Field study of insect species
   b. Identification of at least 10 insects belonging to different orders.
5. a. Field study for various methods of pest management.
   b. Field visit to wearhouses and Plant protection centres.

Semester: IV **Paper type:** Core Elective 4
Paper code: DEZO43A **Name of the Paper:** A. SERICULTURE
Credit: 3 **Total Hours per Week:** 3

(to Choose either A or B)

Course Objectives

1. To know the Biology of silkworm, their economic importance and methods practiced in sericulture.
To develop sericulture as a skill based curriculum.

UNIT -I: ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY

Prospects and status of sericulture in India and other major silk producing countries. Silk producing species - their distribution. *Bombyxmori* - life cycle - organization of larvae, pupae and moth - structure and function of the silk gland.

UNIT-II: MORICULTURE

Mulberry - varieties - distribution - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases.

UNIT-III: SILKWORM REPRODUCTION AND GENETICS

Reproduction: Growth and Development of silkworms - Physiology of moulting in different varieties (Uni, bi and multivoltine) - Endocrinology of reproduction and development. Genetics: mutation breeding and development of new strains.

UNIT-IV: PATHOGENIC DISEASES AND PEST

Pathology: Viral, bacterial, fungal and protozoan diseases - causative organisms – modes of transmission – symptoms - control mechanisms. Uzifly menace.

UNIT-V: SILKWORM REARING AND SILK REELING

Rearing operations - Selection and construction of rearing house - Incubation - Hatching - brooding, Harvesting. Reeling techniques - Re-reeling - Silk examination – lacing, skeining.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- To know the general development of sericulture research.
- Modern trends and Concepts in sericulture research.

2. After studied unit-2, the student will be

- The student will be involved in various aspects of egg production.

3.After studied unit-3, the student will be

- Able to understand silk health diagnosis, identification of deficiency symptoms.

4.After studied unit-4, the student will be

- The student involved in various product of silk.

5.After studied unit-5, the student will be

- The student involved in various product of silk.
- To develops highly qualified protein and profession and manpower in silk and sericulture.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- By Learning the history of sericulture.
- Understanding the status of silk producing countries and sericulture in India.
- Basic terminologies of sericulture.
- Learning the nursery preparation and cultivating silkworms.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- By learning the morphology and variety of Mulberry.
- Study the harvest, transport and preparation of Leaves.
- By learning the establishment of mulberry garden.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Study the external morphology and life cycle of silkworm.
- Learning the anatomy of physiology.
- Learning the endocrine system, hormones and it roles.
- Studying the breeding methods and importance.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Learning Viral, Bacterial, Fungal, and Protozoan Diseases.
- Understanding the mode of transmission and control mechanisms.
- Learning the Uzifly manace.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- By learning the silkworm rearing techniques.
- By understanding the differentiation of young age and old age rearing methods.
- Learning the reeling techniques and examination of silk lacing and skeining.

Text Books

1. Ganga, G. and SulochanaChetty, J. 1997. An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. 2003. Comprehensive Sericulture Vol-I: Moriculture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

3. Ganga, G. 2003. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Madan Mohan Rao, M. 2019. An Introduction to Sericulture. 2nd edition, B.S. Publications. Andhra Pradesh, India.
5. Amardev Singh. 2012. Text book on Sericulture Training. Bio-Green Books. New Delhi.

Reference Items: books, Journal

1. HisaoAruga. 1994. Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Otsuki, R. and Sato, S. 1997. Silkworm Egg Production (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Eikichi Hiratsuka. 1999. Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Mahadevappa, D., Halliyal, V.G., Shankar D.G. and Bhandiwad, R., 2000. Mulberry Silk Reeling Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. 1990. Sericulture Training Manual – Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
7. Wu Pang-Chuan and Chen Da-Chuang. 1994. Silkworm Rearing – Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
8. Lu Yup-Lian and Liu-Fu-an. 1991. Silkworm Diseases - Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

E- Materials

- https://archive.org/details/SericultureHandbook/page/n1/mode/2up
- http://www.csrtimys.res.in/books-0

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:** Core Elective 4
Paper code: DEZO43B **Name of the Paper:** (B) MICROBIOLOGY
Credit: 3 **Total Hours per Week:** 3

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Course Objectives

- To know the structure, function and diversity of microorganisms.
- To gain knowledge on the various techniques of microbiology.
- To acquire a basic knowledge on environmental, medical and industrial microbiology.

