SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN

(AUTONOMOUS),

MADURAI – 2

DEPARTMENT OF ZOOLOGY

Syllabus

M. Sc. ZOOLOGY
(CBCS & OBE)

For students who joined in the Academic year 2022-23

Programme Outcomes (POs)

Upon completion of M. Sc. Programme, students will be able to

PO1: Get enriched by the existing knowledge in their respective disciplines and apply appropriate methodology for research and implementation.

PO2: Develop technology compatible to new perceptions and evolve innovative pedagogy in their discipline.

PO3: Design creative projects and translate it to the present day scenario.
.
PO4: Evaluate the issues and challenges pertaining to their disciplines and synergize them with the growing needs in their arena.

PO5: Explore the diverse value systems of our nation and contribute towards building an egalitarian society.

Programme Specific Outcomes (PSOs)

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

PSO1: Acquire in depth knowledge of basic and advanced areas in Zoology and related fields such as biochemistry, physiology, molecular biology, microbiology, biotechnology, Immunology, Genomics, forensic biology, clinical lab technology, biophysics and biostatistics with interdisciplinary approach.

PSO2: Carryout experimental techniques with proficiency and analyse, apply and solve scientific problems in various areas of Zoology.

PSO3: Develop aptitude and skill in research in different branches of Zoology as well as related disciplines.

PSO4: Acquire skills in Zoology in a global, economic, environment and societal context and to develop personal and key transferable skills such as group work and presentation.

PSO5: Identify, evaluate and apply fundamental concepts of Zoology in designing and developing ideas applicable to the society.

PSO6: Demonstrate awareness for lifelong and professional development towards producing employable candidates in career related to teaching in Zoology, especially in Schools and Colleges.

PSO7: To develop innovative ideas and exhibit skills necessary to initiate unique start-ups in the realm of life science.

SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS)

MADURAI - 2

Programme : M. Sc. ZOOLOGY

Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
SEMESTER – I								
						Int	Ext	Total
Core Course - I	P22CZ1	**Animal Physiology**	6	5	3	25	75	100
Core Course - II	P22CZ2	**Environmental Biology**	6	5	3	25	75	100
Core Course - III	P22CZ3	**Molecular Biology**	5	4	3	25	75	100
Core Course - IV	P22CZ4P	**Animal Physiology, Environmental Biology and Molecular Biology-Practical**	6	3	5	40	60	100
Discipline Specific Elective Course - I	P22DSZ1A	**Clinical Lab Technology**	5	4	3	25	75	100
	P22DSZ1B	**Climate Change and Sustainability**						
Skill Enhancement Course - I	P22SEZ1	**Vectorborne Diseases**	2	2	3	25	75	100
Total			**30**	**23**				**600**
SEMESTER – II								
Core Course - V	P22CZ5	**Applied Microbiology**	6	5	3	25	75	100
Core Course - VI	P22CZ6	**Biochemistry**	6	5	3	25	75	100
Core Course - VII	P22CZ7	**Human Genetics**	5	3	3	25	75	100
Core Course - VIII	P22CZ8P	**Applied Microbiology, Biochemistry and Human**	6	3	5	40	60	100

		Genetics - Practical						
Discipline Specific Elective Course - II	P22DSZ2A	Genomics and Proteomics	5	4	3	25	75	100
	P22DSZ2B	Computational Biology						
Skill Enhancement Course - II	P22SEZ1	Climate Change and Human Health	2	2	3	25	75	100
Total			P22SEZ1	22				600

SEMESTER – III								
Core Course - IX	P22CZ9	**Immunology**	6	5	3	25	75	100
Core Course - X	P22CZ10	**Developmental Biology**	6	5	3	25	75	100
Core Course - XI	P22CZ11	**Biophysics and Biostatistics**	5	4	3	25	75	100
Core Course - XII	P22CZ12P	**Immunology, Developmental Biology Biophysics and Biostatistics- Practical**	6	4	3	40	60	100
Discipline Specific Elective Course - III	P22DSZ3A	**Research Methodology and Bio- techniques**	5	4	3	25	75	100
	P22DSZ3B	**Economic Zoology**						
Non -Major Elective Course	P22NMZ1	**Brain and Human Behaviour**	2	2	3	25	75	100
Total			**30**	**24**				**600**
SEMESTER – IV								
Core Course - XIII	P22CZ13	**Animal Biotechnology**	6	4	3	25	75	100
Core Course - XIV	P22CZ14	**Entomology**	6	4	3	25	75	100
Core Course - XV	P22CZ815	**Biodiversity and Conservation Strategies**	5	4	3	25	75	100
Core Course - XVI (Project)	P22CZPW	**Project Work**	8	5	-	80	20	100
Discipline Specific Elective Course - IV	P22DSZ4A	**Forensic Biology**	5	4	3	25	75	100
	P22DSZ4B	**Animal Behaviour**						
Total			**30**	**21**				**500**

COURSE STRUCTURE ABSTRACT FOR

M. Sc. ZOOLOGY

PART	COURSES	TOTAL NO. OF COURSES	HOURS	CREDITS	MARKS
III	Core Course	15	86	63	1500
III	Core Project	1	8	5	100
III	Discipline Specific Elective Course	4	20	16	400
III	Non-Major Elective Course	1	2	2	100
III	Skill Enhancement Course	2	4	4	200
Total		**23**	**120**	**90**	**2300**

Programme : M. Sc. ZOOLOGY	**Course Type** : CC- I	
Semester : I	**Hours** : 6/W 90/S	
Subject Code : P22CZ1	**Credits** : 5	

TITLE OF THE PAPER: ANIMAL PHYSIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	6	3	2	1

PREAMBLE:

This course provides knowledge and understanding of structure and functions of human organ systems and awareness to prevent human diseases

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: impart knowledge on various types of nutrition anddistinguish the heterotrophic mode of nutritional types such as Saprotrophic, Parasitic, Holozoic nutrition and heterotrophs such as decomposer, omnivore, Herbivore andDetrivore and describe process of digestion.	1	12	K3
CO2: explain breathing, ventilation, and understands the process of gaseous exchange, respiratory pigments. Hemoglobin as oxygen carrier, respiratory quotient, analyse the reasons for respiratory problems and apply the knowledge in caring lungs and prevent respiratory dieases.	2	18	K4
CO3: gain knowledge on the structure and fuctions of heart, understanding of composition of blood and role of blood and blood cells,analyse the causes and applying this with reference to cardiac diseases.	3	20	K4
CO4: associate the structure and functions of Muscular system , compare and contrast CNS, PNS and ANS and discover the role of photo and phonoreceptors,analyse the reasons for neuraldiseaes and apply the knowledge in preventing muscular , neural phonoand photo receptor diseases	4	22	K4
CO5: list the excretory organs in animals and summarise the structure and functions of kidney, understanding the mechanism of urine formation and analyse hypertension with Kidney disorders.	5	18	K4

SYLLABUS

UNIT I:

Feeding and digestion - an overview of nutritional types and feeding mechanisms –Mode of digestion - intracellular and extracellular, mechanism of absorption of carbohydrates, fats, and proteins, defecation.

UNIT II:

Respiration – structure of Lung, external respiration - respiratory movements, breathing, ventilation, process of gaseous exchange, respiratory pigments. Hemoglobin as oxygen carrier, respiratory quotient.

UNIT III:

Circulation – structure and functioning of Heart - composition and functions of blood, mechanism of blood clotting, functioning of heart, cardiac cycle, heart beat – origin and regulation, blood pressure, ECG, diseases of heart.

UNIT IV:

Muscular system - ultra structure of skeletal muscle, mechanism of muscle contraction, theories and biochemical changes during contraction. Nervous system - CNS, PNSl, ANS. Neuron - structure and types, conduction of nerve impulses. Mechanism of photo and phonoreceptors.

UNIT V:

Excretion - products of excretion, excretory organs in animals, structure and functions of human kidney, mechanism of urine formation. Hypertension vs kidney disorders. Osmoregulation - osmoregulators, conformers, stenohaline and euryhaline, osmoregulation in fishes. Thermoregulation - hibernation, aestivation, diapause.

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TEXT BOOK:

1. Hoar WS. General and Comparative Physiology. Prentice Hall of India, ND, 2004

REFERENCE BOOKS:

1. Eckert and Randal. Animal Physiology. CBS Pub., New Delhi, 2005
2. Nagabhushanam, Kodarkar and Sarojini. Text Book of Animal Physiology. Oxford and IBH Pub., New Delhi, 1983
3. Verma PS and Agarwal VK. Animal Physiology. 6th Edn. S. Chand and Company, 1997

Course Designer: DR. M. KALAIARASI

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	An overview of nutritional types and feeding mechanisms	3	Lecture 2 Discussion 1
1.2	Digestion - intracellular and extracellular	3	Lecture 2 video 1
1.3	Mechanism of absorption of carbohydrates, fats, and proteins,defecation	6	Lecture 4 video 2
UNIT II			
2.1	Structure of Lung	3	video 1 Lecture 2
2.2	External respiration - respiratory movements, breathing, ventilation	4	Lecture 2 peer 1 video 1
2.3	Process of gaseous exchange	5	Lecture 4 video 1
2.4	Respiratory pigments. Hemoglobin as oxygen carrier	4	video 1 Lecture 2 discussion 1
2.5	Respiratory quotient	2	Lecture
UNIT III			
3.1	structure and functioning of Heart	3	video 1 Lecture 2
3.2	composition and functions of blood, mechanism of blood clotting	4	Lecture 3 video 1

3.3	functioning of heart, cardiac cycle	5	video 1 Lecture 4
3.4	heart beat – origin and regulation	5	video 2 Lecture 3
3.5	Blood pressure, ECG, diseases of heart.	3	Discussion1 video1 Lecture 1

UNIT IV

4.1	Muscular system - ultra structure of skeletal muscle, mechanism of muscle contraction, theories and biochemical changes during contraction.	8	Lecture 5 video 2 discussion 1
4.2	Nervous system - CNS, PNSl, ANS. Neuron - structure and types, conduction of nerve impulses	8	video 2 Lecture 5 seminar 1
4.3	Mechanism of photo and phonoreceptors.	6	Lecture 4 Video 2

UNIT V

5.1	products of excretion, excretory organs in animals Structure and functions of human kidney, mechanism of urine formation. Hypertension vskidney disorders.	6	Discussion 1 Lecture 4 video 1
5.2	Osmoregulation - osmoregulators, conformers, stenohaline and euryhaline, osmoregulation in fishes.	6	Seminar 1 Lecture 4 video 1
5.3	Thermoregulation - hibernation, aestivation, diapause	6	Lecture 4 video 1 discussion 1

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	4	2	4	3	4	4	3	4	3	3.58
CO2	4	4	3	4	4	4	4	4	3	4	3	4	3.75
CO3	4	4	4	4	3	3	4	3	4	3	4	3	3.58
CO4	4	3	4	2	3	4	3	4	3	4	4	4	3.50
CO5	4	4	3	4	4	4	4	3	4	3	4	4	3.75
Mean Overall Score													**3.63**

Result: The Score for this Course is 3.63 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = $\dfrac{\text{Total of Value}}{\text{Total No. of POs \& PSOs}}$ Mean Overall Score of COs = $\dfrac{\text{Total of Mean Score}}{\text{Total No. of COs}}$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
ANALYSE	30%	30%

Programme : M. Sc. ZOOLOGY	Course Type : CC - II
Semester : I	Hours : 6/ W 90/ S
Subject Code : P22CZ2	Credits : 5

TITLE OF THE PAPER: ENVIRONMENTAL BIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutor ial	ICT
	6	2	-	2	2

PREAMBLE:

   This course helps to understand the basic concepts of ecosystem and community

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: acquire knowledge in basic ecosystem	1	14	K1
CO2: understand the principles of community ecology	2	17	K2
CO3: analyse the significance of natural resources	3	23	K4
CO4: understand effect of pollution	4	18	K2
CO5: create awareness about environmental laws and disasters	5	15	K3

SYLLABUS

UNIT I: Abiotic factors – light and temperature.. Biogeochemical cycles - Nitrgen, Phosphorous and Sulphur.

UNIT II: Community ecology - community structure - ecological succession - types, causes and process - Trends in succession - concept of climax and significance of ecological succession. Population structure and distribution - growth curves, regulation of population – density dependent and independent. -

UNIT III: Ecosystem - concept, types, structure and functions - food chains, food webs, productivity and ecological pyramids. Habitat ecology –- Fresh water, Marine water and Terrestrial. Minerals - Energy from conventional and non-conventional resources - solar, natural gases, oil, petroleum and biogas. Forest – types

UNIT IV: Pollution - types - land, water, air, noise, radioactive and thermal pollution - sources,

effects, control measures. Ecosystem - concept, types, structure and functions - food chains, food webs, productivity and ecological pyramids. Ecological energetics and energy flow in ecosystem

UNIT V: EIA - objectives, benefits and process - methods of EIA - Environmental law and policy - social issues. Natural and Man-made disasters - types and management.

TEXT BOOK:

1. Sharma PD. Environmental Biology. Rastogi Pub., Meerut, 2009

REFERENCE BOOKS:

1. Chary SN and Vyasulu V. Environmental Management. MacMillan India Ltd., New Delhi, 2009
2. Joshi PC and Joshi N. A Text Book of Ecology and Environment. 1stEdn., Himalaya Pub., Mumbai, 2005
3. Odum EP. Fundamentals of Ecology. Akash Press, New Delhi, 2007
4. Singh JS, Singh SP and Gupta SR. Ecology, Environment and Resource Conservation. Anama;ya Pub., New Delhi, 2008

Course Designer: DR. G. SASI REKA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Abiotic factors – light and temperature	4	Lecture (4 hrs)
1.2	Biogeochemical cycles - Nitrgen, Phosphorous and Sulphur	10	Lecture (5 hrs) ICT (2 hrs) Tutorial (3 hrs)
UNIT II			
2.1	Community ecology - community structure	4	Lecture (4hrs)
2.2	Ecological succession - types, causes and process	4	Video (4 hrs)
2.3	Trends in succession - concept of climax and significance	3	Tutorial (3 hrs)

	of ecological succession		
2.4	Population structure and distribution - growth curves, regulation of population – density dependent and independent.	6	ICT (3 hrs) Tutorial (3 hrs)

UNIT III

3.1	Ecosystem - concept, types, structure and functions	5	Lecture (5 hrs)
3.2	food chains, food webs, productivity and ecological pyramids.	5	Lecture (5 hrs) Video (1 hr)
3.3	Habitat ecology –- Fresh water, Marine water and Terrestrial	5	Lecture (5 hrs) Video (1 hr)
3.4	Minerals - Energy from conventional and non-conventional resources - solar, natural gases, oil, petroleum and biogas	5	Lecture (4 hrs) Video (1 hr)
3.5	Forest – types	3	Lecture (3hrs)

UNIT IV

4.1	Pollution - types - land, water, air, noise - sources, effects, control measures	6	Tutorial (3 hrs) GD (3 hrs)
4.2	Radioactive and thermal pollution - Sources, effects, control measures	6	ICT (3 hrs) Tutorial (3hrs)
4.3	Ecological energetics and energy flow in ecosystem	6	Video (3hrs) Lecture (3 hrs)

UNIT V

5.1	EIA - objectives, benefits and process	5	Video (2 hrs) Lecture (3 hrs)
5.2	Methods of EIA - Environmental law and policy, social issues.	5	Lecture (3 hrs) Tutorial (2 hrs)
5.3	Natural and Man-made disasters - types and management.	5	Lecture (3 hrs) GD (2 hrs)

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	3	4	4	4	4	4	4	4	4	4	4	4
CO2	4	3	4	3	4	4	3	4	4	4	4	4	4
CO3	4	4	4	3	4	4	4	4	4	4	4	4	4
CO4	3	4	4	4	4	4	4	4	4	4	4	4	4
CO5	4	4	4	4	4	3	4	4	4	4	4	4	4
Mean Overall Score													4

Result: The Score for this Course is 4.0 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
ANALYSE	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - III
Semester	: I	Hours	: 5/W 75/S
Subject Code	: P22CZ3	Credits	: 4

TITLE OF THE PAPER: MOLECULAR BIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	5	2	-	2

PREAMBLE:

This course helps to gain knowledge on the molecular aspects of the living system and understand the gene functions and its disorders.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Explain concepts such as gene structure and function and obtain an understanding of genetics and molecular biology principles.	1	15	K2
CO2: Define, Analyze and explain the characteristics of codon and gene expression at the level of Transcription.	2	15	K3
CO3: Describe the mechanism of gene expression at the translation level and compare between Prokaryotes and Eukaryotes	3	15	K3
CO4: Explain and demonstrate the gene regulation using examples.	4	14	K3
CO5: Define, explain and generalize the mutation and oncogenes.	5	16	K3

SYLLABUS

UNIT I:

DNA - structure, forms and properties - replication of DNA, Messelsan & Stahl, Hershey- Chase experiment - enzymes in replication - mechanism of replication in prokaryotes and eukaryotes. RNA – types.

UNIT II:

Genetic code - codon characteristics and deciphering. Transcription - mechanism of transcription in prokaryotes and eukaryotes - initiation, elongation and termination - post transcriptional modification - RNA splicing.

UNIT III:

Translation - mechanism of translation in prokaryotes and eukaryotes - post translational

modifications.

UNIT IV:

   Regulation of gene expression in prokaryotes - Operon concept - Lac, Trp and Ara operons – gene regulation in eukaryotes.

UNIT V:

   Mutation - types - mutagenesis. Types of mutagenic agents - DNA repair – photo reactivation, excision,   recombination and SOS - mechanisms. Oncogenes.

