``

MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL - 624 101
Tamil Nadu.

Curriculum Framework and Syllabus for

M.Sc. ZOOLOGY

Programme code: PG-MZO

(For the candidates to be admitted from the academic year 2021-2022 onwards)

(UNDER CHOICE BASED CREDIT SYSTEM- CBCS)

Mother Teresa Women's University, Kodaikanal

M.Sc. ZOOLOGY

1. About the Programme

M.Sc Zoology is a 2-year postgraduate programme dedicated to the study of animals. The program comprises the biology, behaviour and structure of animals. The students can acquire adequate knowledge of animal kingdom, Biodiversity, anatomy of animals, embryology, characteristics and evolution of animal life. The programme also addresses the causes in the loss of habitat and conservation of biodiversity. M.Sc Zoology is an advanced course that focuses on modern technology to study various aspects of animal life. This course equally covers theoretical and practical sessions to understand the concepts in a better way along with outdoor tours. After completing M.Sc Zoology course students can opt for various job roles in public and private sectors like academics, official in Zoological park, Ecologist, Conservation officer, field Trials officer etc.

2. Programme Educational Objectives (PEOs):

PEO1	To train the students in basic and advanced areas of Zoology, Animal Biotechnology and other related subjects along with sensitizing them to the scope for research.
PEO2	To empower the students with analytical and research skills, to nurture entrepreneurial endeavours
PEO3	To prepare a competent generation of zoologist, capable of excelling in their careers
PEO4	To develop them with good communicative skills and function effectively as an individual and as a team member in a professional environment.
PEO5	To develop potential biologist with professional ethics in order to address global and societal issues for sustainable development.

3. Eligibility:

- A candidate who has passed Graduate in Zoology and other Relevant Subject
- Candidate should have secured at least 55% in the above subject from any recognized university.
-

4. General Guidelines for PG Programme

i. **Duration:** The programme shall extend through a period of 4 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. **Medium of Instruction:** English

iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.

Evaluation Pattern	Theory		Practical	
	Min	Max	Min	Max
Internal	**13**	**25**	**13**	**25**
External	**38**	**75**	**38**	**75**

- **Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz(5) = 25**
- **External Theory: 75**

- **Question Paper Pattern for External examination for all course papers.**

Max. Marks: 75 **Time: 3 Hrs.**

S.No.	Part	Type	Marks
1	**A**	**10*1 Marks=10** Multiple Choice Questions(MCQs): 2 questions from each Unit	**10**
2	**B**	**5*4=20** Two questions from each Unit with Internal Choice (either / or)	**20**
3	**C**	**3*15=45** Open Choice: Any three questions out of 5 : one question from each unit	**45**
Total Marks			**75**

*** Minimum credits required to pass: 90**

- **Project Report**

A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 line space.

- **Project Evaluation**

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25 Marks; External (Viva): 75 Marks).

5. Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/Paper)

Range of Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance less than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

7. Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

8. Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the PG Programmes are also applicable for this Programme.

M. Sc. ZOOLOGY CURRICULUM

Sl. No	Course Code	Course Title	Credits	Hours		CIA	ESE	Total
				T	P			
Semester I								
1.	P21ZOT11	Core I -Biology of Invertebrates	4	5	-	25	75	100
2.	P21ZOT12	Core-II- Biology of Chordates	4	5	-	25	75	100
3.	P21ZOT13	Core-III- Cell And Molecular Biology	4	5	-	25	75	100
4.	P21ZOT14	Core-IV-Animal Physiology	4	5	-	25	75	100
5.	P21ZOP11	Core-V-Practical –Biology of Invertebrates, Chordates, Cell & Molecular Biology and Animal Physiology	4	-	6	25	75	100
6.	P21CSS11	Supportive Course I- Computer Skills For Web Designing And Video Editing	2	4	-	25	75	100
		Total	**22**	**30**		**-**	**-**	**600**
Semester II								
7.	P21ZOT21	Core VI- Biochemistry	4	5	-	25	75	100
8.	P21ZOT22	Core-VII- Immunology	4	5	-	25	75	100
9.	P21ZOT23	Core-VIII- Genetics	4	4	-	25	75	100
10.	P21ZOT24	Core-IX - Applied Zoology	4	4	-	25	75	100
11.	P21ZOP22	Core-X-Practical - Biochemistry, Immunology Genetics& Applied Zoology	4	-	6	25	75	100
12.	P21ZON211/ P21ZON212	Non Major Elective	4	4	-	25	75	100
13.	P21ZOS22	Supportive Course II – Medical Laboratory Technology	2	2	-	25	75	100
		Total	**26**	**30**		**-**	**-**	**700**
Semester III								
14.	P21ZOT31	Core XI- Biotechnology & Bioinformatics	4	4	-	25	75	100
15.	P21ZOT32	Core-XII-Developmental Biology	4	5	-	25	75	100
16.	P21ZOT33	Core-XIII-Evolution, Animal Migration & Behaviour	4	4	-	25	75	100
17.	P21ZOT34	Core XIV-Ecology & Toxicology	4	4	-	25	75	100
18.	P21ZOT35	Core XV -Research Methodology and Bioethics	4	5	-	25	75	100
19.	P21ZOP33	Core-XVI- Practical- Biotechnology & Bioinformatics, Developmental Biology, Evolution, Ecology & Toxicology	4	-	6	25	75	100
20.	P21WSS33	Supportive Course III -Women	2	2	-	25	75	100

		Empowerment						
		Total	**26**	**30**				**700**
Semester IV								
21.	P21ZOE411/ P21ZOE412	Elective-I*-Entomology/ Endocrinology/Any MOOC Courses[$]	4	4	-	25	75	100
22.	P21ZOE421/ P21ZOE422	Elective-II *–Biostatistics & Biophysics/Microbiology/Any MOOC Courses[$]	4	4	-	25	75	100
23.	P21ZOR41	Project	8	-	22	25	75	100
		Total	**16**	**30**				**300**
Total			**90**	**120**				**2300**

Non Major Elective

The candidates, who have joined the PG programme, can also undergo Non Major Elective offered by other Departments

Non Major Electives (NME) offered by Zoology:

1. NME-I: Conservation Biology-P21ZOE211
2. NME-II: Epidemiology- P21ZOE212

Additional Credit Courses

1. P21ZOV11:Value Added Program I-Two Credits (First Semester)
2. P21ZOI21:Internship/Industrial Training – Two Credits- (Second Semester)
3. P21ZOO31:Online Courses-Two Credits- (Third Semester)
4. P21ZOV41:Value Added Program II-Two Credits (Fourth Semester)

Value Added Courses

1. VAP I - Medical Transcription- P21ZOV11
2. VAP II - Fisheries Technology- P21ZOV41

*Those who have CGPA 9 and want to do the project in industry/institution during 4th semester, those two elective papers in IV semester can be opted in third semester itself.

[$] For Elective –I/Elective-II, the students can also take either one 4-credit course or two 2-credit courses in MOOC, with the approval of Departmental Committee.

Outside class hours (Attendance compulsory, Certificate Mandatory)

- Health, Yoga and Physical Fitness
- Library Information access and utilisation
- Employability Training
- Students Social Responsibility

PROGRAMME OUTCOMES (POs)

On completion of M.Sc - Zoology programme students will be able to

PO1	impart knowledge to identify and signify the animal kingdom, diversity of animals, cell molecules.
PO2	understand the principles of development, evolution and ethology of different organisms.
PO3	acquire knowledge on organization and molecular effects of cell, gene, compounds, and immunity and to combat microbial infections.
PO4	enable them to maintain and improve their physiology, health and hygiene.
PO5	gain the ideas about biochemical pathways, genetic engineering, development and their disorders, biotechnology field and handling bioinstrumentation and biotechnology field.
PO6	acquire skill on beneficial insects and useful animals to develop into a successful women entrepreneur
PO7	get familiarize to promote innovative research ideas, field knowledge, scientific writing and statistical approach, involve in environmental activities for sustainable development
PO8	apply the scientific knowledge acquired for the development of scientific society and follow a line of investigation of our country.

PROGRAMME SPECIFIC OUTCOMES – (PSO)

On completion of M.Sc Zoology programme, students will be able to

PSO1	understand and acquire knowledge on the characteristic features, diversity, taxonomy, anatomy and physiology of different animals, evolution of organism
PSO2	gain the knowledge about immunity and to combat microbial infections, biochemical pathways, development and their disorders, beneficial insects, useful animals and their economical benefits.
PSO3	enlighten and receive awareness about environmental benefits and to mitigate its degradation
PSO4	learn the advancements in handling bioinstrumentation, genetic engineering and biotechnology field.
PSO5	familiarize to promote innovative research ideas, field knowledge, scientific writing and statistical approach. Enriched and empowered to clear competitive examinations and grab opportunities

SEMESTER -I

Course Code	P21ZOT11	BIOLOGY OF INVERTEBRATES	L	T	P	C
CORE – I			5	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning objectives	• To understand the taxonomy and classification of invertebrates. • To understand the taxonomy and classification of invertebrates. • To know the larval forms of invertebrates • To understand the biological description of invertebrates • To comprehend the structural peculiarities of invertebrates	
Unit I	**Broad classification of the Animal Kingdom**	**12 hours**
Principals involved. Protozoa Feeding, Reproduction and Parasitic Protozoa. Economic importance of Protozoa. Origin and evolution of Metazoa - theories. Mesozoa, Porifera Interrelationship between different classes, Marine sponges and Freshwater sponges.		
Unit II	**Cnidaria Origin and evolution**	**12 hours**
Polymorphism and Reproduction in cnidaria . Corals and Coral reeves, Origin of Bilateria. Importance of Rhabdocoela as a stem group. Origin and evolutionary trends in coelom formation. Platyhelminthes - Functional morphology and adaptive biology for parasitic mode of life.		
Unit III	**Annelida**	**12 hours**
Archiannelida. Inter relationship between different classes of Annelida. Type study - Earth worm, External morphology, setae, nephridia, nervous system and reproductive system – Metamerism in Annelids. Arthropoda: Type study-Marine Prawn – external morphology, appendages, digestive and excretory systems, reproductive system and development—Affinities of Peripatus. Economic importance of Crustaceans, Phylogeny of Arthropoda.		
Unit IV	**Mollusca**	**12 hours**
Type study- Pila – external morphology, digestive system, respiratory system, Osphridium only. Cephalopods as an advanced Mollusc. Echinodermata: Type study – Star fish - external morphology, pedicellaria, Water vascular system only. Larval forms of Echinodermata. Phylogeny of Echinoderms.		
Unit V	**Minor Phyla**	**12 hours**
Structural peculiarities and affinities of Ctenophora, Nemertinea, Rotifera, Pogonophora, Phoronida and Lophophorates. Invertebrate fossils: Trilobites, Brachiopoda, Cephalopoda and Echinodermata.		
Text Books	1. Nair NC, Leelavathy S, Soundara Pandian N Murugan T and Arumugam N. A Text Book of Invertebrates, Saras Publication Nagercoil, Tamilnadu.2010. 2. Nair NC. Invertebrata and Chordata, Saras Publication Nagercoil,Tamilnadu.2017.	
Reference Books	1. Barnes RD, Invertebrate Zoology.7th edition, Thomson Press (India) Ltd 2010. 2. E.L.Jordan and P.S. Verma Invertebrate Zoology, S.Chand & Company Ltd,New Delhi, 2009. 3. P.S. Dhami and J.K. Dhami, Invertebrate Zoology R.Chand & Co. New Delhi, 2003 .	

	4. R.L.Kotpal, Invertebrate Zoology, Rastogi Publications, Meerut, 2005. 5. M.Ekambaranatha Iyer and T.N.Ananthakrishnan, A Manual of Zoology Viswanathan Publications, Chennai, 2003.
E-Reference	1. https://nptel.ac.in/courses/102/106/102106035/ 2. https://biologydictionary.net/invertebrate 3. http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf 4. file:///C:/Users/ACER/Downloads/invertebrates_3-4_unit_guide%20(1).pdf

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the general taxonomic rules on animal classification.	**K1**
CO2	know the origin and evolution of Cnidaria and adaptation of parasite	**K2**
CO3	acquire knowledge on Annelids and Arthropods with economic importance.	**K2**
CO4	classify phylum Molluscs and Echinodermata with taxonomic keys.	**K3**
CO5	gain knowledge about structural peculiarities of minor phyla and fossils	**K2**

Mapping of COs with POs &PSOs:

Course Outcomes	**POs**								**PSOs**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	M	M	S	M	M	S	S	M	M	S
CO2	S	S	S	M	M	S	S	M	S	S	M	M	S
CO3	S	M	S	S	S	S	S	S	S	M	M	S	S
CO4	S	S	S	M	M	S	S	S	S	S	M	M	S
CO5	S	M	S	M	M	S	M	M	S	S	S	M	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT12	BIOLOGY OF CHORDATES-	L	T	P	C
CORE-II			5	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning Objectives	• To comprehend the general classification of chordates taxonomy • To learn the salient features of vertebrates • To understand the economic importance of vertebrates and fossil bird	
Unit I	**Overview Taxonomy**	**12 hours**
Principles of Taxonomy. Nomenclature: Binomial, taxonomic keys. Outline classification of Chordates upto order level with example. Prochordata, Pisces and Amphibia, Concept of Prochordata – Hemichordata- Balanoglossus.		
Unit II	**Urochordata**	**12 hours**
Ascidians, Cephalochordata – Amphioxus - Salient features and Functions. Affinity of Cephalochordata - Origin and Adaptive radiation of bony fishes. Amphibia - Adaptive radiation from water to land.		
Unit III	**Reptilia, Aves and Mammals**	**12 hours**
Classification of class Reptilia, Aves and Mammals upto orders. Salient features with examples - Adaptive radiation of reptiles. Reptilia -Type study – Calotes, external morphology, Urinogenital system and nervous system. Poisonous and non-poisonous Snakes, identification and biting mechanism.		
Unit IV	**Adaptive Radiation**	**12 hours**
Aves- Birds as glorified reptiles, adaptive radiation in birds. Aves- Type study – Pigeon- external morphology, respiratory system, pectoral and pelvic girdles only. Flight adaptations. Migration of birds, - Flightless birds, -Fossil bird Archaeopteryx and its evolutionary importance.		
Unit V	**Mammalia**	**12 hours**
Classification of Mammals with examples, external morphology, nervous system and reproductive system. Dentition in mammals, Stomach in ruminants, Aquatic mammals and economic importance of vertebrates.		
Text Books	1. Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N. A Text Book of Chordates, Saras Publication, Nagercoil, Tamilnadu. 2014. 2. KotpalRL. Mordern Text Book of Zoology Vertebrates, 4th edition, Rastogi Publications, Meerut.2019.	
Reference Books	1. E.L.Jordan and P.S. Verma, Chordate Zoology, S.Chand & Company Ltd, New Delhi, 2011. 2. Pough Harvey F, Christine M .Janis and John B. Heiser. (2002). Vertebrate Life, Pearson Education Inc. New Delhi. 3. Route and Solanki.2002.Learning Prochordata- Mammalia –Theory and Practice Dominant Pub. & Distributors, New Delhi 4. Verma.P.S.(2013).Chordate Zoology, S Chand Publishers, New Delhi.	