UNIT-I: STRUCTURE AND CLASSIFICATION

History and Scope of Microbiology. Structure and classification of virus, bacteria and fungi.

UNIT-II: STERILIZATION AND CULTURE

Sterilization: Principles - dry heat, moist heat, filtration, tyndallization, pasteurization, Radiation - disinfection.

Culture techniques - media preparation - Aerobic and anaerobic culture techniques - Wet mount, hanging drop, staining methods, dyes, simple differential and special staining techniques - acid fast stain, spore stain, capsule stain, staining for pure and mixed cultures.

UNIT-III: ENVIRONMENTAL MICROBIOLOGY

Microbial ecology - role of microorganisms in the productivity of ecosystems - Interactions between microorganisms- and plants and animals. Microbiology of soil, water and air.

UNIT-IV: MEDICAL MICROBIOLOGY

Pathogenic microbes of bacterial, viral, fungal and protozoan diseases - cure, control and prevention. Antimicrobial chemotherapy - Antibiotics - Source – Classification- Mode of action.

UNIT-V: INDUSTRIAL MICROBIOLOGY

Industrial uses of microbes - bioconversions – bioremediation.
Products of industrial microbiology - Penicillin, fuel ethanol, vinegar, vitamin B12, citric acid, glutamic acid, protease.
Food and Dairy microbiology. Role of microbes in food production. Dairy and non-dairy products.

Course Out Comes (five outcomes for each units should be mentioned)
1.After studied unit-1, the student will be able to

- define the microbial organisms of the virus, bacteria, and fungi.
- Student can be able to explain the scope of microbiology.

2. After studied unit-2, the student will be

- Able to demonstrate the practical skill in sterilization and pasteurization techniques.
- Student can be able to explain the technical basis of tools, technological methods methodology.

3. After studied unit-3, the student will be

- Describe the basic concepts of legal, ethical, economical and regulatory dimention of health line and public health.
- To understand the interaction of microorganisms and organisms of soil.

4. After studied unit-4, the student will be

- Student will understand the anti-microbial interactions.
- Student will learn about the Pathogenic microbes and diseases.

5. After studied unit-5, the student will be

- Student can be able to gain knowledge in several field of applied microbiology.
- Student can work in research and development unit in microbial industries.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Understanding the different bacterial morphologies.
- By learning the structure of virus, bacteria, and fungi.
- Learning the difference between Gram negative and Gram positive bacteria.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Understanding the culture techniques of the bacteria and virus.
- Understand the sterilization techniques.
- By learning to compare sterilization and pasteurization techniques.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Understand the microbial metabolisms.
- Understand the bacterial, viral and fungal diseases.
- Study the different types of microbes.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- To learn the pathogenic microbes.
- To understand the anti-microbial chemotherapy.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- To learn the industrial uses of microbes.
- To understand the food and diary microbiology.

Text Books

1. Ananthanaryanan, T. and Paniker, J.C.K. 2000. Text Book of Microbiology. Orient Longman Ltd., Chennai.
2. Ahmed, M. and Basumatary, S.K. 2006. Applied Microbiology. M.J.P Publishers, Chennai.
3. Pelczar, M.J., Reid, R.D. and Chan, E.C.S. 1996. Microbiology. Tata McGraw Hill Co., Ltd. New Delhi.
4. Dubey, R.C. andMaheshwari, D.K. 2006. A Text Book of Microbiology. S. Chand and Company Ltd. New Delhi.
5. Patel, A.H. 2016. Industrial Microbiology. 2nd edition. Trinity Press. New Delhi.
6. Rajan, S. 2007. Medical Microbiology. M.J.P. Publishers. Chennai.
7. Powar, C.B. and Daginawala, H.F. 2010. General Microbiology, Volume: 2. Himalaya Publishing House. Mumbai.