TEXT BOOKS:

   Rastogi SC. - Cell and Molecular Biology. 2nd Edn., Taj Press, New Delhi, 2004.

REFERENCE BOOKS:

1. David Friefelder. Molecular Biology. Nanosa Pub., New Delhi, 1995.
2. Latchman DS. Basic Molecular and Cell Biology. 3rd Edn., Replika Press Pvt.   Ltd., India, 2006.
3. Power C B. Cell Biology. 3rd Edn., Himalaya Pub., Bombay, 1990.
4. Turner P C, Chennan A G M, Bates A D and White M R H. Molecular Biology. 2nd Edn., Vinod Vasishta, New Delhi, 2010.
5. Twyman RM. Advanced Molecular Biology 1st Edn., Vinod Vasishta Press, New Delhi, 1999.

   Course Designer: DR. JOTHI SAM

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	DNA - structure, forms and properties.	4	Lecture - 2 Tutorial – 1 Video - 1
1.2	Replication of DNA, Messelsan & Stahl, Hershey - Chase experiment - enzymes in replication - mechanism of replication in prokaryotes and eukaryotes.	6	Lecture - 4 Tutorial – 1 Video - 1
1.3	RNA – types – tRNA, mRNA and rRNA.	5	Lecture - 3

			Tutorial – 2
UNIT II			
2.1	Genetic code - Codon characteristics and deciphering.	3	Lecture - 3
2.2	Transcription - mechanism of transcription in prokaryotes.	5	Lecture - 3 Tutorial - 1 Video - 1
2.3	Transcription in eukaryotes -initiation, elongation and termination.	4	Lecture - 4
2.4	Post transcriptional modification - RNA splicing.	3	Lecture - 3
UNIT III			
3.1	Translation - mechanism of translation in prokaryotes.	5	Lecture - 3 Tutorial – 1 Video - 1
3.2	Translation in eukaryotes.	5	Lecture - 5
3.3	Post translational modifications.	5	Lecture - 3 Tutorial – 1 Video - 1
UNIT IV			
4.1	Regulation of gene expression in prokaryotes - Operon concept – Lac operon.	6	Lecture - 4 Tutorial - 1 Video - 1
4.2	Trp and Ara operons.	4	Lecture - 4
4.3	Gene regulation in eukaryotes.	4	Lecture - 3 Tutorial - 1
UNIT V			
5.1	Mutation - types - mutagenesis.	5	Lecture - 3 Tutorial – 1 Video - 1
5.2	Types of mutagenic agents.	4	Lecture - 4
5.3	DNA repair - photo reactivation, excision, recombination and SOS - mechanisms.	5	Lecture - 3 Tutorial – 2

5.4	Oncogenes	2	Lecture - 2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4.0	3.6	3.8	3.8	2.8	4.0	3.8	3.5	3.2	3.6	3.0	3.5	3.55
CO2	3.4	2.8	3.4	3.6	2.8	4.0	3.6	3.6	3.2	3.5	2.8	3.5	3.35
CO3	3.5	2.8	3.4	3.6	3.0	4.0	3.6	3.7	3.2	3.5	2.8	3.5	3.38
CO4	3.5	2.8	3.4	3.6	3.0	4.0	3.6	3.6	3.4	3.6	2.8	3.5	3.40
CO5	3.5	3.6	3.3	3.5	3.0	3.5	3.5	3.5	3.4	3.2	2.8	3.4	3.35
Mean Overall Score													3.41

Result: The Score for this Course is 3.41 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - IV
Semester	: I	Hours	: 6/W 90/S
Subject Code	: P22CZ4P	Credits	: 4

TITLE OF THE PAPER:
ANIMAL PHYSIOLOGY, ENVIRONMENTAL BIOLOGY AND MOLECULAR BIOLOGY - PRACTICAL

Pedagogy	Hours	Lecture	Demonstration	TUTORIAL
	8	1	3	4

PREAMBLE:

The techniques in Haematology, blood cell analysis, estimation of O_2, CO_2, Salinity and exposure to practicals related to environmental impact

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Enumerate the RBC, WBC, estimate Haemoglobin content	1	21	K3
CO2: Apply clinical procedures for blood, urine and semen analysis	2	24	K3
CO3: Isolate DNA from the sample, analyse the potein sample content using Paper and Thin layer chromatography	3	24	K4
CO4: Evaluate COD, BOD, alkalinity, salinity and polluting factors from various samples	4	21	K4

SYLLABUS

UNIT I:

Total count of RBC and WBC Differential count of Leucocytes

Bleeding time and Clotting time Estimation of Hemoglobin Analysis of Haemin crystals

UNIT II:

Determination of Blood Pressure

Analysis of excretory products – urea, uric acid and ammonia

Estimation of oxygen consumption in Fish

Semen analysis – Motility and Total count

Spotters: Structure of muscle fibers, reflex arc, ECG

UNIT III:

Isolation of DNA from tissue sample

Quantitative estimation of Nucleic Acid – DNA/RNA

Spotters: Types of DNA, tRNA, Okazaki fragment

UNIT IV:

Estimation of dissolved oxygen in water samples

Estimation of carbon dioxide in water samples

Estimation of alkalinity

Estimation of salinity

Biological water quality analysis - pollution indicators

Estimation of Primary Productivity (Light and dark bottle method)

Spotters: Food web, Ecological Pyramids, Secchic disc

REFERENCE BOOKS:

1.Sinha J and Chatterjee AK. Advanced Practical Zoology. ArunabhaSen Pub., Kolkata, 2014.

2.Poddor T, Mukhopadhaya S and Das SK. An Advanced Laboratory Manual of Zoology. MacMillan Pub., New Delhi, 2010

3.Ghose KC and Manna B. Practical Zoology. New Clinical Book Agency, Kolkata, 2007

Course Designer: MRS . A. SHEELA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Total count of RBC and WBC	7	Tutorial – 7
1.2	Differential count of Leucocytes	7	Tutorial – 7
1.3	Bleeding time and Clotting time Estimation of Hemoglobin Analysis of Haemin crystals	7	Tutorial – 7

UNIT II			
2.1	Analysis of Haemin crystals Determination of Blood Pressure Estimation of oxygen consumption in Fish	8	Demo – 8
2.2	Analysis of excretory products – urea, uric acid and ammonia Spotters: Structure of muscle fibers, reflex arc, ECG	8	Tutorial – 8
2.3	Semen analysis – Motility and Total count Spotters: Structure of muscle fibers, reflex arc, ECG	8	Tutorial – 8
UNIT III			
3.1	Isolation of DNA from tissue sample	8	Demo – 8
3.2	Quantitative estimation of Nucleic Acid – DNA/RNA	8	Demo – 8
3.3	Paper and Thin layer Chromatography Spotters: Types of DNA, tRNA, Okazaki fragment.	8	Demo – 8
UNIT IV			
4.1	Estimation of dissolved oxygen in water samples Estimation of carbon dioxide in water samples Estimation of alkalinity Estimation of salinity	12	Tutorial – 12
4.2	Biological water quality analysis - pollution indicators	9	Demo – 9

Course Outcomes (COs)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO 1	4	3	3	4	4	4	4	5	4	5	4	3	3.91
CO 2	4	4	3	4	4	4	4	4	4	4	3	4	3.83
CO 3	4	4	4	4	4	4	4	4	3	4	4	4	3.91
CO 4	4	4	4	4	4	4	4	4	4	4	4	4	4.0
Mean overall score													3.91

Result: The score for this course is 3.91 (High relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of POs & PSOs

Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type: DSEC - I
Semester	: I	Hours : 5/W 75/S
Subject Code	: P22DSZ1A	Credits : 4

TITLE OF THE PAPER: CLINICAL LAB TECHNOLOGY

Pedagogy	Hours	Lecture	Peer teaching	GD/VIDEO/TUTORIAL
	5	3	-	2

PREAMBLE:

The course will provide basic knowledge on first aid and safety measures, understand the principle and methodology of clinical lab techniques, find placement in Medical Laboratory.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: To understand the laboratory designing and safety methods of First Aid in laboratory.	1	15	K1
CO2: To analyses the human blood regarding types of blood groups (A,B, AB,O)	2	15	K3
CO3: To understand theoretical knowledge about the specimen collection and Transportation of urine	3	15	K2
CO4: To describe the chemical and microscopic examination of stool	4	15	K4
CO5: To Explain the chemical, microscopic examination of sputum and analysis the semen.	5	15	K3

SYLLABUS

UNIT I:

Laboratory designing and safety methods - laboratory designing, code of conduct for clinical laboratory, personal hygiene for laboratory technologists. Laboratory accidents - types, safety measures - First Aid in laboratory and precautions.

UNIT II:

Hematology - Phlebotomy (Peripheral and venous). Composition of blood plasma and corpuscles (self study). ABO Blood group system - Rh typing - blood components separation. Blood transfusion - compatibility testing. Chemical Examination - blood glucose, GTT, diabetes mellitus - types, urea, cholesterol, bilirubin.

UNIT III:

Urine - collection, storage and transport of urine sample. Physical properties - colour, volume, specific gravity, odour, turbidity. Chemical examination of urine - sugar, albumin, bile salts, bile pigments, urobilionogen, Bence-Jones proteins, ketones. Microscopic examination of urine deposits - cast, crystals and cells.

UNIT IV:

Stool - collection and transport of specimen – macroscopic examination – colour, odour, consistency. Chemical examination - Occult blood and pH. Microscopic examination - ova and cyst.

UNIT V:

Sputum -collection and transport of specimen - macroscopic examination -consistency and appearance - microscopic examination - AFB staining. Semen - Semen analysis - collection, gross examination of specimen - microscopic examination - motility, total count and abnormality.

TEXT BOOKS:

1. Mukherjee LK. Medical Laboratory Technology. Vol 3, 2ndEdn. Hill Pub. Ltd., New Delhi, 1988

REFERENCE BOOKS:

1. Sood R. Medical Laboratory Technology - Methods and Interpretations. 5thEdn., Jaypee Pub., New Delhi.

Course Designer: MRS. P. YUVARANI

COURSE CONTENT AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Laboratory designing and safety methods	3	Charts – 1 Visual aids – 1 Lecture – 1
1.2	Laboratory designing, code of conduct for clinical laboratory,	3	Charts – 1 Visual aids - 2
1.3	Personal hygiene for laboratory technologists	3	Lecture - 3

1.4	Laboratory accidents-types, safety measures	3	Charts – 2 Visual aids -1
1.5	First Aid in laboratory and precautions.	3	Charts – 2 visual aids - 1
UNIT II			
2.1	Composition of blood plasma, corpuscles	3	Charts – 1 Lecture - 2
2.2	Blood group system - Rh typing	3	Lecture – 1 Chart – 2
2.3	Blood components separation	3	Visual aids - 1 Lecture – 2
2.4	Blood transfusion	3	Visual aids -1 Lecture – 2
2.5	Chemical Examination	3	Lecture – 2 Chart – 1
UNIT III			
3.1	Urine-collection, storage and transport of urine sample	4	Lecture - 3 Chart – 1
3.2	Physical properties	3	Lecture - 2 Chart – 1
3.3	Chemical examination	4	Visual aids – 2 Lecture – 2
3.4	Microscopic examination	4	Visual aids - 2 Lecture – 2
UNIT IV			
4.1	Stool - collection and transport of specimen	3	Lecture - 2 Chart -1
4.2	Macroscopic examination	4	Visual aids - 2 Lecture -2
4.3	Chemical examination	4	Visual aids - 2 Lecture -2
4.4	Microscopic examination	4	Visual aids - 2 Lecture -2
UNIT V			
5.1	Sputum -collection and transport	3	Lecture - 2

				Chart- 1
5.2	Macroscopicexamination		3	Visual aids -1 Lecture – 2
5.3	Microscopic examination		3	Visual aids -1 Lecture – 2
5.4	Semen analysis		3	Visual aids-1 Lecture – 2
5.5	Microscopic examination		3	Visual aids -1 Lecture – 2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	3	4	3	3	4	4	3	3	3	4	3	3	3.33
CO2	3	4	3	3	3	4	4	3	3	4	3	3	3.33
CO3	3	4	4	3	4	4	3	3	3	4	3	3	3.41
CO4	3	3	4	3	4	4	3	3	3	4	3	3	3.33
CO5	3	4	4	3	4	4	3	3	3	4	3	3	3.41
Mean Overall Score													3.36

Result: The Score for this Course is 3.36 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type : DSEC - I
Semester	: I	Hours : 5/W 75/S
Subject Code	: P22DSZ1B	Credits : 4

TITLE OF THE PAPER: CLIMATE CHANGE AND SUSTAINABILITY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	5	2	1	2

PREAMBLE:

To make the students conceptualize, comprehend climate change forces; predict and implement environmental sustainability metrics and mitigation approaches.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Identify, understand and list the causes of climate change, external climate forces and interpret evidences	I	15	K2
CO2: Comprehend and illustrate environmental consequences and challenges on ecosystem vulnerability	II	15	K2
CO3: Develop technical skills to implement environmental conservation and sustainability	III	15	K3
CO4: Predict and compute mitigation approaches in climate change	IV	15	K3
CO5: Compare and analyze new developments in sustainability metrics and reporting tools	V	15	K4

SYLLABUS

UNIT I: Climatic Systems and Variations

Global Climate System, Causes for Modern Climate Change, Internal Variability: Ocean-Atmosphere Variability, Ocean Currents, External Climate Forces: Greenhouse Gases, Orbital Variations, Solar Fluctuations, Volcanism, Plate Tectonics, Evidence and Measurement of Climate changes

UNIT II: Consequences and Challenges

Impacts on Life, Vegetation, Fauna, Glaciers and Ice Sheets Melting, Sea Level Changes, Economics of Climate Change, Climate Change and Water Scarcity, Coastal Ecosystem and Vulnerability, Threats to Forest and Biodiversity, Agriculture and Food Security, Energy Generation and Climate Change Mitigation.

UNIT III: Environmental Conservation and Sustainability

Technical Skills in Environment and Sustainability, Vulnerability, Adaptation and Livelihoods. Preservation of Biological Diversity, Sustainable Forest Management, Environmental Governance and Sustainability, Environmental Economics and Sustainability, Water Conservation and Sustainable Development, Challenges in Energy, Food and Agriculture.

UNIT IV: Mitigation Approaches in Climate Change

Climate and Weather Statistics, Climate Change Modelling, Carbon Emissions Reduction Technologies, Climate Change Research, Climatology Journals and Top Institutions, Governance for Climate Change, Clean Development Mechanism, Technology Options Fuel Switching and Carbon Sequestration

UNIT V: New Developments in Sustainability

Appropriate Technology and Sustainability Science, Consumption and Production Patterns, Sustainable Transport, Corporate Sustainability, Sustainability Metrics and Indices, Ecological and Carbon Footprint for Sustainability Measurement, Sustainability Measurement and Reporting Tools.

TEXT BOOKS:

1. Climate Change Biodiversity and Green Economy by H.S. Sharma S. Padmaja and Ganesh Sharma, Concept Publishing Company Pvt. Ltd. (2013).

REFERENCES:

1. Environment and Sustainable Development by M.H. Fulekar, Bhawana Pathak, R K Kale, Springer Nature (2013).
2. Sustainable Development in Digital Era by Dr. Aparna Mishra, Dr. Vikas Dahiya, Dr. Kamini Tandon, JSR Publishing House LLP; (2019).

Course Designer: DR.D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I: Climatic Systems and Variations			
1.1	Global Climate System, Causes for Modern Climate Change	4	Lecture - 3 GD -1
1.2	Internal Variability: Ocean-Atmosphere Variability, Ocean Currents	5	Lecture -3 Peer teaching -1, GD -1
1.3	External Climate Forces: Greenhouse Gases, Orbital Variations, Solar Fluctuations, Volcanism, Plate Tectonics, Evidence and Measurement of Climate changes	6	Lecture - 4 GD -2
UNIT II: Consequences and Challenges			
2.1	Impacts on Life, Vegetation, Fauna, Glaciers and Ice Sheets Melting, Sea Level Changes	5	Lecture - 3 Video - 1 GD - 1
2.2	Economics of Climate Change, Climate Change and Water Scarcity	3	Lecture - 2 Video - 1
2.3	Coastal Ecosystem and Vulnerability, Threats to Forest and Biodiversity	3	Lecture -2, Peer teaching -1
2.4	Agriculture and Food Security, Energy Generation and Climate Change Mitigation.	4	Lecture - 3, Peer teaching - 1
UNIT III: Environmental Conservation and Sustainability			
3.1	Technical Skills in Environment and Sustainability, Vulnerability, Adaptation and Livelihoods	3	Lecture - 3
3.2	Preservation of Biological Diversity, Sustainable Forest Management, Environmental Governance and Sustainability	4	Lecture - 2 GD -2
3.3	Environmental Economics and Sustainability, Water Conservation and Sustainable Development	4	Lecture 3, Peer teaching -1
3.4	Challenges in Energy, Food and Agriculture.	4	Lecture-2, GD - 2

UNIT IV: Mitigation Approaches in Climate Change			
4.1	Climate and Weather Statistics, Climate Change Modelling, Carbon Emissions Reduction Technologies	5	Lecture -3, GD -2
4.2	Climate Change Research, Climatology Journals and Top Institutions	3	Lecture -2, Peer teaching -1
4.3	Governance for Climate Change, Clean Development Mechanism	4	Lecture -3, GD -1
4.4	Technology Options Fuel Switching and Carbon Sequestration	3	Lecture -3
UNIT V: New Developments in Sustainability			
5.1	Appropriate Technology and Sustainability Science, Consumption and Production Patterns	4	Lecture -3, Peer teaching -1
5.2	Sustainable Transport, Corporate Sustainability, Sustainability Metrics and Indices	4	Lecture -2, peer teaching -2
5.3	Ecological and Carbon Footprint for Sustainability Measurement	3	Lecture -3
5.4	Sustainability Measurement and Reporting Tools	4	Lecture -3,GD -1

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	5	4	2	-	3	4	4	3	-	-	2.75
CO2	4	-	4	4	-	4	-	5	4	5	3	-	2.75
CO3	5	4	4	3	3	-	4	4	3	4	-	-	2.8
CO4	-	3	-	5	5	-	5	5	4	4	3	-	2.8
CO5	-	3	-	5	5	-	5	5	4	4	3	-	2.8
Mean Overall Score													2.78

Result: The Score for this Course is 2.78 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: SEC - I
Semester	: I	Hours	: 2/W 30/S
Subject Code	: P22SEZ1	Credits	: 2

TITLE OF THE PAPER: VECTOR BORNE DISEASES

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	2	1	-	1

PREAMBLE:

   To introduce the students the basics of vector borne diseases in view of public health importance, its habitats, transmission, health impact on human population and contribute to the general population by administering vector control measures.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Define, describe and write about the details of vector habitats, interaction in the food chain, biotic and abiotic factors	I	6	K1
CO2: Explain and paraphrase Anthroponotic vector diseases and its health impact on humans	II	6	K2
CO3: Discuss and summarize Zoonotic vectors diseases and its health impact on humans	III	6	K2
CO4: Include & prepare themselves and prepare the community on the awareness about arthropods of public importance	IV	6	K3
CO5: Correlate and apply vector control strategies in household and at community level	V	6	K4

SYLLABUS

Unit I: Vector Ecology

   Introduction to Habits and habitats relevant to vectors - Species diversity - Food chain, food web,

ecological niche, prey predator relationships - factors influencing vector dispersal and migration.