E-references	1.https://nptel.ac.in/courses/102/106/102106035/ 2.http://assets.vmou.ac.in/MZO06.pdf

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	acquire depth knowledge on the principles and taxonomic keys concepts of chordates to apply the knowledge for animal classification	**K3**
CO2	learn the salient features and functions of proto chordates with fishes and amphibians.	**K2**
CO3	understand the classification and functional attributes of reptiles	**K2**
CO4	gain deep knowledge on morphology, physiology and adaptive radiation of Aves	**K2**
CO5	comprehend the classification and unique adaptations in mammals.	**K2**

Mapping of COs with POs &PSOs:

Course Outcomes	**PO**								**PSO**				
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	S	S	M	S	M	S	M	S	M	M	M	M	S
CO2	S	S	M	M	S	S	M	M	M	M	M	S	S
CO3	S	S	S	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	M	S	M	S	S	M	S	S	M	S
CO5	S	S	M	M	S	S	M	M	S	S	M	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT13	CELL AND MOLECULAR BIOLOGY	L	T	P	C
CORE-III			5	-	-	4
Cognitive Level	K1:Recall K2:Understand					
Learning Objective	• To understand the various concepts of molecular biology and the central dogma of life. • To develop a comprehensive understanding in the mechanisms of replication, transcription and translation • To gain extensive knowledge on gene expression					
Unit I	**Cell Theory & Cell Cycle**		**12 hours**			
Cell theory, protoplasm theory, prokaryotic and eukaryotic cell differentiation, Cell cycle and regulations. Cell division: mitosis, meiosis and their significance. Cytoplasm: Physical and biological properties of cytoplasmic matrix. Plasma membrane: Chemical composition, structure and functions.						
Unit II	**Structure and function of Cell Organelle**		**12 hours**			
Ribosome and Golgi bodies: Ultrastructure, types and function. Lysosome: Chemical composition, Polymorphism and Functions. Endoplasmic reticulum and plastids. Ultrastructure, types and functions, Mitochondria: Ultra structure and functions. Micro bodies peroxisomes and glyoxisomes.						
Unit III	**Structure and Function of Cell Organelle**		**12 hours**			
Ultra-structure of nuclear membrane. Nucleolus, Nucleoplasm and Chromatic fibres. Microtubules, Microfilaments – Cilia and Flagella. Signal Transduction Pathways: Organisation signals, Receptors. Ion channel coupled receptors – Secondary messengers. Amplifiers, Integrators and Signal hypothesis.						
Unit IV	**Nucleic acid**		**12 hours**			
Nucleic Acid as the genetic material - direct and indirect evidences – Structure and types of DNA and RNA. Eukaryotic Chromosome: Chromosome structure and organization. C-Value paradox DNA – Repetitive DNA. Mutations and DNA damage: physical, chemical and biological agents – Mutation types – Molecular basis of spontaneous and induced mutations. Environmental mutagenesis and toxicity testing: AMES test.						
Unit V	**DNA replication**		**12 hours**			
Semi conservative and rolling circle. Enzymes involved in replications: types and their functions. Transcription and Translation: RNA polymerase – types, properties and functions – Transcription process in prokaryotes and eukaryotes – RNA processing, capping, polyadenylation, splicing, introns and exons. Regulation of gene expression- *lac* operon *and trp* operon, Regulation of gene expression in eukaryotes.						
Text Book	1. Frifelder, D. Molecular Biology 2nd edition. Narosa Publishing House, New Delhi. 2000. 2. Gupta, M.L. and Jangir, M.L., Cell Biology Fundamentals and Application,					

	Student Edition, Jothpur. 2003. 3. Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. Lewin‟s Genes X, Jones and Bartlett publishers Inc, London UK.2011.
Reference Books	1. Karp G .Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley & Sons Ltd. New York. 2010. 2. De Roberties E.D.P and E.M.F.De Roberties. Cell and Molecular Biology. 8th edition. B.I. Publicatons Pvt. Ltd., India. 2011. 3. Haddin J. Becker‟s World of the Cell (8th Editon). Benjamin Cummings Publishing Company , New York.2011 . 4. Lewin, B., Genes-X, Oxford University Press Inc., New York.2012 5. Cooper, GM and Hawman RE. Cell a Molecular Approach (6th Edition). Sinauer Associates, Inc. 2013. 6. . Karp G. Cell and Molecular Biology Concepts and Experiments. John Wiley & Sons, Inc.2013.
E-References	1. https://nptel.ac.in/courses/102/106/102106025/ 2. https://nptel.ac.in/courses/102/103/102103012/ 3. https://swayam.gov.in/nd2 4. https://nptel.ac.in/courses/102/104/102104059

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the cell theory, cell cycle and regulation	**K1**
CO2	attain a deep knowledge on the structure and functions of cell organelles	**K2**
CO3	comprehend the ultra structure and functions of genetic material with microtubules, microfilaments and transduction pathways.	**K2**
CO4	acquire wide knowledge on the organization of genome.	**K2**
CO5	learn DNA replication, transcription, translation with regulation of gene expression.	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	M	S	S	S	S	M	S	M
CO2	S	S	S	M	M	M	M	S	S	S	S	S	M
CO3	S	S	S	S	M	M	M	S	S	S	M	S	M
CO4	M	S	M	S	M	S	M	S	M	S	M	M	M
CO5	S	S	M	S	M	S	M	S	S	S	M	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks

Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT14	ANIMAL PHYSIOLOGY	L	T	P	C
CORE IV			5	-	-	4
Cognitive Level	K1:Recall K2:Understand K3:Apply					
Learning objective	• To learn the biochemical changes and basic thermo dynamic principles. • To know the carbohydrate, Lipid and aminoacid metabolism • To learn the integration of metabolic pathways and Hormonal regulation. • To get thorough knowledge on metabolic pathways of human physiology and to apply the knowledge for biotechnological and biochemical research					
Unit I	**Digestive System (Man)**		**12 hours**			
Digestion, absorption, energy balance, BMR with reference to man, Obesity. Respiratory system (Man): Transport of gases, exchange of gases, respiratory pigments. Haemoglobin as oxygen carrier, respiratory quotient, neural and chemical regulation of respiration in man. Hamperson phenomenon. SARS.						
Unit II	**Blood and Circulation**		**12 hours**			
Blood and its components, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, haemostasis, Hemophilia. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, Myocardial Infarction and CPR.						
Unit III	**Excretory System (Man)**		**12 hours**			
Kidney- Structure and functions, micturition, Osmoregulation in aquatic and terrestrial environments, acid-base balance, Renal failure and Dialysis **Nervous system (Man):** Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, Alzheimer's disease/ Stroke.						
Unit IV	**Muscles**		**12 hours**			
Structure and mechanism of Muscle Contraction - Regulation and Energetics of Contraction, Muscular Dystropy. **Sense organs (Man):** Vision, hearing and tactile response, Glaucoma. **Physiology of Reproduction:** Human Reproductive Physiology- Reproductive Cycles, Hormonal Control, PCOS and Endometriosis.						
Unit V	**Ethology**		**12 hours**			
Patterns and mechanism of behavior, Pheromones in colonial interactions. **Reflexes:** reflex action, types of reflexes, reflex arch, characteristics of reflexes, Reflex dysfunction.						
Text Books	1. Bijlani, R.L.Fundamentals of Physiology. I edn. JayPee brothers, New Delhi.2001. 2. Mariakuttikan, A., Animal Physiology. SARAS Publication, Nagerkoil.2011. 3. Text Book of Medical Physiology, Elsevier Inc. Hall, J.E., 2013.					

	4. Arumugam N and Mariakuttikan A..*Animal Physiology*, Saras Publications, Nagercoil, Tamilnadu.2014.
Reference Books	1. Hall, J.E., Text Book of Medical Physiology, Elsevier Inc. 2013, 2. H.R and Neeraj Kumar Animal Physiology and Biochemistry.Vishal Publishing Co, New Delhi Singh, 2009. 3. Verma, P.S., Agarwal, N.K.,Thyagi, B.S., Animal Physiology. S.Chand & Co.,New Delhi. 1980. 4. Hoar, W.S., General and Comparative Physiology, Prentice Hall. 1987, 5. Renganathan, T.S. A text book of Human Anatomy. VI edn. S. Chand and Company Ltd., New Delhi, 2002. 6. Hoar W.S General and Comparative Physiology. Prentice-Hall of India (P) Ltd. New Delhi, 2004.
E-References	1. https://www.classcentral.com/course/swayam-animal-physiology-12894 2. https://swayam.gov.in/nd1_noc20_bt42/preview 3. https://www.classcentral.com/course/edx-respiration-in-the-human-body-3050. 4. https;//swayam.gov.in/nd1_noc20_hs33/preview

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the nutrition, digestive and respiratory system of man	**K1**
CO2	compare the circulatory and cardio vascular system.	**K3**
CO3	relate the structure and function of excretory and nervous system of man.	**K3**
CO4	understand the function of muscles, sense organs and reproductive physiology .	**K2**
CO5	gain knowledge on the ethology and reflexes action of human.	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	M	S	S	S	M	M	M	S	M	S
CO2	S	S	S	M	S	S	S	M	M	M	M	M	S
CO3	S	S	S	M	S	S	S	M	M	M	S	S	S
CO4	S	S	S	M	M	S	M	S	M	S	M	S	S
CO5	S	S	S	S	S	S	M	S	M	S	M	M	S

Strongly Correlating	(S)	- 3 marks	Moderately Correlating	(M)	- 2 marks
Weakly Correlating	(W)	- 1 mark	No Correlation	(N)	- 0 mark

Course Code	P21ZOP11	PRACTICAL-BIOLOGY OF INVERTEBRATES & CHORDATES, CELL & MOLECULAR BIOLOGY AND ANIMAL PHYSIOLOGY –	L	T	P	C
CORE V			-	-	6	4

Cognitive Level	K2:Understand K3:Apply K4: Evaluate
Learningobjective	• To know the methods for biochemical test and enzyme activity assay • To know the chromatography techniques and develop the laboratory skills. • To train the students to analyze the enzyme properties
Experiments in Biomolecules	**TAXONOMY** Identification and Classification of at least 20 representative animals belonging to major classes of Invertebrate phyla and phylum Chordata by studying their salient features. **Mounting:** Prawn -appendages, Teleost Fish – Placoid, Cycloid / Ctenoid scales, Honey bee - Sting apparatus and Mouth parts. Mosquito – mouth parts **Spotters:** Invertebrate any three Larval forms ; Minor Phyla - *Chaetognatha*, *Phoronida*, and *Sipunculida*. **Diagrammatic representation** 1. Nervous system of Cockroach, Prawn, *Pila globosa* 2. Nervous System of Rat , Cat Fish 3. Major Organs ; Rat-heart, pancreas, liver, kidney and gonads **CELL AND MOLECULAR BIOLOGY** 1. Micrometry - Measuring the diameter of microscopic cells using ocular stage micrometer 2. Preparation of squamous epithelium to observe Barr body 3. Study of Mitosis in the Cells of Onion Root Tip 4. Observing the giant/ polytene chromosomes in the salivary glands of larva of *Chironomus* sp. 5. Isolation of mutant colonies by Gradient plate method. 6. Isolation of mutant colonies by Replica plate method. **7.** Description of -__Bacterial transformation, Conjugation experiment, Complementation test, Phage isolation. **Spotters:** Epithelial Tissues (Ciliated, Columnar, Glandular and Squamous epithelium), Smear of Frog's Blood, Muscles (Cardiac,

	Striated and Non - Striated) and Nerve cell. **ANIMAL PHYSIOLOGY** **1.** Quantitative Estimation of Amylase Activity 2. Oxygen Consumption in Fish related to temperature and salinity 3. Preparation of Haemin crystals. 4. Estimation of Haemoglobin by Sahli's method 5. Total RBC count 6. Total WBC count and Differential count 7. Detection of nitrogenous wastes-Ammonia, Urea and Uric acid **Spotters:** Haemocytometer, Haemoglobinometer, Glucometer, Sphygmomanometer and Kymograph
References	1. Sinha, J., Chatterjeee A.K., Chattopadhyay P Advanced Practical Zoology , Arunabha Sen Publishers 2011 2. H.S. Bhamrah Practical Zoology Invertebrate, Dominant Publishers. 2003. 3. Preeti Guptha and Mridula Chaturvedi, Modern Experimental Zoology,. 2000 4. Verma, Manual of Practical Zoology: Chordates, S. Chand Publishing 2000. 5. Chaitanya K.V. Cell and Molecular Biology: A Lab Manual Prentice Hall India Learning Private Limited, 2013.