Reference Items: books, Journal

1. Tortora, G.J., Funke, R.B. and Case, C.L. 1992. Microbiology - An Introduction. The Benjamin / Cummings Publishing Co., Inc. Sydney.
2. Black, J.G. 1999. Microbiology - Principles and Explorations. John Wiley and Sons Inc. New York.
3. Atlas, R.M. 1995. Principles of Microbiology. Mosby - Year Book Inc.
4. Prescott L.M. Harley J.O. Klein D.A. 1990. Microbiology. WCB Publishers, Sydney.
5. Geo F. Brooks, Karen C. Carroll, Janet S. Butel, Stephen A. Morse. 2007. Medical Microbiology. 24th edition. Tata McGraw Hill, LANGE. New Delhi.
6. Roger Y. Stanier, John L. Ingraham, Mark L. Wheelis, Page R. Painter. 2008. General Microbiology. MacMillan Press Ltd. New York.

E- Materials

- https://openstax.org/details/books/microbiology
- https://www.topfreebooks.org/medical-microbiology/

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:** Open Elective Paper 4
Paper code: DOZO44 **Name of the Paper:** (A) SERICULTURE
Credit: 3 **Total Hours per Week:** 3

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(to Choose either A or B)

Course Objectives

1. To know the Biology of silkworm, their economic importance and methods practiced in sericulture.
2.To develop sericulture as a skill based curriculum.

UNIT -I: ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY

Prospects and status of sericulture in India and other major silk producing countries. Silk producing species - their distribution. *Bombyxmori* - life cycle - organization of larvae, pupae and moth - structure and function of the silk gland.

UNIT-II: MORICULTURE

Mulberry - varieties - distribution - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases.

UNIT-III: SILKWORM REPRODUCTION AND GENETICS

Reproduction: Growth and Development of silkworms - Physiology of moulting in different varieties (Uni, bi and multivoltine) - Endocrinology of reproduction and development. Genetics: mutation breeding and development of new strains.

UNIT-IV: PATHOGENIC DISEASES AND PEST

Pathology: Viral, bacterial, fungal and protozoan diseases - causative organisms – modes of transmission – symptoms - control mechanisms. Uzi fly menace.

UNIT-V: SILKWORM REARING AND SILK REELING

Rearing operations - Selection and construction of rearing house Incubation - Hatching - brooding, Harvesting. Reeling techniques - Re-reeling - Silk examination – lacing, skeining.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- To know the general and development of sericulture research.
- Modern trends and Concepts in sericulture research.

2. After studied unit-2, the student will be

(1) The student will be involved in various aspects of egg production.

3.After studied unit-3, the student will be

- able to understand silk health diagnosis, identification of different system.

4.After studied unit-4, the student will be

- the student involved in various product of silk.

5.After studied unit-5, the student will be

- The student involved in various product of silk.
- To develops highly qualified protein and profession and manpower in silk and sericulture.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- By Learning the history of sericulture.
- Understanding the status of silk producing countries and sericulture in India.
- Basic terminologies of sericulture.
- Learning the nursery preparation and cultivating silkworms.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- By learning the morphology and varieties of Mulberry.
- Study the harvest, transport and preparation of Leaves.
- By learning the establishment of mulberry garden.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Study the external morphology and life cycle of silkworm.
- Learning the anatomy of physiology.
- Learning the endocrine system, hormones and it roles.
- Studying the breeding methods and importance.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Learning Viral, Bacterial, Fungal, and Protozoan Diseases.
- Understanding the mode of transmission and control mechanisms.
- Learning the Uzifly manace.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- By learning the silkworm rearing techniques.
- By understanding the differentiation of young age and old age rearing methods.
- Learning the reeling techniques and examination of silk lacing and skeining.

Text Books

1. Ganga, G. and SulochanaChetty, J. 1997. An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. 2003. Comprehensive Sericulture Vol-I: Moriculture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Ganga, G. 2003. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Madan Mohan Rao, M. 2019. An Introduction to Sericulture. 2nd edition, B.S. Publications. Andhra Pradesh, India.
5. Amardev Singh. 2012. Text book on Sericulture Training. Bio-Green Books. New Delhi.