Unit II: Anthroponotic diseases

Filariasis, Trypanosomiasis, tick typhus - Disease vectors - Life cycle of pathogens and transmission - health impact on human population.

Unit III: Zoonotic diseases

Cutaneous leishmaniasis, Plague, Leptospirosis - Disease vectors - life cycle and transmission - health impact on human population.

Unit IV: Arthropods of Public health importance

Houseflies, cockroaches, lice, bugs, scorpions, centipede, millipede, wasps, bees, beetles, spiders, ants - distribution and impact on human health -toxins, venoms - allergy, asthma.

Unit V: Vector Control Measures

Vector Control: objectives. Alternatives to chemical & microbial insecticides – Vector control at individual and community - Selection of appropriate control measures - Self protection measures - Types of vector control - Selective, integrated and comprehensive vector control

TEXT BOOKS:

Prepared course materials

REFERENCE BOOKS:

1. Tyagi B K., 2008. Vector Borne diseases: Epidemiology and Control; Scientific publishers.

2. David Claborn, 2020. Vector Borne diseases: Recent developments in Epidemiology and Control; Ebook – 978-83880-038-3

Course Designer: DR. D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Introduction to Habits and habitats - Species diversity - Food chain, food web, ecological niche	2	Peer learning - 2

1.2	Prey predator relationships - Interaction with biotic and abiotic factors -	3	Lecture -1, GD -1
1.3	Dispersal and migration.	1	Lecture - 1
UNIT II			
2.1	Filariasis - disease vector - life cycle and transmission - human health impact	2	Lecture -1, Video -1
2.2	Visceral leishmaniasis - disease vector - life cycle and transmission - human health impact	2	Lecture -1, chart -1
2.3	Trypanosomiasis - disease vector - life cycle and transmission - human health impact	2	Lecture -1, Chart -1
UNIT III			
3.1	Cutaneous leishmaniasis - disease vector - life cycle and transmission - human health impact	2	Lecture -1, Chart -1
3.2	Plague - disease vector - life cycle and transmission - human health impact	2	Lecture -1, Chart -1
3.3	Leptospirosis - disease vector - life cycle and transmission - human health impact	2	Lecture -1, Chart -1
UNIT IV			
4.1	Houseflies, cockroaches, lice, bugs, scorpions, spiders - distribution and impact on human health	2	Lecture -1, Peer teaching - 1
4.2	Centipede, Millipede, wasps, bees, beetles, , ants distribution and impact on human health	2	Lecture -1, Peer teaching - 1

4.3	Toxins, venoms - allergy, asthma.	2	Lecture -1, GD -1
UNIT V			
5.1	Vector Control: objectives. Alternatives to the use of insecticides (chemical & microbial) – Vector control at individual or at community or at both levels	2	Lecture -1, GD -1
5.2	Selection of appropriate control measures - Self-protection measures	2	Lecture -1, GD -1
5.3	Types of vector control - Selective, integrated and comprehensive vector control	2	Lecture -2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	5	-	-	4	-	5	-	4	-	5	-	-	1.9
CO2	4	-	4	4	-	4	4	-	4	5	-	-	2.4
CO3	4	-	4	4	-	4	4	-	4	5	-	-	2.4
CO4	-	-	-	5	4	-	4	4	4	5	4	-	2.5
CO5	2	-	-	5	4	-	4	-	4	5	4		2.4
Mean Overall Score													**2.3**

Result: The Score for this Course is 2.3 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs =   Total of Value
                        Total No. of Pos & PSOs

Mean Overall Score of COs = Total of Mean Score
                              Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
SYNTHESIS	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type : CC - V
Semester	: II	Hours : 6/W 90/S
Subject Code	: P22CZ5	Credits : 5

TITLE OF THE PAPER: APPLIED MICROBIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	6	4	-	2

PREAMBLE:

Study of this course aims to gain fundamental knowledge on various branches of microbiology and to get exposure to the techniques applied in various fields of microbiology

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Perform microbial analysis of water ,presumptive test, confirmed test and complete test and gain the knowledge of water born pathogens and prevent the diseases	1	15	K4
CO2: Gain knowledge on treatment of sewage water for microbes and apply biodegradation and bioremediation in day today life	2	18	K3
CO3: Analyse and explain role of microbes in soil fertility , Nif genes nitrogen fixation and apply the knowledge of biofertilizers andVAm fungi in Agriculture	3	18	K4
CO4: Apply the knowledge of food and dairy microbiology in day today life	4	18	K3
CO5: Analyse the role of microbes in industrial microbiology , fermentors and its types and knowing the process of production of wine and citric acid	5	21	K4

SYLLABUS

UNIT I:

Microbiology of water - Microbial analysis of water - sanitary tests for coli forms - MPN - Presumptive test, confirmed test, completed test- the membrane filter technique. Water borne pathogens - water purification.

UNIT II:

Environmental Microbiology - sewage treatment - physical, chemical and biological treatment - trickling filter, activated sludge & oxidation pond. Microbial leaching - copper.Biodegradation - petroleum, pesticides, xenobiotics. Bioremediation - types and its applications.

UNIT III:

Soil and Agricultural Microbiology - types of soil microbes - Role of microbes in soil fertility. Biological Nitrogen Fixation - Nitrogen fixing bacteria - biochemistry of N2 fixation - nitrogenase – Nif genes.Biofertilizers - Azolla. Mycorhizalbiofertilizer - VAM fungi,

UNIT IV:

Food and Dairy Microbiology - types and sources of microorganisms in food. (mould, yeast, bacteria) - Microbial contamination and spoilage of food. Food preservation - physical and chemical methods. Food-borne infections - bacterial and fungal.Fermented dairy products - cheese, butter.

UNIT V:

Industrial Microbiology - Bioreactor –basic design and types. Screening of industrially important microorganisms, strain improvement by gene manipulation techniques- media for fermentation.types of fermentation - submerged and solid state fermentation – downstream processing - microbial production of wine, citric acid and antibiotics (streptomycin).

TEXT BOOK:

1. Dubey RC and Maheswari DK.A Text Book of Microbiology. S. Chand and Company Ltd., New Delhi, 2005

REFERENCE BOOKS:

1. Daniel JC. Environmental Aspects of Microbiology, Bright Sun Pub., Chennai, 1999
2. Fraier WC and Westhoff DC. Food Microbiology. 4thEdn., McGraw Hill, New York, 1988
3. Patel AH. Industrial Microbiology. Macmillan India Ltd. Pub. Chennai, 2005
4. Prescott LM, Harley JP and Klein DA. Microbiology. 2ndEdn., WMC Brown Pub., 1993
5. SubbaRao NS. Soil Microbiology. 4thEdn. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, 2004
6. VijayaRamesh K. Environmental Microbiology. MJP Pub., Chennai, 2004

Course Designer: **DR. M. KALAIARASI**

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1			
1.1	Microbial analysis of water - sanitary tests for coli forms	3	Lecture 2 video 1
1.2	MPN - Presumptive test, confirmed test, completed test	5	Lecture 3 Video 2
1.3	Membrane filter technique	3	Lecture 2 video1
1.4	Water borne pathogens - water purification	4	video1 Lecture 3
UNIT II			
2.1	Sewage treatment - physical, chemical and biological treatment - trickling filter, activated sludge & oxidation pond.	6	Lecture 4 Video 2
2.2	Microbial leaching - copper.	2	Seminar 1 Lecture 1
2.3	Biodegradation - petroleum, pesticides, xenobiotics	5	Lecture 3 discussion1 video 1
2.4	Bioremediation - types and its applications	5	Seminar 1 Lecture 4
UNIT III			
3.1	Types of soil microbes - Role of microbes in soil fertility	4	Lecture 3 video 1
3.2	Biological Nitrogen Fixation - Nitrogen fixing bacteria - biochemistry of N2 fixation - nitrogenase	8	Lecture 5 Seminar 2 Video 1
3.3	Nif genes Biofertilizers- Azolla. Mycorhizalbiofertilizer - VAM fungi.	6	video 2 Lecture 4
UNIT IV			
4.1	Types and sources of microorganisms in food. (mould, yeast, bacteria)	3	Discussion 1 Lecture 2
4,2	Microbial contamination and spoilage of food	3	Lecture 2 Discussion 1
4.3	Food preservation - physical and chemical methods.	3	Lecture 2 Video 1
4.4	Food - borne infections – bacterial and fungal	5	Seminar 2 Lecture 3
4.5	Fermented dairy products - cheese, butter.	4	Lecture 3 Discussion 1

UNIT V			
5.1	Bioreactor –basic design and types.	5	Video 1 Lecture 4
5.2	Screening of industrially important microorganisms, strain improvement by gene manipulationtechniques	5	Lecture 4 Seminar 1
5.3	Media for fermentation. Types of fermentation - submerged and solid state fermentation – downstream processing	6	Lecture 4 Video 1 Discussion 1
5.4	Microbial production of wine, citric acid and antibiotics (streptomycin).	5	Lecture 3 Seminar 1 Discussion 1

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	3	4	3	4	4	4	3	3	4	3	3.90
CO2	4	4	4	4	3	3	3	2	4	4	3	4	3.50
CO3	3	4	3	3	3	4	4	3	3	4	3	4	3.41
CO4	4	3	3	4	4	3	3	3	4	3	4	3	3.41
CO5	4	3	3	3	3	4	3	4	4	3	3	3	3.33
Mean Overall Score													3.51

Result: The Score for this Course is 3.51 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos& PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
ANALYSE	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type: CC - VI
Semester	: II	Hours : 6/W 90/S
Subject Code	: P22CZ6	Credits : 5

TITLE OF THE PAPER: BIOCHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	Charts/Models
	6	3	1	1	1

PREAMBLE:

The course enhance the students to develop an understanding about various biomolecules and to impart a comprehensive knowledge of the principles of biochemistry

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge levels
CO1: Understand basic biochemical systems in the biological systems	1	15	K1
CO2: To learn the fundamental biochemical principles such as structure of bio molecules	2	15	K2
CO3: To gain ideas regarding metabolic pathways	3	20	K4
CO4: To understand the regulations of biological and biochemical processes	4	20	K3
CO5: Analyze the mechanism and involvement of the key factor of metabolism, the enzymes.	5	20	K4

SYLLABUS

UNIT I:

Water - structure, physical properties ,Polarity - interaction of water -weak and non-covalent interaction, Ionization and dissociation of water, pH - buffers - Handerson-Hasselbach equation Biological buffer systems.

UNIT II:

Carbohydrates-classification,Structure and biological importance of glucose, lactose, starch, Carbohydrate metabolism - metabolic cycles and regulation of glycolysis, Glycogenolysis, gluconeogenesis, glycogenesis, HMP shunt,TCA cycle and Electron transport system.

UNIT III:

Proteins - aminoacids - structure, Classifications - physical and chemical properties of

aminoacids. Configuration of proteins - primary, secondary, tertiary and quarternary structures - Ramachandran plot,Metabolism of proteins - deamination , transamination,Transmethylation and Ornithine cycle.

UNIT IV:

Lipids - fatty acids –structure,types, classification, Structure of triglycerides-phospholipids – cholesterol, Biosynthesis of cholesterol,Degradation of fatty acids ,β - Oxidation - formation of Ketone bodies.

UNIT V:

Enzymes - characteristics – classification,Enzyme action - enzyme kinetics ,Activation and inhibition of enzyme action ,Coenzymes - allostetric enzymes - abzymes and ribozymes,Enzymes of cell cycle regulation - CAKs adcDKs. Factors affecting enzyme action

TEXT BOOKS:

1. Dr. Ambika Shanmugam,.Biochemistry Published by Author.

REFERENCE BOOKS:

1. Jain JL, Jain S and Jain N. Fundamentals of Biochemistry. S. Chand and Company, New Delhi, 2009.

2. Conn EE, Stumpf PK, Bruening G and Doi RH. Outlines of Biochemistry. John Wiley and Sons Inc., New York, 199

3. Lehninger L. Principles of Biochemistry. Mac Millen 6thEdn., Global Pub., 2013

4. Stryer L. Biochemistry. W.H. Freeman Company, 2010

5. Rober K. Murray, Daryl K. Grammer, Harper's Biochemistry McGraw Hill, Lange Medical Books. 25th edition.

6. E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry, Oxford and IBH Publishing Co., New Delhi, 1974.

7. Donald Voet, Judith G. Voet8. Biochemistry [with CD rom] (2004) by Publisher: John Wiley &Sons

Course Designer: DR. S. MALA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Water - structure, physical properties	3	Lecture -3
1.2	Polarity - interaction of water -weak and non-covalent interaction	3	Lecture-2, Video-1
1.3	Ionization and dissociation of water	2	Charts-1, lecture-1
1.4	pH - buffers - Handerson-Hasselbach equation	4	Lecture-2, Video-2
1.5	Biological buffer systems.	3	Models-1, lecture 2
UNIT II			
2.1	Carbohydrates-classification	3	Charts -1, lecture-2
2.2	Structure and biological importance of glucose, lactose, starch,	4	Models1, lecture-1, Peer teaching -1
2.3	Carbohydrate metabolism - metabolic cycles and regulation of glycolysis,	3	Charts-1, Lecture-1, Peer teaching -1
2.4	Glycogenolysis, gluconeogenesis, glycogenesis, HMP shunt.	3	Lecture -1, Charts -1, Peer teaching -1
2.5	TCA cycle and Electron transport system.	2	Charts-1, lecture -1
UNIT III			
3.1	Proteins - aminoacids - structure,	4	Lecture - 1, Model-1,Video-2

3.2	Classifications - physical and chemical properties of aminoacids.	5	Lecture-3, Peer teaching -1
3.3	Configuration of proteins - primary, secondary, tertiary and quarternary structures - Ramachandran plot.	6	Charts -2, lecture -2, Video-2
3.4	Metabolism of proteins - deamination , transamination.	3	Lecture -2, Peer teaching -1
3.5	Transmethylation and Ornithine cycle.	2	Lecture -1, Peer teaching -1
UNIT IV			
4.1	Lipids - fatty acids –structure, types, classification	4	Charts-1, Lecture-1, Peer teaching -2
4.2	Structure of triglycerides-phospholipids - cholesterol.	4	Models-1,Lecture-2,Video-1
4.3	Biosynthesis of cholesterol.	6	Charts-2, Lecture-2, Video-2
4.4	Degradation of fatty acids	3	Lecture -1, Peer teaching -2
4.5	β - Oxidation - formation of Ketone bodies.	3	Charts -1, lecture-1,Video-1
UNIT V			
5.1	Enzymes - characteristics – classification	5	Lecture -2, Peer teaching -2 Chart-1
5.2	Enzyme action - enzyme kinetics	4	Charts-1, Lecture-1, Model-2
5.3	Activation and inhibition of enzyme action	4	Video -1, Lecture-3

5.4	Coenzymes - allostetric enzymes - abzymes and ribozymes	3	Lecture - 2,Video-1	
5.5	Enzymes of cell cycle regulation - CAKs and CDKs. Factors affecting enzyme action.	4	Charts -1, Lecture-2, Peer teaching -1	

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	-	4	4	-	4	1	4	4	4	4	4	3.1
CO2	4	-	4	4	-	4	2	4	3	4	4	4	3.1
CO3	4	1	4	4	-	4	-	4	4	4	4	4	3.1
CO4	4	2	4	4	1	4	3	4	4	4	4	4	3.3
CO5	4	1	4	4	-	4	2	4	4	4	4	4	3.3
	Mean Overall Score												**3.18**

Result: The Score for this Course is 3.18 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY		Course Type: CC - VII
Semester	: II		Hours	: 5/W 75/S
Subject Code	: P22CZ7		Credits	: 3

TITLE OF THE PAPER: HUMAN GENETICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL
	5	3	--	2

PREAMBLE:

   To understand the genetic principles based on karyotype, to update the knowledge on application oriented genetics.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/ S	Knowledge Level
CO1: Gain basic knowledge on mendelian principles, Analyse and interpret the characteristics of autosomal dominant and recessive inheritance with examples.	1	15	K1
CO2: Describe the preparation of karyotype and chromosomal aberrations.	2	15	K1
CO3: Incorporate the fundamentals of cancer especially in leukemia and bone marrow transplantation.	3	15	K2
CO4: Interprete and evaluate the prenatal and post natal diagnosis.	4	15	K2
CO5: Understand and apply the principles of genetics in crime and law.	5	15	K3

SYLLABUS

UNIT I:

   Mendel's laws – application of Mendel's laws to human genetics. Principles and methods of pedigree analysis . Mendelian inheritance patterns - Autosomal dominant inheritance – Huntington disease. Autosomal recessive inheritance – phenyl ketoneuria. Sex linked inheritance – haemophilia, colour blindness.