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Out comes**	**Knowledge Level**
CO1	acquire the knowledge of identification and classification of major classes of animals of both invertebrates and chordates and evaluate the salient features	**K4**
CO2	know the methods of mounting of appendages, mouth parts, stings and scales.	**K2**
CO3	perform the technique of micrometry, differentiate cells and invitro culture of bacteria.	**K3**
CO4	know the different methods to enumerate the cells	**K2**
CO5	handle the apparatus and devices used for molecular biology and Animal physiology.	**K3**

Mapping of COs with POs &PSOs:

Course Outcomes	**POs**								**PSOs**				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**

CO1	S	M	M	S	S	S	M	M	S	M	M	S	S
CO2	S	S	S	M	S	S	S	M	S	M	M	M	S
CO3	S	M	S	S	S	S	S	M	M	S	S	S	S
CO4	S	M	S	S	S	M	S	S	M	M	S	S	M
CO5	S	S	S	S	S	S	S	S	M	S	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21CSS11	COMPUTER SKILLS FOR WEB DESIGNING AND VIDEO EDITING	L	T	P	C
SUPPORTIVE COURSE- I			4	-	-	2
Cognitive Level	K2: Understand K3: Apply					
Learning objective	• To gain knowledge on effective web page creation using HTML tags • To create a table within a web • To gain knowledge on inserting heading levels within a web page • To learn how to insert ordered and unordered lists within a web page • To publish a web page • To learn how to combine basic design principles in video editing • To generate a video by applying her knowledge • To present the edited video • To record short clips by using camera					
Unit I	**Basics of Hardware and Software**					**12 hours**
Basics of Windows Operating System – Windows Utilities. **Internet:** Concept of Internet, Applications of Internet, Connecting to the Internet, Troubleshooting – World Wide Web – Web Browsers – Search Engines: Accessing Web Browser, Downloading Web Pages, Printing Web Pages – Understanding URL – Surfing the Web: Using e-Governance Websites.						
Unit II	**Hyper Text Markup Language (HTML)**					**12 hours**
Structure of HTML Script – Components: Text, Table, Image, Hyperlinks, Types of Lists – Headers and Footers. F**orms in HTML**: Label – Text Field – Radio Group – Text Area – Buttons.						
Unit III	**Open Element**					**12 hours**
Introduction – Creating and Saving a Project - Basic User Interface Elements – Media Elements – Images – Carousels - Image Gallery – Videos – Project Preview in Browser. **Containers and Groups:** Accordion Group – Collapsible Panel – Group of Elements – Back-End and Full Stack Development.						
Unit IV	**Video Recording**					**12 hours**
Grabbing all computer activities like playing video games, browsing the net, making VoIP calls, and more - Record the desktop screen in custom or full-screen mode - Capture the computer screen with voice narrations, system audio, and PIP effects - Include annotations such as colorful texts, shapes, lines, arrows, and drawings - Edit the video by cropping, trimming, adding subtitles, applying watermarks - Conversion of Recorded Video to MP4, VOB, MTS, DV.						
Unit V	**Video Editor**					**12 hours**

New Video Project – Sort Video Projects – Store Board – Project Library – Video Editing Tools: Filters, Trim, Split, Text, Motion, 3D Effects, Speed - Screen Direction - Sound Design – Continuity – Titling - Picture Management - Color Correction - Special Effects	
References	1. Jennifer Sargunar **,** Introduction to Information Technology**,** , Dorling Kindersley (India) Pvt. Ltd, 2011 2. A. Ravichandran , Fundamentals of Information Technology, , Khanna Book Publishing Co. Pvt. Ltd. First Edition, 2010. 3. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, Information Technology - The Breaking Wave, Dennis P. Tata McGraw -Hill Publishing Company Limited, New Delhi, 1998. 4. Anne Boehm & Zac Ruvalcaba, HTML5 and CSS3, 4th Edition, 2018. 5. Aaron Goold, Video Editing Handbook, ISBN : 1521721041.2017

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	learn the basics of hardware and software, windows Operating System, web pages	**K2**
CO2	develop an effective web page using HTML tags	**K3**
CO3	execute the media elements, images, carousels, image gallery	**K3**
CO4	apply knowledge to generate video	**K3**
CO5	learn how to combine basic design principles in video editing	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	M	S	M	S	S	M	S	M
CO2	S	M	S	M	S	M	M	S	S	M	S	M	S
CO3	S	M	S	S	M	S	S	M	S	M	M	S	S
CO4	S	S	M	S	S	S	M	M	S	S	M	S	M
CO5	S	S	M	S	S	M	S	S	S	M	S	M	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER II

Course Code	P21ZOT21	BIOCHEMISTRY	L	T	P	C
CORE-VI			5	-	-	4
Cognitive Level	K1:Recall K2:Understand K3:Apply					
Learning Objectives	• To study the hormone classification and biosynthesis • To learn the synthesis and biological functions of pituitary hormones growth hormones and thyroid hormones. • To study about function of pancreas, adrenal hormones, mechanism and role of pathophysiology. • To acquire the knowledge about hormone secretion, function and metabolic regulations					
Unit I	**Atoms & Carbohydrates**		**12 hours**			
Atom, Molecules and chemical bonds, Properties of H_2O, Henderson and Hasselbach equation – Buffer solutions. Carbohydrates – Classification, Structure and properties, Biological importance .Metabolism and its regulation – Glycolysis-TCA cycle, Oxidative phosphorylation. Glycogenesis, Glycogenolysis, Gluconeogenesis, HMP shunt pathway.						
Unit II	**Lipids & Vitamins**		**12 hours**			
Classification and Biological importance, Biosynthesis of fatty acids, triglycerides, phospholipids and cholesterol – Oxidation of fatty acids, Hypercholesterol disorders. Vitamins – Classifications, sources, biological importance, Hormones – Types, functions & disorders.						
Unit III	**Amino acids**		**12 hours**			
Structure, Classification, properties & Biosynthesis of amino acids. Proteins- Classification and Biological significance, Level of organization - Primary, secondary, tertiary and quaternary structure; Ramachandran plot, protein metabolism and degradation- Transamination, deamination and transmethylation & Urea cycle. Peptide sequencing.						
Unit IV	**Nuclic acids**		**12 hours**			
DNA & RNA – structure of purine and pyrimidine bases, nucleosides and nucleotide biosynthesis, regulation & degradation of purine and pyrimidine nucleotides – Biosynthesis of deoxyribonucleotides. Types of RNA, Structure of tRNA.						
Unit V	**Enzymes**		**12 hours**			
Nomenclature and Classification – protein enzymes, coenzymes, prosthetic groups, cofactors, isoenzymes, ribozymes, abyzymes; chemical properties of enzymes, Factors influencing enzyme activity – temperature, pH, concentration of enzyme, substrate and effect of ions: Enzyme kinetics; types of enzyme inhibition – reversible, competitive, non-competitive, uncompetitive, irreversible inhibition; Allosteric enzymes.						

Text Books	**1.** Bhagavan NV.*Medical biochemistry*, fourth edition Academic Press.2010 2. Ambika Shanmugam, Fundamentals of Biochemistry for Medical Students.2003. **3.** K.Ramadevi Ambika Shanmugam's Fundamentals of Biochemistry for Medical students, Published by wolters Kluwer Health(India)2016 .
Reference Books	1. Satyanarayana, U. and Chakrapani, U. Biochemistry, Books and Allied Pvt. Ltd., Kolkat, 2009. 2. Deb, A.C, Fundamentals of Biochemistry, 10th Edition, New Central Book Agency Pvt Ltd., Kolkata, 2011. 3. Jain, J.L., Sunjay Jain and Nitin Jain. Fundamentals of Biochemistry, Fifth Edition,Chand and Company Ltd, NewDelhi, 2010. 4. David L. Nelson & Michael M. Cox, Lehninger Principles of Biochemistry, 6th edition, Worth Publishers, New York. 2011. 5. Nelson, D.L., Leninger, A.L. and Cox, M.M.. Lehninger Principles of Biochemistry, W.H. Freeman Co.,2008.
E-Reference	1. https://swayam.gov.in/nd2_cec20_bt19/preview 2. https://swayam.gov.in/nd1_noc20_cy10/preview 3. https://www.mooc-list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the principles of biophysical chemistry and glucose metabolism.	**K1**
CO2	gain knowledge of lipids, vitamins and hormones in the biological system.	**K2**
CO3	understand the classification, biosynthesis and role of amino acids and use it for proteomic research	**K3**
CO4	distinguish the structure of DNA and RNA and their importance in the cells	**K3**
CO5	have a spell bound idea about enzyme activities and enzyme kinetics.	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	S	S	M	S	S	M	M	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	M	M
CO3	S	M	S	M	S	M	S	S	M	M	M	M	M

CO4	S	S	S	S	S	M	S	S	M	M	M	S	S
CO5	S	S	M	M	M	M	S	S	S	S	M	M	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT22	IMMUNOLOGY	L	T	P	C
CORE –VII			5	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning objective	• To gain in depth knowledge of human immune system • To know the antigen and antibody reactions • To learn the mechanism of Immuno pathology • To acquire the knowledge on hypersensitivity and immunodeficiency diseases • To learn various techniques of immunology	
Unit I	**Lymphoid organs**	**12 hours**
History and Recent advancements in immunology. Innate and Adaptive Immune System: Lymohoid organs**,** Basics of Immunity- Innate immunity and Adaptive immunity-B and T cells-. Cells of the immune system. Immunological factors.		
Unit II	**Antigens**	**12 hours**
Structure and function ,Antibodies: structure. Antigen and antibody reaction Types of immunoglobulin classes. Humoral and cell mediated immune responses- Interferon. - Monoclonal antibodies		
Unit III	**Immunopathology**	**12 hours**
Major histocompatibility complex and its significance. HLA. Transplantation Immunology - Types of graft - Mechanism of allograft rejection.		
Unit IV	**Hypersensitivity**	**12 hours**
Types of hypersensitivity. AIDS and immunity . Complement system. Immunological disorders: Use of artificial intelligence in Immunodeficiency diseases - Congenital and acquired immunodeficiency.		
Unit V	**Immunotechnology**	**12 hours**
Active immunization - Passive immunization - Immunological techniques - RIA and ELISA, COVID virus and immunity. Hybridoma techniques , Vaccines -types of vaccine, immunisation schedule autoimmune Disorders.		
Text Books	1. Goldsby, R.A., Kindt, T.J., Osborne, B.A., Kuby, J. Immunology, Vth edition, W.H. Freeman and Company, New York.2002 **2.** Coico, R., Sunshine, G., Benjamini, E., Immunology: A Short Course, VIth edition. Wiley-Blackwell, New York.2003 **3.** Kannan, I., Immunology, MJP publishers, Chennai.2011.	
Reference Books	1. Arora, M.P. Immunology, Ane Books Pvt. Ltd., New Delhi.2010. 2. Delves, P.J., Martin, S.J., Burton D.R., Roitt, I.M. Roitt‟s Essential Immunology. XIIth edition. Wiley-Blackwell, Oxford, UK.2011. 3. W. Paul., Fundamentals of Immunology, Lippincott Williams & Wilkins.2012. 4. David male, Immunology VII Ed., Elsevier Health sciences, 2008. 5. Kannan, Immunology I Ed., MJP Publisher, 2007. **6.** Coico, R., Sunshine, G., Benjamini, E. Immunology: A Short Course, VIth	

	edition. Wiley-Blackwell, New York.2003.
E-Reference	1. https://www.classcentral.com/course/immunologyfundamentalsimmunitybcells-12724 2. https://swayam.gov.in/nd2_cec20_bt05/preview 3. https://www.classcentral.com/course/swayam-immunology

Course Outcome

Upon completion of this course, the students willbe		
CO	**Course Outcomes**	**Knowledge Level**
CO1	learn the importance of immune system and lymphoid organs	**K1**
CO2	know about various types of antigens and Immuno globulins, monoclonal antibodies , Hybridoma and vaccine.	**K2**
CO3	comprehend the view of hypersensitivity and graft rejection	**K2**
CO4	distinguish immunological disorders, artificial intelligence in immune deficiency disease.	**K3**
CO5	attain a deep knowledge on immunological techniques like hybridoma.	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	S	M	M	M	S	S
CO2	S	S	S	M	S	M	S	S	M	S	S	S	S
CO3	S	M	M	S	M	S	S	S	M	S	S	M	S
CO4	S	S	S	S	M	M	S	S	S	S	S	S	S
CO5	S	S	S	W	M	M	S	S	M	S	S	M	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT23	GENETICS	L	T	P	C
CORE VIII			4	-	-	4
Cognitive Level	K1:Recall K2:Understand 3:Apply					
Learning objective	• To get the knowledge about Mendel law • To learn about the Coupling and repulsion hypothesis and Mechanism of crossing over • To gain the knowledge regarding the Chromosome theory of inheritance. Karyotype and Idiogram • To understand the detection of chromosomal aberration and syndromes					
Unit I	**Historical Background of Genetics**		**12 hours**			
Mendel‟s Study of Heredity: Monohybrid Crosses (pea plant), Mendel‟s laws of Dominance and Segregation, Dihybrid Crosses (pea plant), Mendel‟s laws of Independent Assortment. Incomplete Dominance (flower color in snapdragons and Punnet‟sgametic check board method). Multiple Allelic Inheritance**:** Blood group inheritance in Humans.						
Unit II	**Linkage and Sex Linkage**		**12 hours**			
Coupling and repulsion hypothesis. Linkage in Drosophila, Linkage groups, Complete linkage, incomplete linkage, factors affecting linkage. Crossing over – Mechanism of crossing over. Cytological theories of crossing over. Germinal and Somatic crossing over. Interference and Coincidence. Construction of genetic maps (*Drosophila*).						
Unit III	**Physical basis of inheritance**		**12 hours**			
Chromosome theory of inheritance. Karyotype and Idiogram. Sex Linked inheritance: X-Linked Inheritance (eye colour in Drosophila, haemophilia in humans), Y-linked inheritance (hairy pinna in males). Extra Chromosomal Inheritance / Cytoplasmic Inheritance – Mitochondrial DNA, Kappa particles in Paramecium.						
Unit IV	**Chromosomal aberration**		**12 hours**			
Numerical – Euploidy (Monoploidy, Haploidy and Polyploidy) Polyploidy – Autopolyploidy and allopolyploidy. Aneuploidy – Monosomes, Nullisomes & Trisomes. Structural aberrations: Deletions, Duplications, Translocations and Inversions.						
Unit V	**Syndromes**		**12 hours**			
Down, Edward,Turner and Klinefelter Syndromes. Detection of chromosomal anomalies: Pedigree analysis, Prenatal diagnostics (Amniocentesis, Chorionic Villus sampling).						
Text Books	1. Verma PS and Agarwal VK.. *Genetics*, S. Chand Publishers, New Delhi. 2010. 2. Meyyan RP. . Fundamendals of *Genetics*, Saras Publication Nagercoil, Tamilnadu.2014.					