Reference Items: books, Journal

1. HisaoAruga. 1994. Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Otsuki, R. and Sato, S. 1997. Silkworm Egg Production (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Eikichi Hiratsuka. 1999. Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Mahadevappa, D., Halliyal, V.G., Shankar D.G. and Bhandiwad, R., 2000. Mulberry Silk Reeling Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. 1990. Sericulture Training Manual – Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
7. Wu Pang-Chuan and Chen Da-Chuang. 1994. Silkworm Rearing – Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
8. Lu Yup-Lian and Liu-Fu-an. 1991. Silkworm Diseases - Published by FAO – USA. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

E- Materials

- https://archive.org/details/SericultureHandbook/page/n1/mode/2up
- http://www.csrtimys.res.in/books-0

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

Semester: IV **Paper type:** Open Elective Paper 4
Paper code: DOZO44 **Name of the Paper:** (B) PEARL CULTURE
Credit: 3 **Total Hours per Week:** 3

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Course Objectives

- Learning the natural process of pearl formation.
- Study the Environmental parameters
- Studying the predators of pearl oyster.
- Study and maintaining the genic condition of culture units and post-operative tanks.
- Learning the techniques of implantation.

Unit 1:

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

Unit 2:

Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

Unit 3:

Pearl oyster culture: Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters. Pearl Oyster surgery (Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery), Post-operative culture, harvesting of pearl, clearing of pearl.

Unit 4:

Diseases and Predators of Pearl oysters.

Unit 5:

Present status, prospects and problems of pearl industry in India.

UNIT V

Pearl Production: Overview of pearl trade, pearl oysters and mussels of commercial importance; anatomy, biology and seed production, techniques of implantation, method of rearing and harvesting of pearl, Mable pearl production, processing and quality evaluation of pearls, pearl production by tissue culture

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be

- Identify the characteristics of molluscs.
- Understand the how pearls are formed.
- Understand the role of pearl culture techniques.

1. After studied unit-2, the student will be

- Perform implantation.
- Learning the chemical composition.
- To know about culturing of pearls.

2.After studied unit-3, the student will be

- Understand the how to conserve the habitat of molluscs.
- Student will be able to understand the collection of oysters, theoretical based implantation.
- The student will be able to acquire the knowledge to perform surgical procedure of implantation.

3.After studied unit-4, the student will be

- Monitor the health of pearl oyster by provide sampling and maintaining hygienic condition of culture.
- To understand the disease of Pearl oysters.

4.After studied unit-5, the student will be

- Student will understand and apply the skill needed to achieve academic success.
- Student will understand the economical and moral values.
- Student will learn the workmanship to serve the society.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	No	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Unit-1: (50 to 100 contents) **Teaching Hours:**

- Identify the pearl producing oyster.
- Learning the soil profile and water quality for culture.
- To study the life cycle of the Pearl oyster.

Unit-2: (50 to 100 contents) **Teaching Hours:**

- Study the structure and histology of mantle.
- Learning the natural process of pearl formation.
- Study the chemical composition of Pearls.

Unit-3: (50 to 100 contents) **Teaching Hours:**

- Learning the pearl culture techniques.
- Study the Environmental parameters.
- By learning to identify species capable of producing pearls.
- Learning the anatomy and theoretical basis of surgical implantation.

Unit-4: (50 to 100 contents) **Teaching Hours:**

- Learning the disease caused in pearl oyster.
- Studying the predators of pearl oyster.
- Study and maintaing the genic condition of culture units and post-operative tanks.

Unit-5: (50 to 100 contents) **Teaching Hours:**

- Learning the overview of pearl trade.
- Learning the techniques of implantation.
- Method of rearing and harvesting of pearl.

Text Books

- Paul Southgate, and John Lucas, 2008. The pearl oyster, Elsevier Science

Reference Items: books, Journal

- Paul Southgate, and John Lucas, 2008. The pearl oyster, Elsevier Science

E- Materials

- http://www.ctsa.org/files/publications/CTSA_127631672861923948 3681.pdf
- http://eprints.cmfri.org.in/3208/1/Special_Publication_No_20.pdf
- https://krishi.icar.gov.in/PDF/Selected_Tech/fisheries/33-FS-Fresh%20water%20pearl%20culture.pdf
- https://www.agrifarming.in/pearl-farming-project-report-cost-profits
- https://spo.nmfs.noaa.gov/sites/default/files/legacy-pdfs/leaflet357.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	M	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	M	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	M	M	S	S

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