UNIT II:

   Sex determination in man. Human karyotype - preparation of karyotype. Abnormal karyotyping – Down's syndrome, Klinefelter's syndrome, Turner's syndrome. Sex related phenotypic effects – sex influenced traits, sex limited traits. Twin studies – monozygotic and dizygotic.

UNIT III:

   Oncogenes – functions of proto – oncogenes, effects of oncogenes. Tumor suppressor genes –

knudson's two hit hypothesis - Loss of heterozygosity – neuro oncology. Apoptosis - Role of   P53 – PTCH as a tumor suppressor. Genetic basis of leukemia – bone marrow transplantation, Epigenetics.

UNIT IV:

Methods of prenatal diagnosis – Prenatal screening in pregnancy - neural tube defects, amniocentesis, chorionic villus sampling . Post natal diagnosis – fetal blood sampling, new born blood spot screening. Congenital hypothyroidism, sickle cell disease, Cystic fibrosis and   medium chain acyl – CoA dehydrogenase deficiency.

UNIT V:

Application of genetics – DNA finger printing. Gene therapy. Pharmacogenetics and personalized medicine. Eugenics, euthenics and euphenics. Genetics of social behavior – Tourette syndrome and Alzheimer disease.

TEXT BOOKS:

1. Cummings M R . Human Genetics . Cengage Learning India Pvt. Ltd., New Delhi, 2009

REFERENCE BOOKS:

1. Gardner A and Davies T. Human genetics . Scion Pub . Ltd., UK, 2010

2. Lewin B . Genes VI. Oxford university press, New York, 2000

3. Verma PS and Agarwal VK . Genetics . S . Chand and company, New Delhi, 2008

Course Designer : DR. E. EMIMAL VICTORIA

COURSE CONTENT AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1 : Mendel's laws – application of Mendel's laws to human genetics		4	Lecture-2 Tutorial-1
1.2 : Principles and methods of pedigree analysis		3	Lecture-2 Video -1
1.1 : Autosomal dominant inheritance – Huntington disease		2	Group Discussion-2
1.2 : Autosomal recessive inheritance – phenyl ketoneuria		3	Lecture - 2 Tutorial-1

1.3 : Sex linked inheritance – haemophilia, colour blindness	3	Lecture – 2 Video 1
UNIT II		
2.1 : Sex determination in man	3	Lecture - 2 Tutotial - 1
2.2 : Human karyotype - preparation of karyotype	4	Lecture - 3 Video - 2
2.3: Abnormal karyotyping – Down's syndrome, Klinefelter's syndrome, Turner's syndrome	3	Lecture – 3
2.4: Sex related phenotypic effects – sex influenced traits, sex limited traits	2	Lecture – 3
2.5 : Twin studies – monozygotic and dizygotic	3	Lecture - 2 Tutorial - 1
UNIT III		
3.1: Oncogenes – functions of proto – oncogenes, effects of oncogenes	3	Lecture - 2 Tutorial - 1
3.2: Tumor suppressor genes – knudson's two hit hypothesis	3	Lecture - 2 Tutorial - 1
3.3 : Loss of heterozygosity – neuro oncology	2	Tutorial – 2
3.4 : Apoptosis roll of P53 – PTCH as a tumor supressor	4	Lecture - 3 GD -1
3.5: Genetic basis of leukemia – bone marrow transplantation – epigenetics.	3	Lecture – 3
UNIT IV		
4.1: Methods of prenatal diagnosis – neural tube defects, amniocentesis, chorionic villus sampling .	4	Lecture - 2 Video - 2
4.2: Post natal diagnosis – fetal blood sampling, new born blood spot screening	3	Lecture – 3
4.3 : Congenital hypothyroidism, sickle cell disease	4	Lecture - 3 Tutorial - 1
4.4 : Cystic fibrosis, medium chain acyl – CoA dehydrogenase deficiency.	4	Lecture - 3 Tutorial-1
UNIT V		

5.1: Application of genetics – DNA finger printing, Gene therapy	5	Lecture-3 Video -2
5.2 : Pharmacogenetics and personalized medicine	3	Lecture-2 Tutorial -1
5.3 : Eugeneics, euthenics and euphenics	4	Lecture-3 Tutorial-1
5.4 : Genetics of social behavior – Tourette syndrome and Alzheimer disease.	3	Lecture-2 Tutorial-1

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	3	2	4	4	2	2	3	3.5	3	4	4.5	2	3.1
CO2	4	3	4.5	4	3.5	2	3	4	2	3	2	3	3.2
CO3	3	2	4	4	3	2	2	4	3	2	4	4	3.1
CO4	4	2	3	4	3	2	2	4	3.5	4.5	4	2	3.2
CO5	3.5	2	4	4	2.5	2	2.3	3	3.7	4.5	4	4.5	3.4
Mean Overall Score													**3.24**

Result: The Score for this Course is 3.24 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - VIII
Semester	: II	Hours	: 6/W 90/S
Subject Code	: P22CZ8P	Credits	: 3

TITLE OF THE PAPER: APPLIED MICROBIOLOGY, BIOCHEMISTRY AND HUMAN GENETICS - PRACTICAL

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL
	6	2	2	2

PREAMBLE:

   To gain basic knowledge on biochemical investigation in clinical practices, Assess and evaluate microbial interaction in in-vivo condition and analyze distribution of genetic characters

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Analyse and interpret the quantity of protein, carbohydrate and lipid. Evaluate the quality of protein, carbohydrate and lipid from biological samples	I	25	K4
CO2: Understand the concepts of bacterial enumeration and apply the concepts to test water quality or potability and milk quality. Demonstrate and interpret the bactericidal action of antibiotics by Kirby-Bauer method.	II	25	K3
CO3: Calculate and participate in the preparation of buffer, Molar and Normal solutions; describe the structure of amino acids and gain knowledge on Microbiology instruments.	III	20	K3
CO4: Demonstrate gene frequency pattern. Apply Pedigree chart to evaluate human traits and syndromes	IV	20	K3

SYLLABUS

UNIT I:

1. Qualitative Estimation of carbohydrates, proteins and fats

2. Quantitative estimation of carbohydrates

3.Quantitative estimation of proteins

4. Quantitative estimation of lipids

UNIT II:

1. Serial Dilution Technique

2. Enumeration of microbial population from soil

3. Bacterial examination of water – MPN method

4. Bacterial examination of water- Standard Plate Count (quantitative test)

5. Reductase test for milk – Methylene Blue/Resazurin

6. Antibiotic sensitivity test- Kirby-Bauer method

UNIT III:

1. Preparation of Buffer Solution

2. Preparation of solution based on Normality and Molarity

3. Spotters: Amino acids - types, structure of collagen, primary, secondary and tertiary structure, Ramachandran plot, Autoclave, Hot air oven, pH meter, Fermentors

UNIT IV:

1. Calculation of gene frequency using beads

2. Spotters: Pedigree analysis of human traits – autosomal dominant, autosomal recessive, X-linked dominant, X- linked recessive and Y- linked inheritance, Karyotypes-normal,

Turner's syndrome, Klinefelter's syndrome, Edwards's syndrome, DNA fingerprinting, Twins - identical, fraternal and Siamese twins

REFERENCE BOOKS:

1. Gangene SD, Human Genetics, 4th edn., Elsevier, 2012
2. Guna Sekaran P. Laboratory Manual in Microbiology. New age International Pvt. Ltd., 2009
3. Jayaraman J. Laboratory Manual in Biochemistry. New Age International Pub., 2006
4. Kannan N. Laboratory Manual in General Microbiolgy. Palani Paramount Pub., 1995
5. Wilson K and Walker J. Practical Biochemistry. Cambridge University Press, 1995

Course Designer: DR. D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	PRACT HOURS	MODE OF TEACHING
UNIT I			
1.1	Qualitative Estimation of carbohydrates, proteins and fats	6	Demo - 2, Practical - 4
1.2	Quantitative estimation of carbohydrates	6	Demo - 2 Practical - 4
1.3	Quantitative estimation of proteins	7	Demo - 1 Practical - 6
1.4	Quantitative estimation of lipids	6	Demo - 2 Practical - 4
UNIT II			
2.1	Serial Dilution Technique	3	Practical - 3
2.2	Enumeration of microbial population from soil	4	Demo - 1 Practical - 3
2.3	Bacterial examination of water – MPN method	4	Demo - 1 Practical - 3
2.4	Bacterial examination of water- Standard Plate Count	5	Demo - 1

	(quantitative test)		Practical - 4
2.5	Reductase test for milk – Methylene Blue/Resazurin	4	Practical - 4
2.6	Antibiotic sensitivity test- Kirby-Bauer method	5	Demo - 1 Practical - 4

UNIT III

3.1	Preparation of Buffer Solution	4	Demo, Peer teaching - 4
3.2	Preparation of solution based on Normality and Molarity	4	Demo, Peer teaching - 4
3.3	Amino acids - types	4	Tutorial - 4
3.4	structure of collagen, primary, secondary and tertiary structure,	4	Tutorial - 4
3.5	Ramachandran plot, Autoclave, Hot air oven, pH meter, Fermentors	4	Tutorial - 4

UNIT IV

4.1	Calculation of gene frequency using beads	6	Demo -2 Practical -4
4.2	Pedigree analysis of human traits – autosomal dominant, autosomal recessive, X-linked dominant	6	Demo -2 Tutorial-4
4.3	X- linked recessive and Y- linked inheritance, Twins - identical, fraternal and Siamese twins	4	Tutorial-4
4.4	Karyotypes-normal, Turner's syndrome, Klinefelters syndrome, Edwards's syndrome; DNA fingerprinting	4	Tutorial-4

Course Outcomes (COs)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	5	4	-	-	-	4	5	5	6	-	-	-	2.3
CO2	5	4	-	4	-	5	4	5	-	5	-	-	2.6
CO3	5	5	-	-	-	5	5	3	-	2	-	-	2.08
CO4	5	-	4	-	-	5	4	3	-	4	-	-	2.08
	Mean Overall Score												2.3

Result: The Score for this Course is 2.3 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: DSEC - II
Semester	: II	Hours	: 5/W 75/S
Subject Code	: P22DSZ2A	Credits	: 4

TITLE OF THE PAPER: GENOMICS AND PROTEOMICS

Pedagogy	Hours	Lecture	Peer Teaching	GD/Video/Tutorial
	5	2	1	2

PREAMBLE:

   The course will provide knowledge about the basic principles of Genomics and Proteomics and its applications in various fields

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Gain knowledge about recent developments in 'OMICS' technology	1	10	K1
CO2: Understand various types of genes, their functions and expression pattern in prokaryotes and eukaryotes.	2	18	K2
CO3: Elucidate various separation and expression techniques of protein and their applications in proteomics.	3	17	K3
CO4: Gain knowledge on various gene prediction techniques and protein structure prediction methods and apply them to predict structure of protein	4	15	K3
CO5: Apply and analyse various computational methods in drug designing.	5	15	K4

SYLLABUS

UNIT I:

   Biological databases - types –classification with examples- SRS, ENTREZ similarity search - FASTA and BLAST - sequence alignment types - applications of Bioinformatics.

UNIT II:

   Genomics - types - Prokaryotic and Eukaryotic genome structure - Genomes of *E.coli* and human. Human Genome Project - an overview.Gene expression analysis-cDNAs and ESTs-SAGE

- DNA Microarray - Applications of Microarray.

 UNIT III:

   Proteomics - Types-Separation of protein by Gel Elelctrophoresis. Identification of protein by peptide mass fingerprinting, Mass Spectrometry-MALDI –MALDI - TOF. Protein expression analysis - applications of Proteomics

UNIT IV:

   Gene prediction Methods - Lab based, Feature based, Homology based and HMM based approaches - Protein structure prediction - computational tools for primary and secondary structure of proteins - comparative modeling.

UNIT V:

   Application of genomics and proteomics - drug development – pharmacogenomics - target-lead – hits - Lipinski's rule – CADD - - Ligand and -Structure based drug designing- docking - types. Tools for docking.-

TEXT BOOKS:

   1.Ignacimuthu S. Basic Bioinformatics. Narosa Pub. House, New Delhi, 2008

   2. Singh J. Discovering Genomics and proteomics. Manglam Pub., New Delhi, 2009

   3. Solomon KA. Molecular Modeling and Drug Design. MJP Pub., Chennai, 2008

REFERENCE BOOKS:

   1. Higgs PG and Attwood TK. Bioinformatics and Molecular Evolution. Blackwell Pub., 2005

   2. Krawetz SA and Womble DD. Introduction to Bioinformatics - A Theoretical and Practical Approach. Humana Press, New Jersey, 2009

   3. Larson RS. Bioinformatics and Drug Discovery. Humana Press, New Jersey, 2008.

Course Designer: DR. V. KABILA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTRE HRS.	MODEOF TEACHING
UNIT I			
1.1	Biological databases - types –classification with examples	4	Lecture - 2 Video - 2
1.2	SRS, ENTREZ similarity search - FASTA and BLAST - sequence alignment types	4	Lecture - 2 Tutorial - 2
1.3	Applications of Bioinformatics	2	Lecture - 2
UNIT II			
2.1	Genomics - types - Prokaryotic and Eukaryotic genome structure	5	Lecture - 2 Video -2
2.2	Genomes of *E.coli* and human. Human Genome Project - an overview.	4	Lecture - 3 Tutorial - 1
2.3	Gene expression analysis-cDNAs and ESTs - SAGE	5	Lecture - 5
2.4	DNA Microarray - Applications of Microarray	4	Lecture - 2 Video - 2
UNIT- III			
3.1	Proteomics - Types-Separation of protein by Gel Elelctrophoresis	5	Lecture - 4 Video - 1
3.2	Identification of protein by peptide mass fingerprinting	4	Lecture - 2 Tutorial - 2
3.3	Mass Spectrometry-MALDI –MALDI – TOF	3	Lecture - 2 Video - 1
.4	Protein expression analysis	4	Lecture - 3 Tutorial - 1
3.5	Applications of Proteomics	1	Lecture - 1
UNIT IV			
4.1	Gene prediction Methods - Lab based, Feature based, Homology based and HMM based approaches	5	Lecture - 3 Tutorial - 2
4.2	Protein structure prediction - computational tools for primary and secondary structure of proteins	6	Lecture - 3 Video - 3

4.3	comparative modeling	4	Lecture - 1
			Video - 3
UNIT V			
5.1	Application of genomics and proteomics	3	Lecturer - 3
5.2	drug development – pharmacogenomics - target-lead – hits - Lipinski's rule –	5	Lecture - 3 Video - 2
5.3	CADD –Ligand and-Structure based drug designing	4	Lecture - 2 Tutorial - 2
5.4	Docking - types. Tools for docking.	3	Lecture - 2 Tutorial - 1

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	2	4	2	4	4	4	4	4	4	-	3.3
CO2	4	4	4	4	3	4	4	4	4	4	3	-	3.5
CO3	4	4	4	4	3	4	4	4	4	4	4	-	3.6
CO4	4	3	4	3	4	4	4	4	4	4	3	-	3.5
CO5	4	4	4	4	4	4	4	4	3	4	3	-	3.5
Mean Overall Score													**3.48**

Result: The Score for this Course is 4.0 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
REMEMBERING	20%	20%
UNDERSTANDING	20%	20%
APPLICATION	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: DSEC - II
Semester	: II	Hours	: 5/W 75/S
Subject Code	: P22DSZ2B	Credits	: 4

TITLE OF THE PAPER: COMPUTATIONAL BIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial
	5	3	-	2

PREAMBLE:

The course will introduce basic principles and concepts of computational methods for biological data analysis and interpretation and to impart interdisciplinary expertise in biological science, Statistics and Computer Science.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Levels
CO1: understand descriptive statistical methods effectively.	1	6	K1
CO2: acquire knowledge on the methods of hypothesis testing, statistical inference and designing experiments	2	14	K2
CO3: analyse and interpret the biological data in a statistical perspective correctly and contextually	3	16	K3
CO4: carryout correlation and regression analysis and recognize theoretical distributions	4	12	K3
CO5: apply principles of demonstrate the mastery of concepts of skills for biological data management and analysis	5	12	K2

SYLLABUS

UNIT I: Biostatistics - Descriptive Statistics

Introduction – measures of central tendency - arithmetic mean, geometric mean, harmonic mean, median and mode – measures of dispersion – range, quartiles, mean deviation, variance, standard deviation, standard error and coefficient of variation.