Reference Books	1. D. Peter Snustad, Michael J. Simmons, . Principles of Genetics, 7th Edition, John Wiley & Sons, Inc. 2015. 2. D. Peter Snustad, Michael J. Simmons Principles of Genetics 7th Edition. John Wiley & Sons Ltd. New York. 2015. 3. Benjamin Lewin, , Genes IX, Oxford University Press, New York. 2008.
E-references	1. https://swayam.gov.in/nd2_cec20_bt17/preview 2. https://nptel.ac.in/courses/102/104/102104052/

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	gain more knowledge on Mendelian principles and inheritance of blood grouping in man.	**K1**
CO2	have an elaborative idea about mechanism of linkage, crossing over and gene mapping.	**K2**
CO3	understand the inheritance of traits linked with X and Y chromosomes.	**K2**
CO4	comprehend the various kinds of chromosomes aberrations	**K2,**
CO5	distinguish genetic disorders related syndromes and trace the pedigree of Mendelian traits.	**K3**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	M	S	S	M	M	M	M	S
CO2	S	S	S	S	S	M	S	S	S	S	M	S	S
CO3	S	S	S	M	S	M	S	M	S	S	M	S	S
CO4	S	M	S	S	S	S	S	S	S	M	M	S	S
CO5	S	S	S	M	S	S	S	S	M	S	M	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT24	APPLIED ZOOLOGY	L	T	P	C
CORE-IX			4	-	-	4
Cognitive Level	K2:Understand K3: Apply					
Learning Objective	• To learn the vermi compost technology, • To provide knowledge on apiculture and sericulture. • To understand the economic importance of silkworms. • To know about dairy farming and livestock diseases. • To acquire knowledge about poultry management					
Unit I	**Vermiculture**		**12 hours**			
Introduction to vermiculture. Types of earthworm, Biology of *Eisenia foetida*. *Eudrilus eugeniae*, Rearing of earthworms, Equipments, devices used in vermiculture, Vermicompost Technology –Methods and Products, Small Scale Earthworm farming for home gardens, Larger scale commercial composting, Vermiwash collection, composition &use, Predators and parasites and diseases of Earthworms and their control						
Unit II	**Apiculture**		**12 hours**			
Systematics, Morphology and Biology of honey bees – Honey bee species – Seasonal activities and social behaviour of honey bees – Food of the honeybees, bee flora and honey flow period – Bee keeping and ancillary industries – Newton's Beehive- Extraction of honey-Medicinal value of honey- bee products- Importance of bee colonies in crop pollination- diseases and Predators and parasites of honeybees and their control.						
Unit III	**Sericulture**		**12 hours**			
Origin and history of Sericulture, Moriculture-Mulberry cultivation methods, Silkworm – Taxonomy, Types, Biology and Lifecycle of *Bombyx mori*, Rearing of silkworm – Equipments, Methods, Characteristics and quality of Cocoon- Economic importance of Silk and Silk worm, Diseases and Predators and parasites of Silkworm and their control.						
Unit IV	**Dairy farm Management**		**12 hours**			
Introduction and scope of dairy farming, livestock in India, Dairy animals management and a model dairy farm. Livestock diseases, nutritive value of milk, milk products and dairy industry.						
Unit V	**Poultry**		**12 hours**			
Breeds of fowl, Housing and equipment, deep litter system, laying cages, Methods of brooding and rearing, debeaking. Management of growers, layers, broilers – Feed formulations for chicks, growers, phase I to phase III layers and broilers. Diseases and enemies affecting fowl. Nutritive value of egg and meat, factors affecting egg size, storage and preservation of egg, marketing, incubation and hatching of eggs. Economics of poultry production units.						

Text Books	1. Gnanamani, M.R., Modern Aspects of Commercial Poultry Keeping, Deepam Publications, Madurai. 2010. 2. Seethalakshmi.M, and Shanthi.R., Vermitechnology, Saras Publications, Nagercoil,2014.
Reference Books	1. Ashan, J. and S.P. Sinha – A hand book of Economic zoology – S. Chand & Co-2010. 2. Zade, S.B., Khune, C.J., Sitre, S.R., and Tijare, R.V., Principles of Aquaculture, Himalaya Publishing House, Mumbai. 2011. 3. Ismail. S , Vermiculture, Orient Longman Ltd., Chennai, 2001.
E-Reference	1. https://swayam.gov.in/nd2_cec20_ge23/preview 2. https://www.classcentral.com/course/swayam-indian-agricultural-development-14119

Course Outcome

Upon completion of this course,the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	practice vermicompost technology	**K3**
CO2	acquire knowledge on Aviary and Honey extraction.	**K2**
CO3	understand the process of Silk production and its economy.	**K2**
CO4	acquire the management skills in animal behaviour.	**K2**
CO5	apply and manage a poultry farm to become potential entrepreneur	**K3**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	M	S	S	W	S	S	M	M	M	S	S	S
CO2	S	M	M	M	M	M	W	S	M	S	M	M	M
CO3	M	M	M	M	S	M	S	M	S	M	S	S	S
CO4	S	S	S	M	S	M	M	S	M	M	M	S	S
CO5	S	S	M	S	S	S	S	S	M	S	S	M	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOP22	PRACTICAL – II - BIOCHEMISTRY, IMMUNOLOGY, GENETICS and APPLIED ZOOLOGY	L	T	P	C
CORE- X			-	-	6	4
Cognitive Level	K2:Understand K3:Apply					
Learning objective	• To learn the biochemical techniques • To observe the microbial populations. • To gain hands on training on blood group and Rh typing • To know the simple Mendelian traits • To find out adulteration and silkworm disease					

BIOCHEMISTRY-

1. Qualitative / Quantitative analysis of Carbohydrates, Proteins (Lowry's & Bradford's method) and Lipids and Preparation of standard graph.
2. Isolation and identification of aminoacids using paper chromatography.
3. Determination of pH using pH paper and pH meter.
   Determination of glucose level in blood & urine.

Spotters – Thin Layer Chromatography, Chromatogram, pH-Meter, Colorimeter, Spectrophotometer, Centrifuge, Models - Heamoglobin and ATP.

(Study Tour / Field Trip to animal farm, sanctuary, research lab or industrial area should be arranged to equip practical knowledge.)

IMMUNOLOGY

1. Preparation of Serum and Plasma
2. Determination of human blood group and Rh typing by haemagglutination test.
3. Virtual dissection and Display of Lymphoid organs of mice and chicken.
4. Protein estimation from serum by Biuret method

Spotters: Autoclave, Petridish, Inoculation loop, Colony counter, Laminar Air Flow Chamber. Immunoelectrophoresis, ELISA reader, Model - Antibody structure.

GENETICS

1. Recording Mendelian Traits among students.
2. Study of polygenetic inheritance among students using finger print.
3. Identification of Colour blindness among the students using Isihara‟s colour chart.
4. Mendelian traits and pedigree analysis in man.

Spotters: Normal Human Karyotype, Down syndrome, Klinefelter's syndrome, Turner's syndrome, Edward Syndromes.

APPLIED ZOOLOGY

1. pH and microbial study of vermicompost
2. Milk test for adulteration.

	3. Cocoons, egg cords, Different silkworms. 4. Diseases of silkworm
References	1. Sinha, J., Chatterjeee A.K., Chattopadhyay P., Advanced Practical Zoology Arunabha Sen Publishers, 2011. 2. H.S. Bhamrah, Practical Zoology Invertebrate Dominant Publishers. 2003. 3. Preeti Guptha and Mridula Chaturvedi, Modern Experimental Zoology . 2000. 4. Jain J.L, Sunjay Jain, Nitin Jain, Fundamentals of Biochemistry, 2007. 5. Richard L. Myers Immunology: A Laboratory Manual. McGraw-Hill Inc., US; 2nd Revised edition. 1994.

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	perform the quantitative and qualitative estimation of biomolecules; and understand various biochemical instrumentation methods	**K3**
CO2	Learn the bacterial culture techniques	**K2**
CO3	practice immunological techniques	**K3**
CO4	carry out pedigree analysis and predict mendelian traits	**K3**
CO5	perform microbial study on compost and milk test	**K3**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	M	M	S	S	S	M
CO2	S	S	M	S	S	S	S	M	S	M	S	S	M
CO3	M	M	S	M	S	S	S	M	M	M	S	S	M
CO4	S	M	S	M	S	M	S	S	M	M	S	S	M
CO5	M	M	S	S	S	M	M	S	M	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOS22	MEDICAL LABORATORY TECHNOLOGY	L	T	P	C
SUPPORTIVE COURSE- II			2	-	-	2
Cognitive Level	K1:Recall K2:Understand K3:Apply					
Learning objective	• To learn the proper procedure for the collection, safe handling and analysis of biological specimens. • To understand the medical diagnostics methods used for analysis of Blood. • To know the urine test, blood test and important human diseases. • To enlighten the skills of basic medical techniques. • To mould in clinical testing procedures to fetch job opportunities					
Unit I	**Introduction to Medical Diagnostics and its Importance**					**6 hours**
Diagnostics Methods Used for Analysis of Blood- Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)						
Unit II	**Urine analysis**					**6 hours**
Physical characteristics; Abnormal constituents, Detection of sugar, albumin, deposits and pregnancy test, (b) Blood analysis – Blood grouping, Haemoglobin estimation, Cell counts DC/TC.						
Unit III	**Diseases**					**6 hours**
Causes and diagnosis of– typhoid, malarial fever, dengue, SARS, Helminthes diseases. Glucose Tolerance Test, LFT -Liver Function Tests and Serum Amylase Estimation Increase of bilirubin and levels of SGOT, SGPT, Bilirubin tests, Alkaline phosphatase tests, Prothrombin Time, Coomb's , Liver biopsy						
Unit IV						**6 hours**
Post-Exercise or Sleeping GH levels, Clonidine Stimulation Test, Insulin **Stress Test:** Thyroid Function Test , Thyroid Stimulating Hormone (TSH) Serum Total and Free Thyroxine (T4) Metyrapone Test. Pregnancy test						
Unit V	**Tumours**					**6 hours**
Types Benign/Malignant, Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan.						
Text Books	1.Ochei, Medical Laboratory Science. Theory and practice, Tata McGraw Hill publ. Co, Noida, India, 2000. 2. Dubey R. C. and Maheshwari D. K. S A text book of Microbiology,. Chand & Co. Publ. New Delhi, India, 2007.					
Reference Books	1. Ashok, R. 2000.Antimicrobials in Laboratory Medicine, B.I. Churchill Livingstone. New Delhi 2. Root & I. Samuel. M. K. G.Notes on Clinical Lab Techniques, Iyyer & Sons Publ. Co, Chennai, 1992. 3. 3.Mukherjee. Medical Laboratory Technology Vol. 1,2& 3, Tata McGraw Hill publ. Co, Noida, India, 2006.					

E- Reference	1. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf 2. https://scert.kerala.gov.in/wp-content/uploads/2020/06/16-mlt.pdf 3. https://www.coloradomesa.edu/iris/documents/MedLabTech.pdf

Course Out come

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	learn the medical diagnostics and its importance	**K1**
CO2	get familiarized with urine analysis and blood analysis and able to perform	**K3**
CO3	know causes and diagnosis of– typhoid, malarial fever, dengue, SARS, Helminthes diseases	**K2**
CO4	acquire a sound knowledge in sleeping GH level and thyroid function test	**K2**
CO5	develop the knowledge about tumors types and its diagnosis	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	S	M	S	S	S	M	M	S	S	S
CO2	S	S	S	M	S	S	M	S	S	S	S	S	M
CO3	S	S	S	M	S	S	S	M	S	S	S	M	S
CO4	S	M	S	S	S	S	M	S	M	S	S	S	S
CO5	S	S	M	S	M	S	S	S	M	S	S	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER III