Unit II: Inferential Statistics I

Probability distributions − binomial − Poisson − normal distribution− steps in hypothesis testing procedure − student's t − test and its applications in experimental biology .

UNIT III: Inferential Statistics II

Chi − square test − goodness of fit and contingency tables − ANOVA − assumptions − types − one-way and two-way ANOVA.

UNIT IV: Correlation and Regression

Correlation − types − methods of determining correlation - Computation and interpretation of Karl Pearson's correlation coefficient − coefficient of determination - Spearman's rank correlation coefficient − regression − types .

UNIT V: Bioinformatics

Nucleic acid databases - DDBJ − protein sequence databases - NBRF − PIR and PSD - database similarity searches −FASTA−BLAST−Multiple Sequence Alignment − Phylogenetic trees − structure, construction and interpretation.

Text Book

1. Gurumani N. *An Introduction to Biostatistics*. Chennai: MJP Publishers, 2nd Edition, Triplicane, 2005.

Reference Books

1. Agarwal S.K. *Bioinformatics.* New Delhi: APH Publishing Corporation, 2008.
2. Thiagarajan B. and Rajalakshmi Pa. *Computational Biology.* Chennai: MJP Publishers, 2009.
3. Khan I and Khanum A. *Introductory Bioinformatics*. Hyderabad: Ukaaz Publications, 1st edition, 2004.

Course designer: DR. V. KABILA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HRS.	MODE OF TEACHING
UNIT I			
1.1	Introduction ─ measures of central tendency - arithmetic mean, geometric mean, harmonic mean, median and mode	6	Lecture-3 Tutorial-3
1.2	Measures of dispersion ─ range, quartiles, mean deviation, variance, standard deviation, standard error and coefficient of variation	6	Lecture-3 Video-3
UNIT II			
2.1	Probability distributions ─ binomial ─ Poisson ─ normal distribution.	6	Lecture-3 Tutorial-3
2.2	Steps in hypothesis testing procedure ─ student's t ─ test and its applications in experimental biology	6	Lecture-3 Tutorial-3
UNIT- III			
3.1	Chi ─ square test ─ goodness of fit and contingency tables	6	Lecture-3 Video-3
3.2	ANOVA ─ assumptions ─ types	6	Lecture-3 Video-3
3.3	One-way and two-way ANOVA.	5	Lecture-2 Demo-2 Tutorial-1
UNIT IV			
4.1	Correlation ─ types ─ methods of determining correlation Computation and interpretation of Karl Pearson's correlation coefficient	7	Lecture-3 Lecture-2 Demo-2
4.2	Coefficient of determination - Spearman's rank	7	Lecture-2 Tutorial-2

	correlation coefficient -Regression -Tytpes		Demo-3

UNIT V

5.1	Nucleic acid databases - DDBJ − protein sequence databases - NBRF − PIR and PSD	7	Lecture-5 Demo-2
5.2	*FASTA –BLAST* –Multiple Sequence Alignment	6	Lecture-3 Demo-3
5.3	Phylogenetic trees − structure, construction and interpretation.	7	Lecture-3 Tutorial-1 Demo-3

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO1	4	3	4	3	2	3	4	4	4	4	3	-	3.1
CO2	4	4	3	4	3	4	4	4	4	4	4	-	3.6
CO3	4	4	4	3	4	3	4	3	4	4	4	-	3.4
CO4	4	4	4	4	3	4	3	4	4	3	4	-	3.4
CO5	4	4	4	4	3	4	3	3	3	3	4	-	3.2
Mean Overall Score													**3.34**

Result: The Score for this Course is 3.34 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value Total No. of Pos & PSOs	Mean Overall Score of COs = Total of Mean Score Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
REMEMBERING	20%	20%
UNDERSTANDING	20%	20%
APPLICATION	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type: SEC - II	
Semester	: II	Hours	: 2/W 30/S
Subject Code	:P22SEZ1	Credits	: 2

TITLE OF THE PAPER: CLIMATE CHANGE AND HUMAN HEALTH

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL
	30	19	6	5

PREAMBLE:

To understand global devastation on environment, climate change and associated health implications on human population and to apply the concepts in creating social awareness

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Define, describe and write about the details of Climate Change, Global warming, variability, natural disasters and IPCC	I	6	K1
CO2: Explain and paraphrase Water and Air quality , pollutants and related disease impact on humans	II	6	K2
CO3: Discuss and summarize Climate change impact on food quality, security and Food borne diseases	III	6	K2
CO4: Include & prepare themselves and prepare the community on the awareness about the Physiological impacts influenced by climate change	IV	6	K3
CO5: Correlate, recognize and distinguish mental health related issues impacted by disasters and climate change	V	6	K4

SYLLABUS

UNIT I:

Concepts and definition of Climate Change, Global warming and Climate change – climate variability – Impact on environment – Natural disasters – Storm, Cyclone, Flood, fire, drought, heatwave. The Inter-governmental Panel on Climate Change (IPCC) – Acts and Policies.

UNIT II:

Water and Air quality – types of pollutants / contaminants – allergens, dust, ground level ozone, temperature, chemicals, pathogens - climate change impact, Air borne diseases – respiratory disorders – droplet infection, asthma, bronchitis; Water borne diseases – cholera, typhoid;

UNIT III:

Climate change impact on food quality and security; health challenges – malnutrition, Food borne diseases – diarrhoea, colitis infection

UNIT IV:

Physiological impacts – Morbidity and Mortality, Brief account on the occurrence of climate change influenced cardiovascular, dermatological diseases, birth outcome, fertility issues, pubertal timing, cancer, neurological disorder, diabetes and obesity.

UNIT V:

Mental health and Climate change: Disasters and mental health – acute impacts of flood, heatwave and drought – mental health issues – Brief account on Post traumatic stress disorder, anxiety, major depressive disorder, substance abuse, suicidal ideation, survivors issues

TEXT BOOKS:

Prepared course materials

REFERENCE BOOKS:

1. Mridula Ramesh , The Climate Solution: India's Climate Change Crisis and What We Can Do About It by, Hachette India (2018).

2. Malancha Chakrabarty, Climate change and food security in India; ORF issue brief, 2016

COURSE DESIGNER: DR. D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Concepts and definition of Climate Change, Global warming and Climate change – climate variability	2	Lecture - 2
1.2	Impact on environment – Natural disasters – Storm, Cyclone, Flood, fire, drought, heatwave	2	Lecture - 1, GD -1
1.3	The Inter-governmental Panel on Climate Change (IPCC) – Acts and Policies.	2	Lecture - 2
UNIT II			
2.1	Water and Air quality – types of pollutants / contaminants – allergens, dust, ground level ozone, temperature, chemicals, pathogens - climate change impact	2	Lecture -1, Video -1
2.2	Air borne diseases – respiratory disorders – droplet infection, asthma, bronchitis	2	Lecture -1, Video -1
2.3	Water borne diseases – cholera, typhoid;	2	Lecture -1, Peer teaching -1
UNIT III			
3.1	Climate change impact on food quality and security	3	Lecture-2 GD 1
3.2	health challenges – malnutrition	1	Peer learning 1
3.3	Food borne diseases – diarrhoea, *Escherichia coli* infection	2	Lecture 1, Peer teaching -1
UNIT IV			
4.1	Physiological impacts – Morbidity and Mortality,	1	Lecture -1
4.2	Brief account on the occurrence of climate change influenced cardiovascular, dermatological diseases, birth outcome,	2	Lecture -1, Peer teaching -1
4.3	Brief account on the occurrence of climate change influenced fertility issues, pubertal timing, cancer, neurological disorder, diabetes and obesity.	3	Lecture -1, GD-2

UNIT V			
5.1	Disasters and mental health – acute impacts of flood, heatwave and drought	2	Lecture -1, Peer teaching -1
5.2	Mental health issues – Brief account on Post traumatic stress disorder, anxiety, major depressive disorder	2	Lecture -2
5.3	Mental health issues – Brief account on substance abuse, suicidal ideation, survivors issues	2	Lecture -2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	5	3	-	3	3	4	-	-	4	5	-	-	2.3
CO2	4	4	-	4	-	4	4	4	-	5	-	-	2.4
CO3	4	4	-	-	4	3	4	5	-	4	-	-	2.3
CO4	3	4	-	4	-	4	4	-	4	5	-	-	2.3
CO5	4	4	-	4	-	4	-	-	4	4	4	-	2.3
Mean Overall Score													2.3

Result: The Score for this Course is 2.3 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
REMEMBERING	20%	20%
UNDERSTANDING	20%	20%
APPLICATION	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - IX
Semester	: III	Hours	: 6/W 90/S
Subject Code	: P22CZ9	Credits	: 5

TITLE OF THE PAPER: IMMUNOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial	
	5	2	1	2	

PREAMBLE:

This course helps to understand the basic concepts of immune system and immune response and apply the knowledge in basic research in Immunology

COURSE OUTCOME At the end of the semester, the students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Acquire knowledge in basic immune system	1	18	KI
CO2: Understand the principles of various immunological techniques and apply them in immunodiagnosis of diseases	2	18	K2
CO3: Develop in depth knowledge on activation of immune system	3	18	K2
CO4: Understand the immune response in major health issues such as transplantation and cancer	4	18	K3
CO5: Analyse the immune reactions against various pathogens, allergens, self antigens and vaccines	5	18	K4

SYLLABUS

UNIT I:

Historical perspectives of Immunology. Types of immunity - Innate Immunity, acquired immunity - active and passive immunity. Cells and organs of immune system -structure and functions

UNIT II:

Humoral immune response – antigens. Antibodies - structure, functions and isotypes of

immunoglobulin. Mechanism of humoral immune response - production of antibodies. Antigen and antibody interactions. Cell mediated immune response - types of T cells - Mechanism of CMI

UNIT III:

Cytokines - T cell activation and differentiation - B cell activation and differentiation. Complement - activation - classical, alternative and lectin pathways. Regulation of complement activation - Biological consequences of complement

UNIT IV:

Major Histo-compatibility Complex - Structure and functions of MHC class I and class II molecules. Transplantation Immunology - Graft rejection - Graft versus Host reaction - HLA   Tissue typing. Tumor immunology - types of Tumor - Tumor antigens - Immune response to tumors - Immunodiagnosis of tumor.

UNIT V:

Hyper sensitive reactions – types. Auto immunity - Organ specific and systemic auto immune diseases. Host immune response to bacteria (*Mycobacterium tuberculosis*), virus (HIV) and parasite (*Plasmodium vivax*). Vaccines - types

TEXT BOOK:

1. GolKindt TJ, Goldsby RA and Osborne BA. Kuby Immunology. W.H. Freeman and Company, New York, 2007

REFERENCE BOOKS:

1. Roit I M. Essentials of Immunology. ELBS Blackwell Scientific Pub., London, 2007
2. Tizard K. Immunology - An Introduction. Saunders College Pub., Philadelphia, 1983

Course Designer: DR. H. VIJAYA RANI

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Historical perspectives of Immunology	2	Lecture (2 hr)
1.2	Types of immunity - Innate Immunity, acquired immunity - active and passive immunity	8	Lecture (5 hrs) Video (3 hrs)
1.3	Cells and organs of immune system -structure and functions	8	Lecture (4 hrs) Video (1 hr) Tutorial (3 hrs)
UNIT II			
2.1	Humoral immune response - antigens	3	Lecture (3 hrs)
2.2	Antibodies - structure, functions and isotypes of immunoglobulin	3	Lecture (2 hr) Video (1 hrs)
2.3	Mechanism of humoral immune response - production of antibodies	2	Tutorial (2 hr)
2.4	Antigen and antibody interactions	6	Lecture (2 hrs) video (4 hrs)
2.5	Cell mediated immune response - types of T cells - Mechanism of CMI	4	Lecture (2 hr) video (2 hrs)
UNIT III			
3.1	Cytokines	4	Lecture (4 hrs)
3.2	T cell activation and differentiation	4	Peer Teaching (4 hrs)
3.3	B cell activation and differentiation	4	Peer Teaching (4 hrs)
3.4	Complement - activation - classical, alternative and lectin pathways	4	Lecture (2 hrs) Video (2 hrs)
3.5	Regulation of complement activation - Biological	2	Peer teaching

	consequences of complement		(2 hrs)
UNIT IV			
4.1	Major Histo-compatibility Complex - Structure and functions of MHC class I and class II molecules	6	Lecture (3 hrs) Peer Teaching (3 hrs)
4.2	Transplantation Immunology - Graft rejection - Graft versus Host reaction – HLA- Tissue typing	6	Lecture (2 hrs) Video (3 hrs) Peer Teaching (1 hr)
4.3	Tumor immunology - types of Tumor - Tumor antigens - Immune response to tumors Immunodiagnosis of tumor	6	Lecture (3 hrs) Video (3hrs)
UNIT V			
5.1	Hyper sensitive reactions - types	5	Lecture (2 hrs) Video (2 hrs) Peer Teaching (1 hr)
5.2	Auto immunity - Organ specific and systemic auto immune diseases	5	Lecture (1 hr) Video (2 hrs) Tutorial (2 hrs)
5.3	Host immune response to bacteria (*Mycobacterium tuberculosis*), virus (HIV) and parasite (*Plasmodium vivax*)	4	Lecture (2 hrs) Peer Teaching (2 hrs)
5.4	Vaccines - types	4	Lecture (2 hrs) Peer Teaching (2 hrs)

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	3	4	4	2	4	3	3	3	3	3.41
CO2	4	4	4	3	4	4	4	4	4	4	3	3	3.75
CO3	4	4	4	3	4	4	4	4	4	4	3	3	3.75
CO4	4	4	4	4	4	4	4	4	4	4	3	3	3.83
CO5	4	4	4	3	4	4	4	4	4	4	3	3	3.75
Mean Overall Score													3.69

Result: The Score for this Course is 3.69 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme : M. Sc. ZOOLOGY		**Course Type : CC - X**
Semester : III		**Hours : 6/W 90/S**
Subject Code : P22CZ10		**Credits : 5**

TITLE OF THE PAPER: DEVELOPMENTAL BIOLOGY

Pedagogy	Hours	Lecture	Peer teaching	GD/VIDEOS/TUTORIAL
	6	3	1	2

PREAMBLE:

   The students gets familiarized with the basic facts and problems of biology of development.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Demonstrate knowledge of the fundamental concepts in development of an organism.	1	18	K1
CO2: Describe the mechanism of fertilization and its significance	2	18	K2
CO3: Demonstrate an understanding of cleavage and blastulation	3	18	K3
CO4: Acquire knowledge in morphogenetic movements during gastrulation	4	18	K3
CO5: To understand theoretical aspects of organogenesis and the techniques in IVF and birth control measures.	5	18	K4

SYLLABUS

UNIT I:

   Gametogenesis - spermatogenesis - origin of primordial germ cells - differentiation of spermatozoa - structure and motility of sperm. Oogenesis - Development of oocytes - types of eggs - biochemical changes during oogenesis.

UNIT II:

   Mechanism of fertilization - activation of sperm and ovum – interaction of sperm and ovum - sperm entry - egg surface changes - biochemical, physiological - significance of fertilization - post fertilization changes.

UNIT III:

Cleavage and Blastulation – types of cleavage –patterns of cleavage - influence of yolk in cleavage - products of cleavage - blastula and morula. Biochemical changes during cleavage. Fate map and cell lineage.

UNIT IV:

Gastrulation - morphogenetic movements - epiboly, emboly - invagination, involution, polyinvagination, concrescence, cell proliferation, divergence and extension. Sea urchin gastrulation. Biochemical changes during gastrulation, - nuclear activation and gene activities during gastrulation.

UNIT V:

Organogenesis – development of Brain and Eye. Cellular interaction - differentiation and organogamy. Organizer - Spemann's primary organizer - mechanism of induction. Metamorphosis in amphibia. Regeneration in amphibia. Cryopreservation of gametes and embryos – *invitro* fertilization and embryo transfer - sperm banking - birth control measures.

TEXT BOOK:

1. Balinsky BI and Fabian BC. An Introduction to Embryology. 5[th]Edn., CBS college Pub., 2012

REFERENCE BOOKS:

1. Berril NJ. Developmental Biology. Tata McGraw Hill Pub., New Delhi, 1974
2. Bradley M, Patten M and Carlson BM. Foundations of Embryology. Tata McGraw Hill Book Company, 1974
3. Verma PS and Agarwal VK. Chordate Embryology. S. Chand and Company Ltd., New Delhi, 2011

Course Designer : MRS. N. AMUTHA

COURSE CONTENT AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Gametogenesis-spermatogenesis and oogenesis.	6	Lecture -3

			Video-3
1.2	Differentiation of spermatozoa and motility of sperm.	6	Lecture -3 Charts - 3
1.3	Biochemical changes in oogenesis	6	Lecture -6
UNIT I I			
2.1	Mechanism of fertilization	6	Lecture -2 Video demo 4
2.2	Biochemical, physiological - significance of fertilization	6	Lecture -3 Video demo-3
2.3	Post fertilization changes.	6	Lecture -4 Video demo-2
UNIT III			
3.1	Cleavage and Blastulation - patterns of cleavage	5	Lecture -3 Video dem- 2
3.2	Biochemical changes during cleavage.	5	Lecture -3 Video demo 2
3.3	Fate map and cell lineage.	5	Lecture -3 video demo- 2
UNIT IV			
4.1	Gastrulation - morphogenetic movements	5	Lecture-3 video - 2
4.2	Gastrulation in Sea urchin	5	Lecture-4 – chart-1
4.3	Biochemical changes during gastrulation	5	Lecture-4 video - 1
UNIT V			
5.1	Organogenesis – development of Brain and Eye	5	Lecture-4 chart - 1
5.2	Organizer - Spemann's primary organizer - mechanism of induction.	5	Lecture-3,video-2
5.3	*invitro* fertilization and embryo transfer - birth control measures.	5	Lecture-3 video- 2

Course Outcomes (COs)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO 1	3	3	3	3	2	4	-	3	4	3	4	4	3.0
CO 2	4	4	3	-	3	4	-	4	4	3	3	4	3.0
CO 3	3	-	4	3	3	4	3	3	4	4	4	4	3.25
CO 4	4	2	-	3	3	4	3	3	3	4	4	4	3.1
CO 5	4	3	-	3	4	4	-	4	4	4	4	4	3.2
Mean overall score													3.1

Result: The score for this course is 3.1 (High)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value / Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score / Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20 %	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - XI
Semester	: III	Hours	: 5/W 75/S
Subject Code	: P22CZ11	Credits	: 4

TITLE OF THE PAPER: BIOPHYSICS AND BIOSTATISTICS

Pedagogy	Hours	Lecture	Peer teaching	VIDEOS/TUTORIAL
	5	2	1	2

PREAMBLE:

This paper will enlighten the principles of biophysics and biostatistics and how to apply the biophysical knowledge in working of biological systems and statistics in biological research

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Demonstrate knowledge of the fundamental concepts in Physics and Biology.	1	10	K2
CO2: Describe the principles that govern bio molecular interactions and understand the application of Radio isotopes in Biology	2	12	K3
CO3: Demonstrate an understanding of the central concepts of modern statistical theory	3	17	K2
CO4: Acquire knowledge in data collection and its presentation.	4	18	K1
CO5: Elucidate the results of statistical analysis accurately and effectively; Make appropriate use of statistical software.	5	18	K4

SYLLABUS

UNIT 1:

Intra and intermolecular interactions in biological systems - ionic and covalent bonds - hydrogen bonds - peptide bonds - Vander Waal's forces. Transport across membranes - types of transport - active and passive transport. Osmosis - exosmosis and endosmosis, exocytosis and endocytosis.

UNIT II:

Bioenergetics - ATP structure, formation and breakdown in living systems. Redox couples. Impulse conduction in nerve and muscle. Electro encephalogram and Cathode Ray

Oscilloscope. Radio isotopes - applications of radioisotopes in biology.

UNIT III:

Introduction to Biostatistics. Sampling - Representative sample, sample size, sampling bias and sampling techniques. Types of data, methods of collection of primary and secondary data, classification, tabulation. Graphical representation of data – graphical and diagramatic.

UNIT IV:

Measures of central tendency - Mean, median, mode. Measures of dispersion - standard deviation, standard error, variance, range, mean deviation, quartile deviation and coefficient of variation. Correlation - positive and negative correlation, calculation of Karl - Pearsons co-efficient of correlation.

UNIT V:

Regression - Linear regression and regression equation. Calculation of an unknown variable using regression equation. ANOVA - one way classification. Tests of significance - Chi-square test (Theory & problem), Student's t test.

TEXT BOOKS:

1.Arora MP. Biophysics. Himalaya Pub., 2007

2.Palanichamy S and Manoharan M. Statistical Methods for Biologists. Paramount
   Pub., 2008

REFERENCE BOOKS:

1. Lehninger L. Biochemistry. Kalyani Pub., New Delhi, 2012

2. Subramanian MA. Biophysics - Principles and Techniques. MJP Pub., Chennai, 2005

3. Palanichamy S and Shanmugavelu M. Principles of Biophysics. PalaniPramount
   Pub., 2002

4. Pagano M and Gauvreau. K. Principles of Biostatistics. Duxbury Press, USA, 2000

Course Designer: MRS. A. SHEELA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Intra and intermolecular interactions in biological systems - ionic and covalent bonds-hydrogen bonds - peptide bonds - Vander Waal's forces.	5	Lecture - 3 Video demo - 2
1.2	Transport across membranes - types of transport - active and passive transport.	5	Lecture - 3 Video demo - 2
1.3	Osmosis - exosmosis and endosmosis, exocytosis and endocytosis.	5	Experimental demo -5
UNIT II			
2.1	ATP structure, formation and breakdown in living systems. Redox couples.	5	Lecture –3 video demonstration -2
2.2	Impulse conduction in nerve and muscle.	5	Lecture -3 video demonstration -2
2.3	Electro encephalogram and Cathode Ray Oscilloscope.Radio isotopes - applications ofradioisotopes in biology.	5	Lecture -3 video demonstration-2
UNIT III			
3.1	Sampling - Representative sample, sample size, sampling bias and sampling techniques.	5	Experiment - 3 Group activity-2
3.2	Types of data, methods of collection of primary and	5	Experiment -

	secondary data, classification, tabulation.		3 Group activity-2
3.3	Classification, tabulation., representation of data – graphical and diagramatic.	5	Experiment - 3 Group activity-2
UNIT IV			
4.1	Measures of central tendency - Mean, median, mode	5	Lecture -3 Assignment - 2
4.2	Measures of dispersion - standard deviation, standard error, variance, range, mean deviation, quartile deviation and coefficient of variation.	5	Lecture -3 Assignment - 2
4.3	Correlation - positive and negative correlation, calculation of Karl - Pearsons co-efficient of correlation.	5	Lecture -3 Assignment - 2
UNIT V			
5.1	Linear regression and regression equation. Calculation of an unknown variable using regression equation.	5	Lecture -3 Assignment - 2
5.2	ANOVA - one way classification.	5	Lecture -3 Assignment - 2
5.3	Tests of significance - Chi-square test (Theory & problem), Student's t test.	5	Lecture -3 Assignment - 2

Course Outcomes (COs)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO 1	4	3	4	4	3	4	3	4	4	5	3	4	3.75
CO 2	4	4	4	4	4	4	4	4	4	4	4	5	4.08
CO 3	4	3	4	3	3	4	4	3	3	4	4	4	3.58
CO 4	4	4	5	4	4	4	4	4	5	4	4	5	4.25
CO 5	4	4	4	4	5	4	5	4	4	5	3	4	4.0

Mean overall score	3.93

Result: The score for this course is 3.93 (High relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUTION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - XII
Semester	: III	Hours	: 6/W 90/S
Subject Code	: P22CZ12P	Credits	: 4

**TITLE OF THE PAPER: IMMUNOLOGY, DEVELOPMENTAL BIOLOGY
AND BIOPHYSICS AND BIOSTATISTICS - PRACTICAL**

Pedagogy	Hours	Lecture	Demonstration	Tutorial
	6	1	4	1

PREAMBLE:

   This course helps to acquire practical knowledge on various immunological   techniques, mounting of chick embryo and to apply statistical techniques in Zoology

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Carry out immunodiagnostic techniques	1	25	K4
CO2: Demonstrate immunological techniques used in research	2	25	K4
CO3: Carry out mounting of chick embryo	3	15	K2
CO4: Apply statistical techniques in research	4	15	K3
CO5: Acquire practical knowledge on developmental biology and biophysics	5	10	K1

SYLLABUS

UNIT I: Preparation of antigen

               Separation of lymphocytes

               Agglutination tests - WIDAL – Slide and tube test

               RA test

               ASO test

UNIT II: Precipitation tests - Ouchterlony's Double Immuno Diffusion test (ODD)

                Counter Current Immuno Electrophoresis (CIE)

                Rocket Immuno Electrophoresis (RIE)

                Rapid Plasma Region Test (RPR)

                Demonstration of ELISA

UNIT III:	Serial sections of Chick embryo
	Mounting of Chick Blastoderm
UNIT IV:	Data collection – Primary and Secondary data,
	Calculation of Mean, Median, Mode and SD
	Representation of Data -Tabulation, Histogram and Pie diagram
UNIT V:	Spotters: Oogenesis and Spermatogenesis
	Chick - Four cell stage, 48 hrs stage, 56 hrs stage, 72 hrs and 96 hrs stage
	Membrane transport mechanism - active and passive transport

REFERENCE BOOKS:

1. Dubey RC and Maheswari DK. Practical Microbiology. S. Chand and Company Ltd., New Delhi, 2008

2. Gunasekaran P. Laboratory Manual in Microbiology. New Age International Ltd. Pub., 2009

3. Palanichamy S and Manoharan M. Statistical Methods for Biologists. Paramount Pub., 2008

4. Subramanian MA. Biophysics - Principles & Techniques. MJP Pub., Chennai, 2005

Course Designer: DR. H. VIJAYARANI

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1			
1.1	Preparation of antigen	6	Demo (4 hrs) Lecture (2hrs)
1.2	Separation of lymphocytes	6	Demo (4 hrs) Lecture (2hrs)
1.3	Agglutination tests - WIDAL – Slide and tube test	7	Demo (5 hrs) Tutorial (2hrs)
1.4	RA test, ASO test	6	Demo (4 hrs) Tutorial (2hrs)
UNIT II			
2.1	Precipitation tests - Ouchterlony's Double Immuno Diffusion	6	Demo (5 hrs) Lecture (1 hrs)

	test (ODD)		
2.2	Counter Current Immuno Electrophoresis (CIE)	6	Demo (5 hrs) Lecture (1 hrs)
2.3	Rocket Immuno Electrophoresis (RIE)	6	Demo (5 hrs) Lecture (1 hrs)
2.4	Rapid Plasma Region Test (RPR)	3	Demo (3 hrs)
2.5	Demonstration of ELISA	4	Demo (4 hrs)
UNIT III			
3.1	Serial sections of Chick embryo	8	Demo (5 hrs) Tutorial (3hrs)
3.2	Mounting of Chick Blastoderm	7	Demo (5 hrs) Tutorial (2hrs)
UNIT IV			
4.1	Data collection – Primary and Secondary data	5	Tutorial (5hrs)
4.2	Calculation of Mean, Median, Mode and SD	5	Tutorial (3hrs) Lecture (2hrs)
4.3	Representation of Data -Tabulation, Histogram and Pie diagram	5	Tutorial (4hrs) Lecture (1hrs)
UNIT V			
5.1	Spotters: Oogenesis and Spermatogenesis	3	Lecture (2 hrs) Demo (1 hr)
5.2	Spotters: Four cell stage, 48 hrs stage, 56 hrs stage, 72 hrs and 96 hrs stage	3	Lecture (2 hrs) Demo (1 hr)
5.3	Spotter: Membrane transport mechanism - active and passive transport	4	Lecture (2 hrs) Demo (2 hrs)

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	4	4	4	4	4	4	4	4	4	4
CO2	4	4	4	4	4	4	4	4	4	4	4	4	4
CO3	3	3	3	3	2	4	4	4	2	4	2	2	3
CO4	4	4	4	4	4	4	4	4	4	4	4	4	4
CO5	4	-	2	2	-	4	3	2	3	4	3	3	2.5
Mean Overall Score													3.5

Result: The Score for this Course is 3.5   (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = Total of Value / Total No. of Pos & PSOs	Mean Overall Score of COs = Total of Mean Score / Total No. of COs

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type : DSEC - III
Semester	: III	Hours	: 5 P/W 75 P/S
Subject Code : P22DSZ3A		Credits : 4

TITLE OF THE PAPER: RESEARCH METHODOLOGY AND BIOTECHNIQUES

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial/ Demonstration
	5	4	-	1

PREAMBLE:

The course will provide knowledge about the basic principles of Genomics and Proteomics and its applications in various fields

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Understand the basics if research, types and process	1	10	K1
CO2: Elucidate the research problem, design and techniques of literature survey	2	17	K2
CO3: Formulate research hypothesis and list out various components of a thesis and also to understand how to apply ethical aspects in writing a thesis	3	18	K3
CO4: Gain knowledge on basic principles of centrifuge and Chromatography and apply them in experimental work	4	15	K3
CO5: Enumerate basic principles of spectrometry and electrophoresis and apply them in experimental work	5	15	K4

SYLLABUS

UNIT I:

Introduction-Objectives and Types of Research - Descriptive & Analytical, Applied and Fundamental, Quantitative, Qualitative, Conceptual and Empirical types - Research Process - Steps involved in Research Process.

UNIT II:

Formulation of Research Problem-selecting and defining research problem-Research design-reliability and validity, steps of research design. Literature Review - Primary and Secondary Sources - Offline and online sources-journals, monographs and books.

UNIT III:

Formulation of research hypothesis -Thesis writing- components of thesis - Literature citation- Reference Management tool - Mendley and Endnote. Research ethics- ethical issues in animal experiments - CPESEA guidelines - plagiarism.

UNIT IV:

Biotechniques:

Chromatography - Principles and methodology of column, ion exchange and affinity chromatography - GLC and HPLC.

Centrifugation: Ultracentrifuge, Differential and gradient centrifugation - Principles, methodology and applications

UNIT V:

Spectrophotometry - Principles - colorimeter and Spectrophotometer- Meth0odology and applications.

Electrophoresis: types (AGE, PAGE), principles - Methodology and applications

TEXT BOOKS:

1. Kothari C.R. Research Methodology -Methods and Techniques. New Age International publishers.2004
2. Misra S.B., Alok S. Handbook of Research Methodology. Educreation Publishing.
3. Jayaraman J. Laboratory Manual of Biohemistry, New Age International Publications.2006
4. David T.Plummer. Introduction to Practical Biochemistry, Tata-McGraw Hill Publication Company Ltd.1999.

REFERENCE BOOKS:

1. Bhome S., and Jha N. Research Methodology . Himalaya Publishing House, 2013.
2. Wilson K and Walker J. Principles and Techniques of Biochemistry and Molecular Biology Cambridge University Press, 2010.

Course Designer: DR. V. KABILA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTRE HRS.	MODE OF TEACHING
UNIT I			
1.1	Introduction-Objectives and Types of Research	4	Lecture - 2 Video - 2
1.2	Descriptive& Analytical, Applied and Fundamental, Quantitative, Qualitative, Conceptual and Empirucal types	4	Lecture - 3 Tutorial - 1
1.3	Research Process-Steps involved in Research Process	2	Lecture - 2
UNIT II			
2.1	Formulation of Research Problem-selecting and defining research problem	5	Lecture - 2 Turorial - 2 Video - 1
2.2	Research design-reliability and validity, steps of research design.	4	Lecture - 3 Tutorial - 1
2.3	Literature Review-Primary and Secondary Sources-	4	Lecture - 5
2.4	Offline and online sources-journals, monographs and books	4	Lecture - 2 Tutorial - 2
UNIT- III			
3.1	Formulation of research hypothesis -Thesis writing-components of thesis	5	Lecture-4 GD-1
3.2	Literature citation-Reference Management tool.	5	Lecture-3 Video-2

3.3	Reference Management tool-Mendley and Endnote	4	Lecture-1 Tutorial-1 Video-2
3.4	Research ethics- ethical issues in animal experiments-CPESEA guidelines-plagiarism.	4	Lectuire-2 GD-2
UNIT IV			
4.1	Chromatography-Principles and methodology of column, ion -exchange. chromatography	5	Lecture - 3 Tutorial - 2
4.2	GLC and HPLC	5	Lecture - 3 Tutorial - 2
4.3	Centrifugation: Differential and gradient centrifugation-Ultracentrifuge - Principles and applications	5	Lecture - 3 Tutorial - 2
UNIT V			
5.1	Spectrophotometry - Principles of colorimetry -colorimeter and Spectrophotometer.	6	Lecturer - 3 Tutorial - 3
5.2	Colorimeter and Spectrophotometer - procedure and applications	5	Lecture - 2 Tutorial - 3
5.3	Electrophoresis: principles-types-procedure and application	4	Lecture - 2 Tutorial - 2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	4	--	4	3	4	3	3	4	1	3.2
CO2	4	3	3	4	--	4	3	4	4	3	4	--	3.0
CO3	3	4	3	4	--	4	4	3	3	4	3	1	3.0
CO4	4	4	3	4	--	4	3	4	4	3	4	1	3.1
CO5	4	4	3	4	-	4	4	4	3	4	3	--	3.1
Mean Overall Score													**3.1**

Result: The Score for this Course is 3.10 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
REMEMBERING	20%	20%
UNDERSTANDING	20%	20%
APPLICATION	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: DSEC - III
Semester	: III	Hours	: 5/W 75/S
Subject Code	: P22DSZ3B	Credits	: 4

TITLE OF THE PAPER: ECONOMIC ZOOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial
	5	3	-	2

PREAMBLE:

- This course will enhance knowledge and practical understanding about sericulture, Apiculture, Lac culture, vermicompost, Fishery Biology, Poultry, and Dairy Farming and
- to develop entrepreneurial skills.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Levels
CO1: gain knowledge on beneficial insects such as silkworm , honey bee and lac insects and their significance in Indian economy	1	17	K1
CO2: understand various methodology used in vermi technology practices and apply them in various fields	2	20	K2
CO3: gain knowledge about various cattle breeds and their diseases	3	11	K2
CO4: understand and apply knowledge about poultry industry and their products	4	12	K3
CO5: to understand about various fishes, fishery industry and their significance	5	15	K4

SYLLABUS

UNIT I:

Beneficial insects- Silk worm- life cycle, types of silk, silk production in India. Honey bee - social organization, chemical composition of honey, value of honey, bee wax and bee venom. Bee keeping in India, Lac insect cultivation - harvesting, processing, composition, uses and properties. Lac Industry in India.