Course Code	P21ZOT31	BIOTECHNOLOGY & BIOINFORMATICS	L	T	P	C
CORE-XI			4	-	-	4

Cognitive Level	K2:Understand K3:Apply K4:Evaluate K5: Analyze	
Learning objective	• To learn various tools and techniques in biotechnology • To gain knowledge in different areas like animal, industries, medical, agriculture biotechnology • To learn about the applications of cell culture • To acquire knowledge about internet, e-mail, e-book and youtube applications in biology • To understand genomics, proteomics and bioinformatics tools and data bases	
Unit I	**Tools and Techniques of Genetic Engineering**	**12 hours**
Basic Principles of Genetic Engineering; Restriction enzymes, Linkers/Adaptors; Cloning Vectors - Salient Features and Types; Techniques – Strategies of rDNA Technology, Gene Library, Insertion of a Foreign DNA into a Vector; Transfer of rDNA into a Bacterial Cell, Selection & Screening of Recombinants, Recovery of Cells containing rDNA, Expression of Cloned DNA.		
Unit II	**Industrial, Medical & Environmental Biotechnology**	**12 hours**
Fermentation - Types, Upstream and Down Stream Processing; Production of Alcohol, Antibiotics, hormones, vaccines and interferons, Biofuels, Bioremediation, Biodegradation, Biomining & Biosorption. Bioplastics.		
Unit III	**Animal and Plant biotechnology**	**12 hours**
Equipments for animal cell culture, Types of tissue culture medium, Primary culture, Stable cell line, Cultivation of Animal Cells; Somatic Cell Fusion, Applications of Cell Culture– , Blood Factor VIII and Erythropoietin; Organ Culture; Transgenic Animals and their application; Micropropagation of plants, Transgenic plants. Biosafety and bioethics.		
Unit IV	**Bioinformatics**	**12 hours**
Scope and applications of Bioinformatics. Biological/specilalized databases- Nucleic acid databases (Genbank,DDBJ and EMBL), NCBI, EBI, Protein databases - primary, composite, secondary; Specialized databases-SGD,TIGR, Structural databases -PDB, CATH ModBASE. Genomics - Proteomics.		
Unit-V	**Applications**	**12 hours**
Similarity search (FASTA, BLAST), Multiple sequence alignment-Clustal W (Conserved domains search), Mult Align, Homology modelling, Phylogenetic analysis – MEGA, phylogenetic tree construction (Neighbor Joining method and Maximum parsimony). Data mining tools for Biomedical applications-SNP analysis, drug designing and docking.		
Text Books	1. Dubey, R.C., A Text book of Biotechnology, S.Chand & Co., New Delhi, 2015. 2. Gupta, P.K, Elements of Biotechnology, Rastogi Publications, Meerut, 2006 . 3. Sathyanarayana, Biotechnology, Uppala Author-Publisher Interlinks,Vijayawada,A.P.2015	

References Books	1. Lewin, B., Gene XI , Oxford University Press, New York, 2002. 2. Brown, T.A. Gene Cloning & DNA Analysis: An introduction. V edn. Blackwell publishing USA, 2006.. 3. Balasubramanian, D, C.F.A. Bryce, K.Dharmalingam, Y.Green, Kunthala Jeyaraman, Concepts in Biotechnology. Universities (P) ltd. Hyderabad, 2004. 4. Baxevanis, A.D. and Quellette, B.F.F.. Bioinformatics. A practical guide to the analysis of genes and proteins. II edn. Wiley-Intern Science Publication, New York, 2009. 5. Lesk, M.A. Introduction to Bioinformatics. Oxford Univ. Publishers, 2008. 6. Attwood, T.K. and Parry, D.J – Smith, D.J. Introduction to Bioinformatics. Pearson Education (Singapore) Pvt. Ltd, 2005. 7. Twyman, R.H, Instant notes on Bioinformatics. Viva Books Pvt. Ltd., NewDelhi, 2003 8. Mount, W. Bioinformatics sequence and genome analysis. Cold Spring harbour Laboratory Press, New York, 2005.
E-References	1. https://swayam.gov.in/nd1_noc20_bt31/preview 2. https://swayam.gov.in/nd1_noc19_bt33/preview 3. https://swayam.gov.in/nd1_noc19_bt15/preview

Course outcome

Upon completion of this course, the students will be able to

CO	Course Outcomes	Knowledge Level
CO1	know the various techniques used in genetic engineering	**K2**
CO2	learn the methods used in manufacturing of industrial, medical products, waste removal and pollution control field	**K2**
CO3	understand the animal and plant tissue culture techniques along with the bio safety methods	**K2**
CO4	analyse the nucleotide and amino acid sequences of DNA and proteins by using bioinformatics tool	**K5**
CO5	Compare and evaluate the similarity of species and their phylogenetic relations	**K4**

Mapping of COs with POs &PSOs:

CO	Pos								PSOs				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	S	S	S	S	M	M	S	S	S
CO2	S	S	M	S	S	S	S	M	S	S	S	S	S
CO3	S	M	M	S	S	M	S	M	S	S	S	S	M
CO4	S	S	M	M	S	S	S	S	S	M	S	S	M
CO5	S	S	M	S	S	S	S	S	M	M	S	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mar

Course Code	P21ZOT32	DEVELOPMENTAL BIOLOGY	L	T	P	C
COREXII			5	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning objective	• To acquire knowledge about basic concepts of development • To understand the events of gametogenesis, fertilization and early development • To learn the mechanism of differentiation and organogenesis • To study regeneration and screening of genetic disorders • To learn about assisted reproductive technology (ART)	
Unit I	**Theories**	**12 hours**
Introduction historical perspective, Theories – preformation, epigenesis, recapitulation and germplasm, Gametogenesis- Spermatogenesis, Oogenesis. Fertilization - Physiological and biochemical pathway, Parthenogenesis - types, (natural and artificial) and significance.		
Unit II	**Cleavage**	**12 hours**
Salient features, Planes of cleavage, Patterns of cleavage and factors affecting cleavage. Gastrulation- Salient features, Metabolic and Molecular changes during gastrulation, gastrulation in amphioxus. Fate-map: construction of fate-map in amphibians- artificial and natural markings.		
Unit III	**Organogenesis**	**12 hours**
Organogenesis in Vertebrates – brain, eye, heart, kidney, skin and its derivatives, Regulation and development. Placentation: Classification and physiology of placenta. Teratogenesis - Teratogenic agents.		
Unit IV	**Metamorphosis and regeneration**	**12 hours**
Morphological and biochemical changes during amphibian metamorphosis and its hormonal control. Neuro endocrine control of insect metamorphosis - Biochemistry and mechanism of action of hormones during metamorphosis. Process and factors influencing regeneration.		
Unit V	**Programmed cell death, aeging and senescense**	**12 hours**
- Asexual reproduction – assisted reproductive technology(ART) – Male infertility – sperm abnormalities – super ovulation – IVF – ICSI – GIFT – Screening genetic disorders. Contraceptive devices.		
Text books	1. Arumugam, N., A Text book of Embryology, Saras Publications, Nagercoil. 2012. 2. Arumugam NA. *Text Book of Embryology*, Saras Publication Nagercoil.2014. **3.** Balinsky, B.K.,.An introduction to embryology, saunders Philadelphia.1981.	
References Books	1. Gilbert, S.F., Developmental Biology, 7th Ed., Sinamer Associates Inc., Publishers, Saunderland, Massachusettes, USA. 2003. 2. Arora M.P. Embryology , Himalaya Publishing House, New Delhi . 2009. 3. Gilbert SF . *Developmental Biology*, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.2010.	
E-references	1. https://nptel.ac.in/courses/102/106/102106084/]	

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Out comes**	**Knowledge Level**
CO1	know the history of embryology.	**K1**
CO2	understand the functions of gonads and gametogenesis.	**K2**
CO3	gain in depth knowledge about the organogenesis.	**K2**
CO4	differentiate the progressive and retrogressive metamorphosis.	**K3**
CO5	attain knowledge on the IVF and other important aspects of animal reproduction.	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	M	S	S	S	M	M	M	M	S	M
CO2	M	S	S	M	S	S	S	S	S	W	S	S	M
CO3	M	S	M	M	M	S	S	S	M	M	S	S	S
CO4	S	S	S	S	S	S	S	M	M	M	S	S	M
CO5	M	S	S	S	S	S	S	S	M	M	S	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT33	EVOLUTION,ANIMAL MIGRATION AND BEHAVIOUR	L	T	P	C
CORE XIII			4	-	-	4
Cognitive Level	K1:Recall K2:Understand K3:Apply					
Learning objective	• To study the different evolutionary theories • To understand the role of gene in evolution • To be acquainted with the species concept and phylogeny • To gain the knowledge on animal behaviour. • To know the importance of migration					
Unit I	**Concepts**		**12 hours**			
Early ideas of evolution- The nature of evolutionary units Darwinism. Lamarckism. Natural selection. The causes of evolution; Hardy-Weinberg equilibrium: - Genetic drift and Non-random breeding-Reproductive isolating mechanisms.						
Unit II	**Models of population growth**		**12 hours**			
Phenetics and cladisticts, molecular clock. Ontogeny and phylogeny: Evolutionary innovations and the origin of higher taxa-Evolution of *Homo sapiens* and molecular biological and immunological evidences for evolution. Impact of DNA bar coding in modern Evolutionary studies.						
Unit III	**Species concepts**		**12 hours**			
The Biological Species concept and Theories of Evolution. A general theory of speciation and its impacts. Historical perspective; allometry and Species selection. Population genetics and ecology. Metapopulations - Monitoring natural populations – Extinction of small populations - Loss of genetic variations - Conservation of genetic resources in diverse taxa – Artificial evolution (in vitro).						
Unit IV	**Animal behavior & Evolution**		**12 hours**			
Importance of animal behaviour studies – patterns of behaviour – daily and seasonal cycles of behaviour – physiological basis of behaviour. Environmental modification of behaviour – developmental changes in behavior – Genetic differences in behavior – behavioral disorders						
Unit V	**Migratory animals**		**12 hours**			
Importance of bird migration – behaviour – special reference to bird pollinations – migratory fishes and crustaceans – importance of migration. Group formation- Social relationship, process of socialization, locality and behaviour – practical application – behavioral characters for management practices**.**						

Text Books	1. Hoshang S. Gunderia and Hare Govind Singh. The text book of Animal behaviour ., S. Chand & Co.) .2005. 2. Himanshu Arora and Mohan P. Arora . A Text Book of Organic Evolution, third edition. Himalaya Publications, New Delhi. 2013. 3. Arumugam NA and Natarajan P. Animal Behaviour – Ethology, Saras Publication Nagercoil,Tamilnadu.2012. 4. The text book of Animal behaviour by Hoshang S. Gunderia and Hare Govind Singh, S. Chand & Co.) 2005
Reference Books	1. Himanshu Arora and Mohan P. Arora. A Text Book of Organic Evolution, third edition. Himalaya Publications, New Delhi, 2013. 2. Veer Bala Rastogi, Organic Evolution. Kannan publications, Meerut, 2012. 3. Peter E. Rosenbaum. Volpe‟s Understanding Evolution, McGraw-Hill, New York.2010. 4. Peter E. Rosenbaum. 2010. Volpe‟s Understanding Evolution, McGraw-Hill, New York.2010. 5. Veer Bala Rastogi, *Organic Evolution*. Knrn publications, Meerut.2012. 6. Animal Behaviour (Ethology), V.K. Agarwal, S. Chand & Company Ltd, New Delhi.2009.
E-references	1. https://www.classcentral.com/course/early-vertebrate-evolution-5417 2. https://www.classcentral.com/course/molecularevolution-3555

Course Outcome

Upon completion of this course, the students will be able to

CO	Course Out comes	Knowledge Level
CO1	understand the ideas of Darwinism, Lamarckism and Natural Selection	**K1**
CO2	comprehend the Phylogeny, Ontogeny and knowledge on evidences of Evolution.	**K2**
CO3	gain knowledge on species concept and Theories of Evolution	**K2**
CO4	describe the students to understand animal behaviour and developmental changes in behaviour.	**K2**
CO5	acquire the knowledge of importance of animal behavior and migration.	**K2**

Mapping of COs with POs &PSOs:

CO	Pos								PSOs				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	M	S	S	S	M	S	S	S	S	M	S	S	M
CO5	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT34	ECOLOGY AND TOXICOLOGY	L	T	P	C
CORE-XIV			4	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning objective	• To understand different habitat and niche • To acquire the knowledge on interactions between organisms and their environments, dynamics of populations and communities • To know the different types of pollution and their management to protect the environmental health • To gain knowledge about biomes in biogeography	
Unit I	**Concepts of Environmental studies**	**12 hours**
Renewable and non-renewable resources. Conservation of natural resources, Use of alternate energy sources. Ecosystems: concept, types, structure, components and functions. Energy flow, Review of Bio-geo Chemical cycles. Energy cycles in the ecosystems and ecological succession. Food chains, webs and ecological pyramids.		
Unit II	**Concept of Limiting factors**	**12 hours**
Liebig's law of the minimum – Shelford's law of tolerance. Population and Community Ecology: Basic concepts, characteristics, dynamics and regulation of population density. Characteristics, composition, structure, development and classification of communities.Succession, Homeostasis.		
Unit III	**Environmental Pollution**	**12 hours**
Air, water, soil and land pollution. Radioactive pollution Impact of pollutants on general fauna, flora and ecosystems. Factors influencing physiology due to concentration of toxicants. Toxicity: Pesticides and Types: insecticides, herbicides, fungicides, rodenticides, nematicides, fumigants. Properties and effects of pesticides: Mechanism of action Ecotoxicology and its environmental significance, Environmental monitoring of pollutants Environmental policy in control of pollution.		
Unit IV	**Toxicology**	**12 hours**
Definition – Types – Scope of toxicology –Routes of Entry and Testing Procedures: Absorption – distribution – Excretion – Bio-transformation-Bioassay – Acute toxicity – Chronic toxicity. Assessment of safety /risk. K3Pesticide. Margin of safety, Toxicity curves, cumulative toxicity and toxicity of chemical mixtures. Food Additives: Types and functions of food additives, hazards of food additives.. Toxicology of metals – Arsenic, cadmium, chromium, lead, mercury. Metabolism, Storage and Excretion of Xenobiotic		
Unit V	**12 hours**	**12 hours**