UNIT II:

Earthworms – Characteristics. Classification of Earthworm based on habitat – Epigeic species, Endogeic species and Anecic species. Vermiculture and vermi composting – definition, scope, importance and Environmental requirements in vermicomposting. Culture methods - small scale and large scale – pit method, heap method and windrow method. Applications of vermiculture – agricultural and horticultural practices. Vermicast, vermiwash.

UNIT III:

Dairy industry - two breeds of dairy animals - Cow-Sindhi and Jersy-Buffalo - Murrah and Jaffarabadi, Feeding stuffs, any three diseases of dairy animals (anthrax, calf pneumonia and mastitis). Milk and milk products.

UNIT IV:

Poultry industry- indigenous breeds- Aseel and Chittagong, exotic breeds- Leghorn and Rhode islandred, food and feed formula. Diseases of poultry- Ranikhet, fowl pox, fowl cholera. Poultry products - egg, poultry meat and poultry manure.

UNIT V:

Fishery industry and Animal products- edible fishes - *Catla*, *RohuTilapia* and *Chanos*, Economic importance of fishes. Ornamental fishes - Goldfish, Angel fish, Fighter fish, Gourami fish, Guppy, Molly, Mosquito fish, Paradise fish, Tiger barb, Zebra fish - significance. Pharmaceutical products from animals.

TEXT BOOK:

1. ManjuYadav. Economic zoology. Discovery Pub., 2003

REFERENCE BOOKS:

1.Gnanamani MR. Modern Aspects of Poultry keeping .Deepam Pub., 2010

2.MalhotraP. Economic zoology. Adhyayan Pub., 2008

3.Sinha RK. Hand book of Fish and Fisheries. Agrotech Press, 2014

Course Designer: DR.V. KABILA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Silk worm- life cycle, types of silk, silk production in India	5	Lecture –- 3, Demo-2
1.2	Honey bee - social organization, chemical composition of honey, value of honey, bee wax and bee venom. Bee keeping in India,	7	Lecture – 3 Tutorial-2 Discussion-2
1.3	Lac insect cultivation - harvesting, processing, composition, uses and properties. Lac Industry in India	5	Lecture – 3, Tutorial-2
UNIT II			
2.1	Classification of Earthworm based on habitat – Epigeic species, Endogeic species and Anecic species.	5	Lecture – 3,Tutorial-2
2.2	Vermiculture and vermi composting – definition, scope, mportance and Environmental requirements in vermicomposting.	5	Lecture – 3, Demo=2
2.3	Culture methods - small scale and large scale – pit method, heap method and windrow method	5	Lecture-1Demo-4
2.4	Applications of vermiculture – agricultural and horticultural practices. Vermicast, vermiwash.	5	Lecture – 3 Discussion-2
UNIT III			
3.1	Dairy industry - two breeds of dairy animals - Cow-Sindhi and Jersy-Buffalo - Murrah and Jaffarabadi, Feeding stuffs	6	Lecture – 2 Tutorial-2 video-2
3.2	Three diseases of dairy animals (anthrax, calf pneumonia and mastitis). Milk and milk products.	5	Lecture – 3 Discussion-2
UNIT IV			
4.1	Indigenous breeds- Aseel and Chittagong, exotic breeds- Leghorn and Rhode islandred, food and feed formula.	4	Lecture –2 Video and photos-2

4.2	Diseases of poultry- Ranikhet, fowl pox, fowl cholera. Poultry products	4	Lecture –2 Video and photos-2
4.3	Poultry products - egg, poultry meat and poultry manure.	4	Lecture –2 Video and photos-2
UNIT V			
5.1	Edible fishes - *Catla*, *RohuTilapia* and *Chanos*, Economic importance of fishes.	5	Lecture - 3, Demo – 2
5.2	Ornamental fishes	5	Lecture - 3 Phoos/viseo- 2
5.3	Pharmaceutical products from animals.	5	Lecture - 3, Photos/video – 2

Course Outcomes (COs)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	3	4	3	4	4	4	3	3	3	3	4	3.5
CO2	4	3	3	3	4	3	3	4	3	3	4	4	3.4
CO3	4	3	3	3	4	2	3	3	3	3	4	3	3.1
CO4	4	3	3	3	4	3	4	3	3	3	4	4	3.4
CO5	4	3	3	3	4	3	4	3	3	3	4	4	3.4
Mean overall score													**3.36**

Result: The score for this course is 3.36 (High relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = $\dfrac{\text{Total of Value}}{\text{Total No. of POs \& PSOs}}$ Mean Overall Score of COs = $\dfrac{\text{Total of Mean Score}}{\text{Total No. of COs}}$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
REMEMBERING	20%	20%
UNDERSTANDING	20%	20%
APPLICATION	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: NMEC
Semester	: II	Hours	: 2/W 30/S
Subject Code	: P22NMZ1	Credits	: 2

TITLE OF THE PAPER: BRAIN AND HUMAN BEHAVIOUR

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL
	2	1	-	1

PREAMBLE:

To introduce the amazing brain facts and its functions for non-biology students; and to make them learn, understand and associate the behavior pattern with brain activity.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Acquire knowledge about the structure and functions of brain and describe it with basic understanding	I	6	K1
CO2: Distinguish and explain the types of neurons, neurotransmitters and its functions	II	6	K2
CO3: Understand the process of learning and associate with individuals' behavior patterns	III	6	K2
CO4: Integrate the concepts of thought process and motivation through self-understanding	IV	6	K3
CO5: Interpret emotions and relate it with behavior changes, recognize stress and its effect on human body and mind; Practice Stress management	V	6	K4

SYLLABUS

UNIT I:

Architecture of Brain - Cerebrum - Frontal, Parietal, Occipital and Temporal lobes. Cerebellum, Brain stem - Mid brain, Pons, Medulla oblongata.Limbic system – Thalamus, hypothalamus, amygdala and hippocampus.Functions of different parts of brain.

UNIT II:

Nervous system - Functional description of Central, Peripheral and Autonomic nervous system in brief. Neurons - Motor and Sensory. Neurotransmitters - acetylcholine, adrenalin, endorphins, serotonin, dopamine - functional significance.

UNIT III:

Learning - Classical conditioning, Instrumental or Operant conditioning, reinforcement, Reward and punishment learning.

UNIT IV:

Thought process - Problem solving and Decision making. Motivation - needs and drives – Biological motives.

UNIT V:

Emotion and Stress - Biological basis of emotion - types of emotion - influence of emotions on behavior. Types and Sources of Stress - physical, psychological and biological symptoms. Stress management.

TEXT BOOK:

1. Fundamentals of Psychology, Published by School of Social Sciences, TNOU, 2012

REFERENCE BOOKS:

1. Garrett B. Brain and Behaviour. 4thEdn., SAGE Pub., 2007
2. Pfaff DW and Joels M. Hormones, Brain and Behaviour. 3rdEdn., Elsivier Pub., 2016

Course Designer: DR.D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Architecture of Brain - Cerebrum - Frontal, Parietal, Occipital and Temporal lobes.	2	Lecture -1, Video-1
1.2	Cerebellum, Brain stem - Mid brain, Pons, Medulla oblongata	1	Lecture 1
1.3	Limbic system – Thalamus, hypothalamus, amygdala and hippocampus.	1	Lecture - 1
1.4	Functions of different parts of brain.	2	Lecture -1, GD-1
UNIT II			
2.1	Nervous system - Functional description of Central, Peripheral nervous system in brief.	2	Lecture - 2
2.2	Autonomic nervous system in brief. Neurons - Motor and Sensory. Neurotransmitters - acetylcholine, adrenalin	2	Lecture -1, Video-1
2.3	Endorphins, serotonin, dopamine - functional significance	2	Lecture - 2
UNIT III			
3.1	Learning - Classical conditioning	2	Lecture-1, Peer Teaching -1
3.2	Instrumental or Operant conditioning, reinforcement	2	Lecture - 2
3.3	reward and punishment learning	2	Lecture-1, Peer Teaching -1

UNIT IV			
4.1	Thought process	1	Lecture - 1
4.2	Problem solving and Decision making.	2	Lecture-1, GD-1
4.3	Motivation - needs and drives	2	Lecture - 2
4.4	Biological motives.	1	Lecture - 1
Unit V			
5.1	Emotion and Stress - Biological basis of emotion	2	Lecture-1, GD -1
5.2	Types of emotion - influence of emotions on behavior	1	Lecture - 1
5.3	Types and Sources of Stress - physical, psychological and biological symptoms.	2	Lecture-1, GD-1
5.4	Stress management.	1	Lecture - 1

Course Outcomes (COs)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	-	4	-	-	5	-	3	4	4	2	-	2.3
CO2	5	-	-	3	-	5	4	-	4	4	-	-	2.08
CO3	5	-	-	-	3	5	3	-	-	4	4	-	2.07
CO4	5	-	-	3	-	5	3	4	4	-	3	-	2.3
CO5	5	-	-	-	4	5	-	5	-	5	3	-	2.3
	Mean Overall Score												**2.2**

Result: The Score for this Course is 2.2 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = $\dfrac{\text{Total of Value}}{\text{Total No. of Pos \& PSOs}}$

Mean Overall Score of COs = $\dfrac{\text{Total of Mean Score}}{\text{Total No. of COs}}$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc ZOOLOGY	Course Type: CC - XIII

Programme   : M. Sc ZOOLOGY   Course Type: CC - XIII

Semester   : IV   Hours   : 6/W 90/S

Subject Code : P22CZ13   Credits   : 4

TITLE OF THE PAPER: ANIMAL BIOTECHNOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/Videos/Tutorial
	6	3	1	2

PREAMBLE:

This course helps to gain knowledge on basic techniques and tools of biotechnology and understand the application of biotechnology in various fields.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Acquire knowledge on the tools of genetic engineering	1	12	K2
CO2: Understand the principle and methodology of basic techniques in genetic Engineering	2	22	K3
CO3: Learn advanced techniques in genetic Engineering	3	20	K4
CO4: Apply skills to develop genetically modified organisms	4	18	K4
CO5: Apply skills to develop recombinant vaccines and to assess the biosafety and other regulations of biotechnology	5	18	K4

SYLLABUS

UNIT I:

Tools of Genetic Engineering - Vectors - plasmids, bacteriophage, cosmids, shuttle vectors, yeast vectors. Enzymes - exonucleases, endonucleases, restriction endonucleases, ligases, reverse transcriptases, polymerases, terminal transferases, isozymes. Probes and molecular markers - RFLP, RAPD.

UNIT II:

Techniques in Genetic Engineering - selection and isolation of desired genes, gene splicing, introduction of rDNA into host, selection of clone containing DNA insert, PCR, DNA finger printing, blotting techniques, DNA sequencing, genomic library, cDNA library.

UNIT III:

Gene cloning - Gene transfer in animals - gene transfer technology, expression of induced genes. Animal cell culture- cell culture, culture media, monolayer and suspension culture, cell lines, somatic cell fusion and Hybridoma technology. Organ culture - techniques, advantages and applications.

UNIT IV:

Transgenic Animal Technology - production of transgenic animals, Genetically Modified Organisms - Gene knockouts, Gene silencing, Transgenic Mice, Sheep and Fishes, uses of transgenic animals.

UNIT V:

Medical Biotechnology - production of recombinant vaccines. Problems related to biotechnology - social, cultural, economic and legal problems, safety in biotechnology, Bioethics, Intellectual Property Rights, and Patenting.

TEXT BOOK:

1. Dubey RC. A Text Book of Biotechnology. Multicolor IllustratuiveEdn., S. Chand Pub., New Delhi, 2006

REFERENCE BOOKS:

1. Brown TA. Gene Cloning - An Introduction. 4thEdn., Black Bell Science Ltd., New Delhi, 2001
2. Primrose SB. Principles of Gene manipulation. Old R.N. and 6thEdn., Black Bell Science Ltd., New Delhi, 2003
3. U. Biotechnology. 1stEdn., Books and Allied (P) Ltd., 2005

Course Designer: DR. H. VIJAYARANI

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Tools of Genetic Engineering - Vectors - plasmids, bacteriophage, cosmids, shuttle vectors, yeast vectors	8	Lecture(3hrs) Video (3 hrs) GD (2 hrs)
1.2	Enzymes - exonucleases, endonucleases, restriction endonucleases, ligases, reverse transcriptases, polymerases, terminal transferases, isozymes	4	Lecture 2hrs) Tutorial (2hrs)
UNIT II			
2.1	Techniques in Genetic Engineering - selection and isolation of desired genes, gene splicing, introduction of rDNA into host, selection of clone containing DNA insert	6	Lecture(2hrs) Peer teaching (2hrs) Video (2 hrs)
2.2	PCR, DNA finger printing	4	Lecture(4hrs)
2.3	Blotting techniques, DNA sequencing	8	Lecture(4hrs) Peer teaching (2 hrs) Video (2 hrs)
2.4	Genomic library, cDNA library	4	Lecture (3 hrs) Video (1hr)
UNIT III			
3.1	Gene cloning - Gene transfer in animals - gene transfer technology, expression of induced genes	8	Video (4 hrs) Tutorial(4hrs)
3.2	Animal cell culture- cell culture, culture media, monolayer and suspension culture, cell lines, somatic cell fusion and Hybridoma technology	8	Peer teaching (4 hrs) GD (4 hrs)
3.3	Organ culture - techniques, advantages and applications	4	Lecture (4

			hrs)

UNIT IV

4.1	Transgenic Animal Technology - production of transgenic animals	6	Lecture (5 hrs) Video (1 hrs)
4.2	Genetically Modified Organisms - Gene knockouts, Gene silencing	6	Lecture (4 hrs) Peer teaching (2 hrs)
4.3	Transgenic Mice, Sheep and Fishes, uses of transgenic animals.	6	Lecture (4 hrs) Peer teaching (2 hrs)

UNIT V

5.1	Medical Biotechnology - production of recombinant vaccines	6	Lecture (4 hrs) Video (2 hrs)
5.2	Problems related to biotechnology - social, cultural, economic and legal problems	6	Lecture (4 hrs) GD (2 hrs)
5.3	Safety in biotechnology, Bioethics, Intellectual Property Rights, and Patenting.	6	Lecture (2 hrs) GD (1 hr) Peer teaching (3 hrs)

Course Outcomes (Cos)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	4	4	4	4	4	4	4	4	4	4
CO2	4	4	4	4	4	4	4	4	4	4	4	4	4
CO3	4	4	4	4	4	4	4	4	4	4	4	4	4
CO4	4	4	4	4	4	4	4	4	4	4	4	4	4
CO5	4	4	4	4	4	4	4	4	4	4	4	4	4
Mean Overall Score													4

Result: The Score for this Course is 4.0 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Mean Score of COs = $\dfrac{\text{Total of Value}}{\text{Total No. of POs \& PSOs}}$ Mean Overall Score of COs = $\dfrac{\text{Total of Mean Score}}{\text{Total No. of COs}}$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: CC - XIV
Semester	: IV	Hours	: 6/W 90/S
Subject Code	: P22CZ14	Credits	: 4

TITLE OF THE PAPER: ENTOMOLOGY

Pedagogy	Hours	Lecture	Peer teaching	GD/VIDEOS/TUTORIAL	
	6	3	1	2	

PREAMBLE:

This will enable the students to understand the basic concept of insect biology and evolutionary relationships of insect orders and families and to have a deeper understanding of several aspects of insect biology .

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Acquire the knowledge about insect classification with examples	1	18	K2
CO2: Compare the morphology of insect organ systems.	2	18	K3
CO3: Understand the physiology of insects in a comparative manner.	3	18	K1
CO4: Identify the insect pests, their control methods and pesticide applications and to develop the skills in rearing beneficial insects.	4	18	K4
CO5: Enhance the productivity of agricultural crops through insect pest management.	5	18	K4

SYLLABUS

UNIT I:

Classification - Insect classification up to order level. General characters and classification up to family level - Hemiptera, Lepidoptera and Coleoptera.

UNIT II:

Insect Morphology - morphology of head, thorax and abdomen. Appendages - antennae, legs and genitalia. Wing structure and mechanism of flight. Mouth parts - types, morphology and feeding mechanism.

UNIT III:

Insect Physiology - respiratory system - tracheal, aquatic and plastron respiratory mechanism. Excretory system. Reproduction - male and female reproductive system, structure of testis and ovary, mechanism of spermatogenesis and oogenesis with secial reference to vitellogenesis.Metamorphosis - types of larvae and pupae.

UNIT IV:

Life Cycle, rearing and economic importance of honey bee, lac insect and silk worm. Damages caused, life cycle and control measures of *Schistoceragregaria*, *Leptocoryzaacuta*, *Triboliumcastaneum*.

UNIT V:

Vector borne diseases - Malarial and Dengue vectors – life cycle and control measures. Methods of insect control - Principles and methods of pest control - physical, mechanical, chemical and biological control - *Bacillus thuringiensis* , *Beauveriabassiana*, Nuclear Polyhedrosis virus, Cytoplasmic polyhedrosis virus, Parasitoids. Integrated Pest Management.