Acute, Sub acute, Chronic and Special tests (Metabolic, neurotoxicity and reproductive toxicity, Carcinogenicity and Mutagenicity). Synergism and antagonism, Dose-Response relationships, determination of LD50 and ED50, Statistical concept of toxicity-concentration,- SPSS software to determine LC50 –Computers in Toxicology and Risk Assessment	
Text Books	1. Verma PS and VK. *Cell Biology, Genetics, Evolution and Ecology*, S Chand Publishers, New Delhi.2004. 2. Arumugam N. *Concepts of Ecology*, Saras Publication, Nagercoil, Tamilnadu.2014. 3. Agarwal.K.C. Textbook for Environmental Studies, Erach Bharucha, UGC, New Delhi.2018. 4. P. D. Sharma. Environmental Biology and Toxicology Rastogi Publications, Meerut.2018
References Books	1. M.Kato. The Biology of Diversity- Springer 2012 2. S. N. Prasad & Vasantika Kashyap, Introduction to Toxicology: S. Chand & Co., New Delhi.1991 3. M. Manivasakam Environmental Pollution :, National Book Trust, New Delhi 2017 4. Gupta, P. K. and Salunkhe. D. K Modern Toxicology: Vol. I, II, III:. Metropolitan Book Co. Pvt. Ltd. New Delhi.1985. 5. S. N. Prasad & Vasantika Kashyap, Introduction to Toxicology: S. Chand & Co., New Delhi. 2008. 6. M. Manivasakam, Environmental Pollution : National Book Trust, New Delhi .2001 7. Modern Toxicology: Vol. I, II, III: Gupta, P. K. and Salunkhe. D. K. Metropolitan Book Co. Pvt. Ltd. New Delhi.2002.
E-References	1. https://swayam.gov.in/nd1_noc19_ge23/preview 2. http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_pg.php/697

Course Outcome

Upon completion of this course, the students will be		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the ecosystem and bio-geo chemical cycles.	**K1**
CO2	obtain sound knowledge on population and community ecology .	**K2**
CO3	get an in depth knowledge on environmental populations and its impacts.	**K2**
CO4	learn about the toxicological testing methods and to perform the test	**K3**
CO5	know the effects of toxicants, metabolism and control measures	**K2**

Mapping of COs with POs &PSOs:

CO	Pos								PSOs				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	S	M	M	S
CO2	S	S	S	M	M	S	S	S	M	S	S	S	M
CO3	M	S	S	S	M	M	S	S	S	S	M	M	M
CO4	S	S	S	S	M	M	M	M	M	S	S	S	S
CO5	M	M	S	M	S	M	M	S	M	S	S	M	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOT35	RESEARCH METHODOLOGY AND BIOETHICS	L	T	P	C
CORE-XV			5	-	-	4

Cognitive Level	K1:Recal K2:Understand K3:Apply
Learning objective	• To acquire knowledge on dissertation writing and publishing of research papers. • To learn laboratory hazards and safety measures • To study the variables in biology • To understand the hypothesis testing, significance of correlation. Regression and application of SPSS in biology

Unit I	**Importance of scientific research**	**12 hours**

Identification of research problems and research gaps–Sources, Extensive Literature Review, Developing the objectives, Preparing the Research Design, Types, Approaches, Methods of Research (Survey, Observation, case study, experimental, historical and comparative methods) collection and review of literatures– Planning and implementation of Research work – Journals database: Web of science- Scopus- UGC Care list Pubmed-Google scholar

Unit II	**Presentation, publishing research report**	**12 hours**

Dissertation writing – Preparation of research papers- Scientific Journals- Ethics in thesis writing- Plagiarism Impact factor of journals- Articles citations, h-index- i10 index. PowerPoint preparation for presentation Research funding promoting agencies- State- TANSCHE, TNSCST, National (ICMR, ICAR, DAE,CSIR, UGC, DST, DBT)

Unit III	**Principles of microscopy**	**12 hours**

fluorescent microscope, UV-visible spectrophotometer- SEM-TEM-GCMS- HPLC- AAS- PCR- DNA sequence- NGS Dosimetry: Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography, Radio Immuno Assay, Enzyme Linked Immuno Sorbent Assay (ELISA); SDS-PAGE, Agarose Gel Electrophoresis, 2D Gel Electrophoresis, Gel Documentation.

Unit IV	**Bioethics, GLP and CPCSEA Guidelines**	**12 hours**

Introduction to Bioethics-Positive effects – Negative effects - Biotechnology examples – Rice , Vitamin A - Slow Ripening Fruits- Saving the Banana- Toxic Soils-Fast Growing fish- The Monarch Butterfly Story- Consumer traits – food safety- Environmental concerns- Economic and Social Concerns. Bioethics regulation frame work in India. GLP introduction – National Good Laboratory Practice (GLP) Programme. CPCSEA Guidelines for Laboratory Animal Facilities.

Unit V	**Intellectual Property Rights**	**12 hours**

Origin of the Patent Regime- Early patents Act. History of Indian Patent System– Basis of Patentability –Patent Application Procedure in India- Patent Granted Under copy right, trade mark, Convention Agreement- Opposition to Grant of Patent-Grant and Sealing- Exclusive Rights - Special Provision for selling or distribution - Suits relating to infringements – Compulsory License- Relief under TRIPS agreement.

Text Books	1. Gurumani, Research Methodology, MJP Publishers, Chennai. 2006. **2.** Kothari C.R.,. Research Methodology. 2nd edition, New Age International Publishers, 2004.
Reference Books	1. Sood (O.P), Rattan (Ashok),Ethics in animal experimentation .Ranbaxy science foundation and Design.2004. 2. Leedy, P.D. and Ormrod, J.E., Practical Research: Planning, Prentice Hall.2004. 3. Fink, A., Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.2009. 4. Veerakumari, L. Bioinstrumentation. MJP Publishers, Chennai.2009. 5. Ghatak K.L.Techniques and Methods in Biology. PHI Learning Pvt. Ltd. New delhi.2011. **6.** Shaleesha A.Bioethics. Stanley Wisdom Publication .2018.
E-references	https://www.mooc-list.com/course/understanding-research-methods-coursera https://swayam.gov.in/nd2_ugc19_ge04/preview

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the research problems	**K1**
CO2	understand the method of thesis and research paper writing	**K2**
CO3	learn the principles and mechanism of various research instruments and able to handle them for research	**K3**
CO4	understand the laboratory practices and animal usage with reference to bioethics	**K2**
CO5	know about the patent rights and its regulations.	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	M	M	S	S	M	M	M	M	S	M	S	S
CO2	M	M	S	M	S	S	M	M	M	M	M	M	S
CO3	M	S	S	S	S	S	M	S	M	S	S	S	S
CO4	S	S	M	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOP33	PRACTICAL-III	L	T	P	C
CORE -XVI		BIOTECHNOLOGY & BIOINFORMATICS, DEVELOPMENTAL BIOLOGY, EVOLUTION, ECOLOGY & TOXICOLOGY	-	-	6	4

Cognitive Level	K2:Understand K3:Apply
Learning objective	• To learn the techniques of DNA isolation and safe handling of microorganisms • To acquire the skill to use Bioinformatics tool for analysis of sequence • To know the various stages involved in embryo • To estimate the physico-chemical parameters of the water and lethal dose of toxic chemicals
Experiments in Biomolecules	**BIOTECHNOLOGY** • Laboratory demonstration on safe handling of microorganisms. • Isolation of DNA from saliva. • Isolation of yeast DNA and Transformation of E-Coli. • Trypan blue exclusion method for cell viability estimation. • Production of penicillin and testing of antimicrobial activity. **BIOINFORMATICS** • Multiple Sequence Alignment. • Construction of Phylogenetic Trees for DNA and Proteins. • Sequence Retrieval from Databases. • Building of Molecules. • BLAST, FASTA programs for sequence database search. **DEVELOPMENTAL BIOLOGY** • Temporary mounting of chick blastoderm (24, 48,72 and 96 hrs). • Observation of frog spermatozoa. • Study of life cycle /early embryogenesis of frog. • Effect of hormones in amphibian metamorphosis **Spotters** Frog's / Human's sperm Frog's Egg, 8-Celled Stage, 16 Celled Stage, Yolk Plug Stage, Blastula, Gastrula • T.S of testis and ovary of frog and mammal • Chick Embryo: Primitive Streak, 24 hrs, 48 hrs and 72 hrs Chick Embryo. **EVOLUTION:** • Observation of forelimbs and hindlimbs -Frog, Calotes, Bird and Mammal) • Observation of fossils. Peripatus, Archaeyopteryx ,*Physa princepii* • Observation of leaf insects and stick insects , Monarch and Viceroy butterflies • Study of polygenetic inheritance among students using finger print.

- Hardy - Weinberg Law & Calculation of Gene Frequency of Dominant and Recessive using two different colour beads.

ECOLOGY & TOXICOLOGY

- Estimation of Chlorides, Total Hardness
- Determination of pH, DO and Co2
- Collection and Mounting of any three Zoo planktons-
- Estimation of primary productivity
- Estimation of LC50 or LD50 of an organo phosphorous pesticide.
- Physico-chemical analysis of soil pH, moisture, temperature, organic matter.

Spotters: Secchi Disc, BOD incubator, Wet and Dry bulb Thermometer, , Hygrometer, Rain Gauge, Sandy, Muddy and Rocky Shore Fauna (each five).
Report on Ecological Collection of Fauna representing Different Habitat

(Study Tour/Field Trip to animal farm, sanctuary, research lab or industrial area should be arranged to equip practical knowledge.

COURSE OUTCOME

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	perform the techniques, isolation of DNA and antimicrobial test	**K3**
CO2	use bioinformatics tool for research analysis	**K3**
CO3	differentiate various stages of development of chick blastoderm	**K3**
CO4	compare the fore limbs and hind limbs of different vertebrates on evolutionary pattern	**K2,**
CO5	gain practical knowledge on toxicolological techniques –LC_{50} / LD_{50} and water quality test	**K3**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	S	S	S	S	M	S	S	S	S	M
CO3	S	S	M	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	M
CO5	S	S	M	S	S	S	S	S	S	S	M	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21WSS33	WOMEN EMPOWERMENT	L	T	P	C
SUPPORTIVE- COURSE- III			2	-	-	2
Cognitive Level	K2: Understand K3: Apply K5:Analyse					
Learning objective	• To know the objectives, types, determinants of women Empowerment. • To learn the various national and international agencies for women empowerment. • To uplift women in socially, economically and politically as empowered. • To make aware of women rights and enhance their life • To know the women entrepreneurship development in India					

Unit I	Fundamentals of Women's Studies	6 hours

Meaning and Definition of the concept of Women's studies - Need and Scope - Women's studies as an academic discipline - Women's Studies – theories and Achievements- International Women's Year 1975 - International Women's Decade 1975 -1985; Towards Equal Status 1976 – Current trends-Importance of women's education – Efforts of various Committees –Life Skill Education to build capacity - Education as a tool of Women Empowerment - Obstacles to Women Education – Social, Economic, Cultural and other factors, limitations of Formal system of education-Role of educational institutions, Parents and Community

Unit II	Issues of Women	6 hours

Girl Children and Women in Society: Social Networking- Influencing factors of Social Networking-Types of Social Networking- impact and consequences of networking- Remedial measures and strategies for solution- NCW: Initiatives to overcome Women's issues - Ministry of Home Affairs and Networking with State Women Commissions: Cyber Crime Prevention against Women and Children (CCPWC)-challenges - efforts & effective measures to prevent crime against women and children - create awareness for social issues. Motherhood - Single Parent - Widows – Multiple Roles of Women - Role conflict, Role change - Social Responsibility and Gender Empowerment.

Unit III	Achievement and Rights of Women	6 hours

Gender Equality: Achievement of Women - Educational, Political, Economic, Social - Panchayat Raj - Political role and participation - National and International Levels; Women's Rights - Property Rights - Redressal mechanism at different levels - Rights of Women with Disability: Case Studies on Women Achievers in the field of politics, education, arts science, law etc.

Unit IV	Empowerment of Women	6 hours

Empowerment of Women: Alternative approaches - Women in Development (WID) - Women and Development (WAD) - Women's Development- Definition, Meaning and Scope, Gender and Development (GAD), Human Development Index (HDI) vs Gender Development Index (GDI). Types of Empowerment: Social, Educational, Political, Economical, Legal to Holistic levels-Role of Govt. and NGOs - Help line numbers in promoting women's empowerment - National and International Funding Agencies in promoting research on women.

Unit V	Women Entrepreneurship	6 hours

Women Entrepreneurship:– Types of Entrepreneurs Opportunities and Risk – Push and Pull Factors –financial Assistance and credit facilities-Micro finance- Entrepreneurship Skill and Competencies - Women Entrepreneurship Development in India: TRYSEM – NABARD – NMEW - Support to STEP – TREAD – Rural Entrepreneurship Development Programme – Gramia Bank –Mahila bank and supportive measures- Industrial Development Bank of India (IDBI) – Small Industries Development Bank of India-SHG and Entrepreneurship opportunities	
Text Books	1. Rani Sandhya, "Development of Women – Issues and Challenges", Discover Publishing House Pvt Ltd, New Delhi, 2012. 2. Anil Kumar Jha, "Gender Inequality and Women Empowerment", Axis Books, New Delhi, 2012. 3. Nandal Santosh , "Women and Development", A Mittal Publications, New Delhi, 2012
Reference Books	1. Rao Pulla, "Political Empowerment of Women in India – Challenges and Strategies", ABD Publishers, New Delhi, 2012. 2. Jenny Edwards, Andrea Cornwall, et al., "Feminisms, Empowerment and Development: Changing Women's Lives", Kindle Edition, 2014. 3. Elson Diane, et al. "Gender Equality and Inclusive Growth: Economic Policies to Achieve Sustainable Development", UN Women, 2019 4. Priyanka Sharma Gurnani, "Women Entrepreneurship – Emerging Dimension of Entrepreneurship in India" Educreation Publishing House, New Delhi, 2016.
E-Reference links	1. https://asiapacific.unwomen.org/en/focus-areas/governance/political-participation-of-women

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	gain knowledge about the concept, need and scope of women's studies	**K2**
CO2	acquaint and analyze issues of women in various contexts	**K5**
CO3	understand changing role of women in society and issues related to it	**K2**
CO4	understand the importance of women's education.	**K2**
CO5	comprehend empowerment of women and their achievement	**K3**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	M	S	S	S	M	S	S	M	S	M

CO2	S	M	M	S	M	S	S	M	S	M	S	S	M
CO3	M	M	M	S	S	S	S	M	S	S	S	M	S
CO4	S	M	S	M	S	S	M	S	S	M	S	S	M
CO5	M	S	M	S	S	S	S	S	S	M	M	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER-IV

Course Code	P21ZOE411	CHOICE -I	L	T	P	C
ELECTIVE – I		ENTOMOLOGY	4	-	-	4

Cognitive Level	K2:Understand K3:Apply	
Learning objective	• To learn the classification of insects • To comprehend the external morphological features of insects • To understand the various internal organs systems of insects • To gain deep knowledge in insects relationship between abiotic and biotic factors • To understand the pest of various crops	
Unit I	**Taxonomy**	**12 hours**
Basics of Insect Classification, Classification up to Order Level, Key Characteristics with South Indian Examples.		
Unit II	**External anatomy and Growth**	**12 hours**
External Anatomy of a Typical Insect - Exoskeleton, Head, Thorax, and Abdomen. Mouth Parts of Insects, Different Types of Larvae and Pupae - Growth and Metamorphosis of Insects.		
Unit III	**Physiology of Insects**	**12 hours**
Digestive System, Excretory System, Respiratory System, Circulatory System, Nervous System and Sense organs, Reproductive System of a typical insect. Endocrine System and Pheromones in ants.		
Unit IV	**Ecology of Insects**	**12 hours**
Abiotic Factors Affecting Insects - Temperature, Moisture, Air-currents, Diapause, Light, Food. Habit & Habitat - Terrestrial and aquatic. P rotection, Competition, Parental Care, Trophyllaxis, Commensalism, Captives, Food Storage, Natural Enemies, Insects and Plant associations. Brief note on social insects.		
Unit V	**Agricultural Entomology**	**12 hours**
Insect Pest of Crops and their control measures: Paddy, Groundnut, Coconut, Cotton. Sugarcane, Brinjal, Lady's finger and Pests of Stored grains. Pest Control: Prophylatic, Mechanical, Chemical and Biological Control measures. Integrated Pest Management.		

Text Books	1. Ambrose Dunston P.The Insects: Structure, Function and Biodiversity, Kalyani Publishers, Ludhiana. 2004. 2. Vasantharaj David, B. and Kumaraswami, T., Elements of Economic Entomology, Popular Book Depo, Chennai. 1995
Reference Books	1. Tembhare, D.B.,Modern Entomology, Himalaya Publishing House, Mumbai. 2012 2. Ambrose Dunston P., The Insects: Structure, Function and Biodiversity, Kalyani Publishers, Ludhiana. 2004, 3. Chapman, R.F., The Insects: Structure and Function, Cambridge University Press. 2012. 4. T.N. Ananthakrishnan, and B.V.David, General and Applied Entomology, Tata McGraw Hill Publishing House, New Delhi.1986 5. Wigglesworth, V.B., , Principles of Insect Physiology, 9th Ed. Chapman & Hall, London. 2001.

E-references	1.https://onlinecourses.swayam2.ac.in/cec20_bt02/preview 2.https://www.classcentral.com/course/swayam-endocrinology-19855

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Out Comes**	**Knowledge Level**
CO1	classify and group the insects according to their taxonomy.	**K3**
CO2	understand the characteristic features of insects	**K2**
CO3	learn the importance of beneficial insects	**K2**
CO4	know the physiology and significance of pheromones	**K2**
CO5	know the vector and pest management practices.	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOE412	CHOICE -II	L	T	P	C
ELECTIVE-I		ENDOCRINOLOGY	4	-	-	4
Cognitive Level	K1:Recall K2:Understand					
Learning Objectives	• To have a knowledge on the functions of neuroendocrine systems • To get a thorough knowledge on various glands and related hormones • To know the role of hormones in metabolism • To understand the hormonal regulation in reproduction					
Unit I	**Hormone:** Nature, function and classification of hormones – Feedback control of hormone secretion – Organisation and functions of neuroendocrine systems- Hypothalamo– hypophyseal interactions- Bioactive peptides.					
Unit II	**Pituitary gland:** Structure and functions, role of hormone secretions - Thyroid gland – Structure, function and biosynthesis of thyroid hormone – Parathyroid – Structure and PTH – Calcitonin – Role of hormones in calcium and phosphate metabolism.					
Unit III	**Gastrointestinal hormones**: secretion, control and function – Insulin and glucagons – Adrenal hormones and Stress management – Catecholamines as emergency hormones- their role in the regulation of carbohydrate, protein and lipid metabolisms.					
Unit IV	**Adrenal Hormone:** Adrenal gland – Structure and role played its hormones in glucose metabolism – Aldosterone and the rennin- angiotensin system – Pineal gland- structure and its influence on reproduction and pigmentation – Thymus gland – Structure and thymic hormones – their functions in brief					
Unit V	**Steroid hormone**: Biosynthesis in the ovary and testis – Hormonal regulation of ovarian cycles in mammals – Folliculogenesis, ovulation, corpus luteum formation and regression – Hormones in pregnancy and lactation. Gonadal steroid action on spermatogenesis and spermiogenesis – Role of hormones in sex accessory gland growth and functions.					
Text Books	1.Yadav, Text book of Endocrinology, 2009, Sonali Publications, New Delhi - 2009.					
Reference Books	1.Yadav, Text book of Endocrinology, 2009, Sonali Publications, New Delhi 2. M.P. Goswami, Endocrinology and Molecular Cell Biology, Gaurav book centre Pvt Ltd, Delhi .2013 3. George Griffing, Endocrinology,Stat Pearls Publishing, USA .2015 4. Mac E. Hadley, Endocrinology, Prentice Hall .2001					

E-Reference	https://www.classcentral.com/course/swayam-endocrinology-19855

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the hormone classification and function of hormones	**K1**
CO2	know the structure of Pituitary glands and its hormone function	**K2**
CO3	comprehend the gastrointestinal hormones functions on the regulation of macromolecules metabolism	**K2**
CO4	learn the importance of adrenalin and thymic hormones	**K2**
CO5	get deep knowledge on ovarian cycles and sex hormones	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	M	M	S	S	M	S	M	S
CO2	S	S	S	S	M	S	S	S	S	S	M	S	S
CO3	S	S	M	S	S	S	S	S	S	M	M	S	S
CO4	M	S	S	S	M	S	S	S	S	M	S	S	M
CO5	S	S	S	M	S	S	S	S	S	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOE421	CHOICE -I	L	T	P	C
ELECTIVE- II		BIOSTATISTICS AND BIOPHYSICS	4	-	-	4
Cognitive Level	K1:Recall K2:Understand K3:Apply					
Learning objectives	• To learn the variables in biology • To explore the use of statistical methodology in designing, analyzing,interpreting and presenting biological experiments and observations. • To understand the basic concepts of Biophysics					
Unit I	**Data collection & presentation:** Variables in Biology, Collection, classification and tabulation of data. Frequency distribution, Diagrammatic and Graphical presentation of statistical data, Sampling techniques. Measures of Central Tendencies: Mean, Median and Mode; Measures of Deviation: Standard Deviation, Quartile deviation, Mean deviation and Standard Error					
Unit II	**Normal Distribution:** Data distribution – Normal, Binomial and Poisson Distribution. Skewness and Kurtosis. Correlation Analysis - types, methods - Scatter plot, Karl Pearson's Correlation Coefficient, Spearman's Rank correlation. Simple regression Analysis - predicting X on Y and Y on X.					
Unit III	**Hypothesis Testing and estimation:** H_0 and H_1, Hypothesis testing, significance level, degrees of freedom. Definitions and applications of Chi-square test, 't' and 'f' test. Analysis of variance (ANOVA)-One way and two way classified data; Application of SPSS in biology.					
Unit IV	**Biophysics:** Introduction – Scope of biophysics.-I, II, III laws of Thermodynamics, Concepts of free energy, Entropy, Enthalpy, biological oxidation reduction reaction – redox potentials in biological system. Molecular structure of water–Non-covalent bonding: Hydrogen bond, electrostatic interaction-Vander Waals forces thermal, solvent properties, ionization of water – colligative properties of aqueous solution					
Unit V	Biological significance of Osmosis, Electrical conductivity, Diffusion, Surface tension, Adsorption, Hydrotropic, Precipitation, Viscosity and Colloids, - Donnan Equilibrium in Living systems. Diffusion – Fick"s laws, constant laws–exergonic and endergonic reaction – rate of reactions – energy activation – Arrhenius expression- LASER and its applications in Biology.					

Text Books	1.Pillai, R.S.N. and Bagavathi,V. S. Statistics theory and practice. Chand & Co.Ltd, New Delhi. 2010. 2.Gupta, S.P. Statistical Methods. S. Chand & Co. Ltd, New Delhi.2014. 3.Kothari,C.R. and Garg,G. Research methodology –Method and techniques. NewAge International (P) Ltd. New Delhi. 2010.
Reference Books	1. Arora, P.N and P.K.Malhan. Biostatistics. Himalaya Publications, Mumbai.2008. 2. Daniel, W.W. Biostatistics-A foundation for analysis in health sciences, John Wiley (Asia) & sons, Singapore.2006 3. Gupta S.P.. Statistical Methods. 40th edition, S.S. Chand Publishers, New Delhi.2011. 4. Subramanaiam, M.A., Biophysics. MJP Publishers, Chennai. 2002 5. Daniel, M., Basic Biophysics for Biologists, Agro-Botanical Publisher, Bikaner, India.2001
E-References	1. https://swayam.gov.in/nd2_ugc19_ma03/preview 2. http://rijuebookbiostatistics.blogspot.com/2008/06/biostatistics-ebooks-free-download.html

Course outcomes

Upon completion of this course, the students will be able to		
CO	**Course Out comes**	**Knowledge Level**
CO1	understand to collect the data , arrange and interpret it.	**K1**
CO2	differentiate the normal and skewed data., correlation between different variables.	**K3**
CO3	comprehend the significanceof testing, for their present statistical results and understand the importance of statistical software in research.	**K3**
CO4	understand the thermodynamic laws and type of bonding lying between different biological atoms.	**K2**
CO5	get thorough knowledge on osmosis and diffusion	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S	M	S	S
CO3	S	M	S	S	S	M	S	S	S	S	S	M	S
CO4	M	S	S	S	M	S	S	S	S	M	S	S	M

CO5	S	S	S	M	S	S	S	S	S	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOE422	CHOICE -II	L	T	P	C
ELECTIVE-II		MICROBIOLOGY	4	-	-	4

Cognitive Level	K1:Recall K2:UnderstandK3:Apply	
Learning objectives	• To understand the basics of microbiology and its classification • To comprehend the various pathways of microbial metabolism • To get knowledge about food spoilage and food poisoning by micro organisms • To know the techniques of production of various microbial commercial products • To learn the microbial role for the treatment of sewage and agricultural	
Unit I	**History and Microbial Growth**	**6 hours**
History and scope of Microbiology, Microbial Culture: Sterilization Isolation of Pure Culture, Microbial growth -Synchronous. Bacterial growth - Growth curve, Measurement of Bacterial Growth. – Cell, count method and Turbido metric method. Staining Techniques - Simple, differential and Gram Staining.		
Unit II	**Microbial Metabolism**	**6 hours**
Glycolysis, Pentose Phosphate Pathway (HMP), Entner-Doudoroff pathway,TCA cycle, Glyoxylate cycle and Fermentation. Bacterial Photosynthesis-Classification of photosynthetic Bacteria, Mechanism of photosynthesis.		
Unit III	**Food and Medical Microbiology**	**6 hours**
Microbiology of Milk,Dairy Industry ; Dairy Products-Yoghurt, Butter Milk, Butter, Cheese. Microbial Spoilage of food: Microbial Contamination and Spoilage of Poultry, Fish and Sea.Preservation of Food - Physical and Chemical Methods.Bacterial diseases: Diphtheria, Meningitis, Pertusis, Streptococcal Pneumonia.Sexually Transmitted Diseases - Gonorrhea and Syphilis,Contact Disease – Leprosy. Viral diseases - Influenza, Hepatitis - B, Rabies.		
Unit IV	**Industrial Microbiology**	**6 hours**
Alcohol production – Ethanol:Production of Acids - Lactic acid and Vinegar,Production of Antibiotics – Penicillin and Streptomycin ;Production of Amino acid - L-lysine, L- glutamic acid. Production and Application of Microbial Enzymes.		
Unit V	**Agricultural and Environmental Microbiology**	**6 hours**
Role of Ti Plasmid and Nif gene in Agriculture. Biofertilizers and Biopesticides, Bacterial Insecticides - Bacillus thuringenesis and Viral Insecticides. Potable water and Sewage treatment. Water Pollution Management – Bioaugmentation and Bioremediation		
Text Books	1. Ananda narayanan, T. and Jayram Paniker, C.K., 2000, Textbook of Microbiology, 6th Ed. Orient Longman Ltd., Chennai. 2. 2. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore .2009. 3. Dr.R.C.Dubey .Dr.D.K.Maheswari, A Text book of Microbiology, S.Chand & CO Ramnager, New Delhi. 2010.	

	4. Kanika Sharma. Textbook of Microbiology – Tools and Techniques. 1st Edition, Ane Books Pvt. Ltd., New Delhi. 2011. 5. .Dr.R.C.Dubey .Dr.D.K.Maheswari, A Text book of Microbiology, S.Chand& CO Ramnager, New Delhi, 2010.
Reference Books	1. Pelczar, M.J., E.C.S. Chan and N.R. Kreig. 2009. Microbiology, fifth edition. McGraw-Hill. Book Co. Singapore . 2009. 2. Samuel Baron , Medical Microbiology, II Ed., Wesley publishing company-2008. 3. Black, J.G. Microbiology-principles and explorations, 6th edition. John Wiley & Sons, Inc. New York .2005. 4. Prescott, L.M., Harley, J.P. and Klein, D.A. Microbiology (7th edition) McGraw Hill, Newyork.2008. 5. Madigan, M.T., Martinkl, J.M. and Parker, J. Brock Biology of Microorganisms, 12th Edition, MacMillan Press, England,2009.
E-references	1. https://onlinecourses.swayam2.ac.in/cec20_ag09/preview 2. https;//onlinecourses.swayam2.ac.in/cec20_bt14/preview

Course Outcomes

Upon completion of this course, the students will be able to		
CO	**Course Out comes**	**Knowledge Level**
CO1	learn the development and advancements of microbiology	**K1**
CO2	understand the microbial feature and immune system.	**K2**
CO3	gain knowledge on food preservation, infectious diseases and to overcome infection.	**K3**
CO4	learn the production of microbial products from industries	**K2**
CO5	attain knowledge about microbial role in environment and agricultural sector.	**K2**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	M	S	S	S
CO2	S	S	S	M	S	M	M	M	S	S	M	S	S
CO3	M	S	M	S	S	S	S	M	S	S	S	S	S
CO4	S	M	S	S	S	S	M	S	S	S	S	M	S
CO5	S	S	M	M	M	S	M	M	M	S	S	S	M

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOR41	MAJOR PROJECT	L	T	P	C
			-	-	22	8

All the candidates of M.Sc (Zoology) are required to undergo a Major project and submit the following:

1. Dissertation/Thesis based on the work done by the student.
2. Soft copy of the project on CD/DVD

Project Evaluation Guidelines.

The project is evaluated on the basis of following heads:

Presentation - 25% of total marks

Viva - 20% of total marks.

Thesis/ Dissertation - 30% of total marks.

Learning outcome: Empowering students to carryout individual research projects.

NON-MAJOR ELECTIVES

Course Code	P21ZON211	CONSERVATION BIOLOGY	L	T	P	C
NME -I			4	-	-	4

Cognitive Level	K1:Recall K2:Understand K3:Apply
Learning objective	• To update the knowledge of current status of biodiversity and its extinction • To understand the significance of biodiversity • To identify the ways to conserve the biodiversity • To obtain knowledge about the conservation of Biodiversity

Unit I	**Components of Biodiversity**	**12hours**

(Ecosystem, Genetic and Species diversity) – Assigning values to biodiversity – Species concepts – Animal diversity: (Distribution inventory, species richness) – Biodiversity Hotspots (Western Ghats, Indo-Burma region). Biogeography of India – patterns and distribution of ecosystems, ecological succession, biotic and abiotic factors of an ecosystem. Conservation ethics and values of wildlife.

Unit II	**Extinctions**	**12hours**

Past rates of Extinctions – Concepts of Island biogeography and extinction rates on Islands – Human induced, Modern and local extinctions – Population reduction-threats to wildlife (examples) – Habitat loss, degradation and fragmentation. Threats to animal diversity in India – Status of species: Rare, endemic and threatened species – Measuring status of species in the wild – IUCN Red list (Assessments and methodologies) – Status of Indian animals.

Unit III	**In situ conservation of Indian animals**	**12hours**

(Case studies). Ex situ: Captive breeding programme – people participation in conservation – Successes and failures of conservation actions in India (Case study) – Tools in Conservation: GIS – remote sensing – Landscape model – PVA – VORTEX. Red listing process: categories and criteria, SIS. Wildlife conservation in India importance of conservation – methods of wildlife conservation

Unit IV	**Economics of biodiversity conservation**	**12hours**

Wildlife (Protection) Act of India (1972) – Protected Area network – forest policy – Prevention of cruelty to Animal Act – Convention on Biological diversity, International Trade in endangered species – Zoo policy- Laws and their applications in Zoological parks, wildlife sanctuaries and biosphere reserves – Economics of biodiversity conservation. The world Conservation Union (IUCN) – World wildlife fund (WWF) – Indian Board for Wildlife (IBWL).

Unit V	**Wildlife / Animal magazines**	**12hours**

Journals- How to write popular and Scientific articles – Magazine and Journal information – Wildlife, nature, environment games (examples) – Role of NGO's and Government organizations in wildlife conservation – Wildlife celebration days in India. Technical writing and reporting of field studies. Public presentation. Field Project/ Report – visit to Zoological parks, wildlife sanctuaries and biosphere reserves.

Text Books	Peter H. Raven, Navjot S. Sodhi, Luke Gibson, Conservation Biology: Voices from the Tropics, Willey Online library.2013.
Reference Books	1. Meffe, G. K. and C. R. Carroll.Principles of Conservation Biology, Sinauer Associates, USA .1994 2. Michael, P. Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw Hill Publishing Company Limited, New Delhi. 2001. 3. Peter H. Raven, Navjot S. Sodhi, Luke Gibson. Conservation Biology: Voices from the Tropics, Willey Online library.2013
E-references	1. https://nptel.ac.in/courses/102/104/102104068/ 2. https://swayam.gov.in/nd1_noc20_bt39/preview 3. https://swayam.gov.in/nd1_noc20_bt38/preview

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	understand the types of biodiversity and conservation ethics	**K1**
CO2	know the causes of biodiversity extinction and IUCN-Red list	**K2**
CO3	learn the insitu and exsitu biodiversity conservation methods	**K2**
CO4	know the wild life protection act and organization	**K2**
CO5	obtain the knowledge on wild life animal magazines and role of NGOs for the conservation of biodiversity	**K3**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S	S	M	S
CO3	S	S	M	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	M	S	S	M
CO5	S	S	S	M	S	S	S	M	S	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZON212	EPIDEMIOLOGY	L	T	P	C
NME-I			4	-	-	4
Cognitive Level	K1:Recall K2:Understand					
Learning Objectives	• To understand the basic principle of Epidemiology • To know the concepts of infectious diseases, non-infectious diseases and sexually transmitted diseases					
Unit I	**History**					**12 hours**
Historical aspects of Epidemiology and evolution - Definition and understanding - Natural history of disease - Survey methodology including census procedures and Sampling.						
Unit II	**Tools of Epidemiology**					**12 hours**
measuring disease Frequency (Prevalence, incidence, morbidity rates, attack rates etc.						
Unit III	**Epidemiological aspects of diseases of national importance**					**12 hours**
Diarrhoea - Vaccine preventable disease - Tuberculosis - Visual impairment/blindness - Malaria - Filariasis - Coronary Heart disease.STD						
Unit IV	**Non-infectious Diseases**					**12 hours**
Localized or widespread rise in a various type of cancer, birth defects. Infectious disease-Food borne illness, Influenza, Pneumonia and COVID.						
Unit V	**National Programmes**					**12 hours**
National Programmes related to Communicable and Non Communicable diseases, Dengue, Swine Flu, Chikungunya,COVID etc.						
Text Books	1. Gordis, L. *Epidemiology.* Third edition. Philadelphia: Elsevier Saunders. (The second edition is also acceptable.)2004 2. Pagano, M. and Gauvreau, K. *Principles of Biostatistics.* Belmont, CA: Wadsworth. 2000. 3. Aschengrau A & Seage GR. Essentials of Epidemiology in Public Health. 3 rd Edition.2014					
Reference Books	1. Robert H. Friis and Thomas A. Sellers. Epidemiology for Public Health Practice, Fourth Edition. Jones and Bartlett Publishers, 2009 2. Aschengrau A & Seage GR. Essentials of Epidemiology in Public Health. Sudbury, Massachusetts: Jones and Bartlett Publishers, 2013. 3. Gordis L. Epidemology, 3rd Ed. Philadelphia, PA. Elsevier Saunders: 2004 4. Last JM, editor. Dictionary of epidemiology. 4th ed. New York: Oxford University Press; 2001. 5. Cates W. Epidemiology: Applying principles to clinical practice. Contemp Ob/Gyn. 1982.					
E-Reference	1. http://www.phppo.cdc.gov/PHTN/catalog/pdffile/Epi_Course.pdf 2. http://www.pitt.edu/~super1/ 3. https://www.bmj.com/about-bmj/resources-readers/publications/epidemiology-uninitiated/1-what-epidemiology					

Course outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	know the concept of epidemiology	**K2**
CO2	acquire knowledge on tools of epidemiology	**K2**
CO3	construct clinical life table in epidemiologic studies	**K2**
CO4	gain knowledge on vaccine preventable diseases	**K2**
CO5	clearly understand the national programme for various diseases	**K1**

Mapping of COs with POs &PSOs:

CO	**POs**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	S	M	M
CO3	M	S	M	S	S	M	S	S	S	S	M	S	S
CO4	S	S	S	S	M	S	S	S	M	M	S	S	M
CO5	S	M	S	M	S	S	S	M	S	M	S	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

VALUE ADDED COURSE

Course Code	P21ZOV11	MEDICAL TRANSCRIPTION	L	T	P	C
VALUE ADDED COURSE-1			4	-	-	2

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning objective	• To understand the fundamental concepts of medical transcription • To learn medical theories and legal responsibilities • To gain basics of computer for preparing medical reports	
Unit I	**Medical terminology**	**6 hours**
Pharmacology and Anatomy of humans , General medical terms, surgical terms, diseases , Human body parts, systems and functions , Medication terminology, treatments, drug reactions, pharmacology legalities, medication handling and doctor's orders.		
Unit II	**Theory**	**6 hours**
Medical Theories and Techniques Ethical and Legal Responsibilities Medical Transcription Equipment and Technology, Diagnostic and therapeutic procedure terms and practices, Surgical procedure terms and practices, Lab procedures: patient preparation and blood drawing techniques.		
Unit III	**Basic Transcription**	**6 hours**
Medical Grammar and Style, Medical Reports Formatting, Transcribing audio files into typed format. Healthcare Documentation formats, American Medical Association stylistic standards.		
Unit IV	**Computer Information Systems**	**6 hours**
Speech Recognition Editing, Basics of Microsoft Office software, including Word, PowerPoint, Excel, Basic formatting practices and e-mail and Internet usage and file organization.		
Unit V	**Software**	**6 hours**
Speech recognition software to transcribe dictation and taking dictation with background noise.		
Reference Books	1. Medical Transcription: Fundamentals and Practice, Prentice Hall,2007. 2. Linda Campbell, The Medical Transcription.,Paper back, 2011	
E-References	1. https://hlcuomtdn.firebaseapp.com/aGxjdW9tdGRuMDEzMTg4MTQzNA.pdf 2. https://www.yumpu.com/en/document/view/64011468/pdf-download-medical-transcription-fundamentals-where-success-takes-root-full-online	

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Outcomes**	**Knowledge Level**
CO1	learn and familiar with medical terminology and medication handling	**K1**
CO2	comprehend the medical theories, therapeutic, surgical and lab procedures	**K2**
CO3	know the basic transcription and medical reports	**K1**
CO4	handling computer for preparation of necessary reports and documents	**K3**
CO5	acquire knowledge in software for transcription.	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	S	S	M	S	M	S	M	S	M	S
CO2	M	S	S	M	S	S	S	S	S	S	S	M	S
CO3	S	M	M	S	S	M	S	M	S	S	S	S	S
CO4	M	M	S	S	M	S	S	S	S	M	M	S	M
CO5	M	S	S	M	S	S	S	M	S	M	M	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	P21ZOV41	FISHERIES TECHNOLOGY	Total Hours	C
Value Added Course-2			30	2

Cognitive Level	K1:Recall K2:Understand K3:Apply	
Learning Objective	• To understand the basics of fisheries • To know the aquarium fish culture • To learn construction of fish farm and management	
Unit I	**Basics of Fisheries**	**6 hours**
Scope and importance of Fisheries - Development of fish culture. Indian Fisheries – Research and career opportunities.		
Unit II	**Aquarium Setting**	**6 hours**
Freshwater and Marine Ornamental Fisheries Ornamental Fish Trade- Disease Management for Aquarium Fishes.		
Unit III	**Culture of Edible Fishes**	**6 hours**
Biology of Carps – Culture of Indian Major Carps Integrated Fish Farming – Fish Culture in Rice Fields– Induced Breeding – Procedure of Induced Breeding Hypophysation.		
Unit IV	**Aqua Feed Formulation Methods**	**6 hours**
Nutritional Requirement of Finfish - Types of Fish Feeds – Formulated Feeds – Preparation of Supplementary Feed – Immunostimulants-Diet Processing – Management of Feeding – Preparation of Natural Food In Fish Pond		
Unit V	**Construction of a Fish Farm**	**6 hours**
Site Selection – Size and Depth of the Ponds – Water Quality (Physical Chemical and Biological Factors) Pond Renovation – Harvesting – Post Harvesting – Fish Preservation – Hatchery seed production- Fish Products and by Products.		
Text Books	Omprakash Sharma, Handbook of Fisheries and Aquaculture,Agrotech publishing Academy,Udaipur,2009.	
Reference Books	1. Faridi.A.Z.Textbook of Fish Processing, Technology,2014.ISBN: 9789353147167 **2.** Dr**.** D. K. Belsare,Text Book of Fish, Fisheries and Aquaculture, Kindle Edition,2019. 3. Claude E. BoydAaron A. McNevin, Aquaculture, Resource Use, and the Environment, John Wiley & Sons, 2014.	
E-References	1. https://content.kopykitab.com/ebooks/2016/05/7035/sample/sample_7035.pdf 2. https://www.cmfri.org.in/ebooks	

Course Outcome

Upon completion of this course, the students will be able to		
CO	**Course Out comes**	**Knowledge Level**
CO1	understand the importance of fish culture	**K1**
CO2	develop skills for setting aquarium	**K3**
CO3	know the principles and methods involved in the induced breeding of fishes	**K2**
CO4	acquire knowledge on the aqua feed Formulation	**K2**
CO5	apply knowledge of Construction of a Fish Farm and become potential entrepreneur	**K2**

Mapping of COs with POs &PSOs:

CO	**Pos**								**PSOs**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	S	S	M	S	M	S	M	S	M	S
CO2	S	M	S	M	S	S	S	S	S	S	S	M	S
CO3	S	M	M	S	S	M	S	M	S	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	M	M	S	M
CO5	S	M	S	M	S	S	S	M	S	M	M	S	S

Strongly Correlating (S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

******