TEXT BOOK:

1.Tembhare DB. Modern Entomology. Himalaya Pub., 2012

REFERENCE BOOKS:

1. Vasantharaj David B and Ananthakrishnan TN. General and Applied Entomology. TaTa McGraw Hill, New Delhi, 2010
2. Chapman.RF. The Insect Structure and Function. Cambridge University Press London, 2008
3. WiggleWorth VB. The Principles of Insect Physiology. English Language Book Society and Methuen and Co. Ltd., 2007
4. Vasantharaj David B and Kumaraswami T. Elements of Economic Entomology. Popular Book Depot, Chennai, 2000

Course Designer: MRS. A. SHEELA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Insect classification up to order level.	6	Chart – 1, Lecture - 5
1.2	General characters and classification up to family level - Hemiptera, Lepidoptera	8	Lecture - 6, Video demo – 2
1.3	General characters and classification up to family level - Coleoptera,	4	Lecture - 6, Video demo – 2
UNIT II			
2.1	Insect Morphology - morphology of head, thorax and abdomen. Appendages - antennae, legs and genitalia.	8	Demo with specimen - 5, Lecture -3
2.2	Wing structure and mechanism of flight.	4	Demo with specimen - 1, Lecture -3
2.3	.Mouth parts - types, morphology and feeding mechanism.	6	Demo with specimen - 4, Lecture - 2
UNIT III			
3.1	Insect Physiology - respiratory system - tracheal, aquatic and plastron respiratory mechanism. Excretory system.	6	Lecture - 3, Video demo -3
3.2	Reproduction - male and female reproductive system, structure of testis and ovary, mechanism of spermatogenesis and oogenesis with special reference to vitellogenesis.	6	Lecture -3, Video demo - 3
3.3	Metamorphosis - types of larvae and pupae.	6	Lecture - 3, video demo - 3
UNIT IV			
4.1	Life Cycle, rearing and economic importance of honey bee, lac insect	8	Lecture - 5, Video/Field

					visit - 3
4.2	Life Cycle, rearing and economic importance of silk worm	4			Lecture - 2, Video/Field visit-2
4.3	Life cycle and control measures of *Schistoceragregaria, Leptocoryzaacuta, Triboliumcastaneum*.	6			Lecture - 3,
UNIT V					
5.1	Vector borne diseases - Malarial and Dengue vectors	6			Lecture-4,
5.2	Methods of insect control - Principles and methods of pest control - physical, mechanical, chemical and biological control	6			Seminar -4, Group activity - 2
5.3	Integrated Pest Management.	6			Lecture-5, Video demo-1

Course Outcomes (Cos)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO 1	4	3	3	3	3	4	3	3	4	4	3	4	3.41
CO 2	4	3	4	3	3	4	4	4	3	4	3	3	3.5
CO 3	4	3	3	3	3	4	4	4	3	3	3	4	3.41
CO 4	4	4	4	4	4	4	4	4	5	4	4	5	4.16
CO 5	5	5	4	5	5	5	4	4	5	4	4	5	4.25
Mean overall score													**3.74**

Result: The score for this course is 3.74 (High relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High

$$\text{Mean Score of Cos} = \frac{\text{Total of Value}}{\text{Total No. of Pos \& PSOs}}$$

$$\text{Mean Overall Score of Cos} = \frac{\text{Total of Mean Score}}{\text{Total No. of Cos}}$$

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUTION	30%	30%

Programme : M.Sc. ZOOLOGY	Course Type : CC - XV
Semester : IV	Hours : 5/W 75/S
Subject Code : P22CZ815	Credits : 4

TITLE OF THE PAPER: BIODIVERSITY AND CONSERVATION STRATEGIES

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL	ICT
	5	2	-	2	1

PREAMBLE:

This course helps to understand the benefits and values associated with biodiversity and gain knowledge on the scientific and technical concepts and skills relating to biodiversity.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Understand, describe the concepts of biodiversity	1	17	K2
CO2: Outline the sources and values of biodiversity and list down the benefits.	2	16	K2
CO3: Explain and analyze the megadiversity zone in India and discuss the threats.	3	14	K4
CO4: Discuss the methods and types of biodiversity conservation	4	15	K2
CO5: Understand and describe the Biodiversity Act - organizations involved	5	13	K3

SYLLABUS

UNIT I:

Biodiversity - types - Genetic, species and ecosystem. Regional, national and global patterns of biodiversity - α, β and γ. Evenness, abundance, richness and biodiversity indices. Ecosystem diversity.

UNIT II:

Sources and values of biodiversity - food, drugs, medicines, industry. Ecotourism – aesthetic, cultural and scientific benefits of biodiversity – ecosystem services – ecosystem functioning.

UNIT III:

India - A mega biodiversity zone – Hotspots in India. Endemic species, endangered species,

Vavilovian centres of origin. Key stone species, IUCN, Red Data Book - Threats to biodiversity - species extinction.

UNIT IV:

Conservation of biodiversity - types of conservation management - *In-situ* - Wild life sanctuaries, national parks, sacred grooves, botanical and zoological gardens. *Ex-situ* - Tissue culture and gene Bank - challenges in conservation of biodiversity - Land and water

UNIT V:

Biodiversity conservation - Biodiversity Act - organizations involved - India -global - Future Conservation strategies for India – carrying capacity of the system. Enhancement of the protected areas – Stress on Integrated Development Research impetus - types - strategies opportunities and options.

❖ Field Trip to Wild life and Biodiversity Conservation Centres.

TEXT BOOK:

Joshi PC and Namita J. Biodiversity and Conservation. APH Pub., New Delhi, 2004

REFERENCE BOOKS:

1. Biswas S. Indian biodiversity for the present millennium - Global prospect and perspectives. Satish Serial Pub., New Delhi, 2006
2. Krishnamoorthy KV. Introduction to Biodiversity. Oxford and IBH, 2003
3. Dadhich LK and Sharma AP. Biodiversity strategies for conservation. APH PUB., New Delhi, 2002

Course Designer: DR. G. SASI REKA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1			
1.1	Biodiversity - types - Genetic, species and ecosystem. Regional, national and global patterns of biodiversity - α, β and γ. Evenness, abundance, richness and biodiversity indices.	6	Lecture - 6

	Ecosystem diversity.		
1.2	Regional, national and global patterns of biodiversity - α, β and γ. Evenness, abundance, richness and biodiversity indices. Ecosystem diversity.	7	Lecture - 5 ICT - 2
1.3	Ecosystem diversity	4	Lecture - 4
UNIT II			
2.1	Sources and values of biodiversity - food, drugs, medicines, industry.	3	Lecture - 3
2.2	Ecotourism – aesthetic, cultural and scientific benefits of biodiversity – ecosystem services – ecosystem functioning	5	Lecture - 2 Tutorial - 2 Video - 1
2.3	Ecosystem services	4	Lecture - 3 ICT - 1
2.4	Ecosystem functioning.	4	Lecture - 2 Tutorial - 2
UNIT III			
3.1	India - A mega biodiversity zone	4	Lecture - 2 Tutorial - 2
3.2	Hotspots in India. Endemic species, endangered species, Vaviloviancentres of origin.	4	Lecture - 2 Tutorial - 2
3.3	Key stone species, IUCN, Red Data Book	4	Lecture - 2 Tutorial - 2
3.4	Threats to biodiversity - species extinction	2	Lecture - 2
UNIT IV			
4.1	Conservation of biodiversity - types of conservation management - *In-situ* - Wild life sanctuaries, national parks, sacred grooves, botanical and zoological gardens.	7	Lecture - 5 Tutorial - 2
4.2	*Ex-situ* - Tissue culture and gene Bank	4	Lecture - 2 Tutorial - 2
4.3	Challenges in conservation of biodiversity - Land and water	4	Lecture - 2 Tutorial - 2
UNIT V			
5.1	Biodiversity conservation - Biodiversity Act - organizations involved - India -global	5	Lecture - 2 Tutorial - 2 ICT - 1
5.2	Future Conservation strategies for India – carrying capacity of the system.	4	Lecture - 3 ICT - 1

5.3	Enhancement of the protected areas – Stress on Integrated Development Research impetus - types - strategies opportunities and options.	4	Lecture - 4

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	4	4	4	4	4	3	3	4	4	4
CO2	4	4	4	4	4	4	4	4	4	4	4	4	4
CO3	4	4	4	4	4	4	4	4	4	4	4	4	4
CO4	4	4	4	4	4	4	4	4	4	4	4	4	4
CO5	3	4	3	4	4	4	4	4	4	4	4	4	4
Mean Overall Score													**4**

Result: The Score for this Course is 4.0 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of POs & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
ANALYSE	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type : DSEC - IV
Semester	: IV	Hours	: 5/W 75/S
Subject Code	: P22DSZ4A	Credits	: 4

TITLE OF THE PAPER: FORENSIC BIOLOGY

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDOES/TUTORIAL
	5	2	2	1

PREAMBLE:

To introduce the students the basic concepts of forensics and crime related applications and to create awareness about the legal aspects of forensic law and cyber crime.

COURSE OUTCOME At the end of the Semester, the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: List & categorize forensic evidences and crime scene identity; analyze and relate socio economic offences to the present societal scenario	I	14	K1
CO2: Classify finger prints, describe post mortem changes, understand and interpret blood group and DNA paternity test	II	15	K2
CO3: Generalize and explain about insects of forensics, venoms and poisons. Discuss and summarize related medico-legal issues	III	16	K2
CO4: Classify narcotic drugs and cosmetics; Associate the symptoms and explain its effects on humans	IV	15	K3
CO5: Distinguish and apply information technology and legal aspects related to forensics; gain knowledge about Enforcement agencies	V	15	K4

SYLLABUS

UNIT I:

Scope of forensics - history - evidences and their classification - specific socio economic offences against human body, property, terrorism, pollution, adulteration - crime scene - establishment of identity.

UNIT II:

Finger printing - primary classification and computerized prints - Types of injuries wounds - signs and symptoms of death time - post mortem changes- Blood stains, grouping, and identification- disputed paternity and DNA tests.

UNIT III:

Forensic entomology and forensic medicine - biology of insects of forensic importance - study of maggots – sarcophagi - venoms and poisons - Medico legal issues of organ transplantation - organ racketing - euthanasia- sexual offences- rape, semen analysis.

UNIT IV:

Food poisons and narcoanalysis - classification and sources of drugs, narcotics, cosmetics and abortificients- physiological and psychological effects - toxic nature of poisoning - sources of poisons - Narco analysis.

UNIT V:

Information technology and legal aspects - cyber crime - law of robotics - super imposing techniques - e-com and intelligent systems - laws of copyrights and patents. Forensic sourcing - Enforcement agencies - public and private - police, CBI - National Institute of criminology and forensic science - Interpol, prisons and rehabilitation.

TEXT BOOKS:

1. Forensic Biology, Lesson notes prepared by DDE, Madurai Kamaraj University,

2014

REFERENCE BOOKS:

1. Ignatius, P.C, Forensic Medicine and Toxicology, 2nd edn, Letterwave Books, 2016

Course Designer: DR. D. HELEN CHRISTINA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	PRACT. HOURS	MODE OF TEACHING
UNIT I			
1.1	Scope of forensics - history - evidences and their classification	4	Lecture - 3 GD -1
1.2	Specific socio economic offences against human body, property, terrorism, pollution, adulteration	5	Lecture -3, Peer teaching - 1, GD -1
1.3	Crime scene - establishment of identity.	5	Lecture - 4 , GD -1
UNIT II			
2.1	Finger printing - primary classification and computerized prints	2	Lecture -1, Video -1
2.2	Types of injuries - wounds - signs and symptoms of death time	5	Lecture - 4, Peer teaching-1
2.3	Post mortem changes, Blood stains, grouping, and identification	4	Lecture - 3, Peer teaching-1
2.4	Disputed paternity and DNA tests	4	Lecture - 2, Peer teaching-1

UNIT III			
3.1	Forensic entomology and forensic medicine - biology of insects of forensic importance - study of maggots	3	Lecture - 3
3.2	Sarcophagi - venoms and poisons	5	Lecture - 3, Video - 2
3.3	Medico legal issues of organ transplantation - organ racketing	4	Lecture - 3, Peer teaching-1
3.4	Euthanasia, Sexual offences - rape, semen analysis	4	Lecture - 4
UNIT IV			
4.1	Food poisons and narcoanalysis - classification and sources of drugs, narcotics, cosmetics and abortificients	5	Lecture -3, GD - 2
4.2	Physiological and psychological effects	3	Lecture -2, Peer teaching-1
4.3	Toxic nature of poisoning - sources of poisons	4	Lecture - 3, ICT - 1
4.4	Narco analysis	3	Lecture - 3
UNIT V			
5.1	Information technology and legal aspects - cybercrime - law of robotics	5	Lecture - 4, ICT -1
5.2	Super imposing techniques - e-com and intelligent systems	4	Lecture - 2, ICT - 2
5.3	Laws of copyrights and Patents	2	Lecture - 2,
5.4	Forensic sourcing - Enforcement agencies - public and private - police, CBI - National Institute of criminology	4	Lecture - 3,

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	-	-	5	-	5	4	-	3	4	4	-	2.4
CO2	5	-	5	4	-	5	-	4	3	4	4	-	2.8
CO3	5	-	3	4	-	5	-	4	3	4	3	-	2.6
CO4	5	-	-	3	5	5	-	4	3	4	3	-	2.6
CO5	5	-	-	4	5	4	-	4	-	5	4	-	2.6
Mean Overall Score													2.6

Result: The Score for this Course is 2.6 (Medium Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs = Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
EVALUATION	30%	30%

Programme	: M. Sc. ZOOLOGY	Course Type	: DSEC - IV
Semester	: IV	Hours	: 5/W 75/S
Subject Code	: P22DSZ4B	Credits	: 4

TITLE OF THE PAPER : ANIMAL BEHAVIOUR

Pedagogy	Hours	Lecture	Peer Teaching	GD/VIDEOS/TUTORIAL
	5	2	1	2

PREAMBLE:

The course will provide basic knowledge on the broad field of Animal Behaviour and to learn about the behavioural pattern in various group of animals

COURSE OUTCOME At the end of the Semester the Students will be able to	Unit	Hrs P/S	Knowledge Level
CO1: Acquire knowledge of fundamental concepts in animal behavior and to know about the pioneers and significance of animal behavior relating inheritance and relationships	I	15	K1
CO2: Explain and integrate thinking skills in communication and ecological aspects of orientation ,habit selection and aggression of Animal behavior	II	15	K3
CO3: Relate habituation, conditioning and reasoning behavior of Animals	III	15	K4
CO4: Understand the proximate control of hormones of animal behavior and to gain depth knowledge in motivation and aggregation of animals	IV	15	K2
CO5: To relate theory and practical knowledge , emphasizing animal communication and social behavior to solve problems in society	V	15	K4

SYLLABUS

UNIT I:

Behaviour - Types and mechanism of animal behaviour. Pioneers of animal behavior - Karl von Frisch, Konard Lorenz and Nikolaas Tinbergen. Significance of animal behaviour. Reflexes and complex behaviour. Evolution and ultimate causation- Inheritance behaviour and relationships

UNIT II:

Communication - Chemical, visual, olfactory and auditory, species specificity of songs, evolution of language in primates. Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defences, aggression, homing territoriality, dispersal, host parasite relations.

UNIT III:

Biological rhythms – Circadian, Lunar and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds. Learning and memory Conditioning, habituation, insight learning, association learning and reasoning.

UNIT IV:

Neural and hormonal control of behaviour. Genetic and environmental components in the development of behaviour. Motivation: Drive, timing and interaction of drives, physiological basis of motivation, hormones and motivation, aggregation.

UNIT V:

Reproductive behavior - Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection, parental care. Social behaviour, aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness , social organization in insects and primates.

TEXT BOOK:

1. Agarwal VK. Animal Behaviour (Ethology). S. Chand Pub., New Delhi, 2013

REFERENCE BOOKS:

2. Lcock J. An Evolutionary Approach. Sinauer Association, Sunderland, Mass, USA, 2013

3. Bradbury JW and Vehrencamp SL. Principles of Animal Communication. Sinauer

Association, Sunderland, Mass, US, 2011

4. Clutton-Brock TH. The Evolution of Parental Care. Princeton University Press, Princeton, NJ, USA, 2012

Course Designer: DR. C. RANI VIJAYA

COURSE CONTENTS AND LECTURE SCHEDULE

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I			
1.1	Behaviour - Types and mechanism of animal behaviour. Pioneers of animal behavior - Karl von Frisch, Konard Lorenz and Nikolaas Tinbergen	3	Lecture -2, Peer Teaching-1
1.2	Pioneers of animal behavior - Karl von Frisch, Konard Lorenz and Nikolaas Tinbergen	2	Lecture -1, Peer teaching-1
1.3	Significance of animal behaviour. Reflexes and complex behaviour.	5	Lecture -30, GD – 2
1.4	Evolution and ultimate causation	2	Lecture -2
1.5	Inheritance behaviour and relationships.	3	Lecture -2, GD 1
UNIT II			
2.1	Communication - Chemical, visual, olfactory and auditory	3	Lecture -2, GD-1
2.2	Species specificity of songs, evolution of language in primates.	3	Lecture -2, Video - 1
2.2	Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defences,	4	Lecture-2, Video - 2
2.3	Aggression, homing territoriality, dispersal, host parasite relations.	5	Lecture -3, Video -2
UNIT III			
3.1	Biological rhythms - Circadian and circannual rhythms	5	Lecture -3, GD 2
3.2	Orientation and navigation, migration of fishes, turtles and birds.	4	Lecture -2, Video-2

3.3	Learning and memory	2	Lecture -2
3.4	Memory Conditioning, habituation, insight learning, association learning and reasoning.	4	Lecture -3, Video -1
UNIT IV			
4.1	Neural control of behaviour	3	Lecture-3
4.2	Hormonal control of behaviour	2	Lecture - 2
4.3	Genetic and environmental components in the development of behaviour.	3	Lecture-2, Peer teaching -1
4.4	Motivation: Drive, timing and interaction of drives, physiological basis of motivation,	4	Lecture-2, GD -2
4.5	Hormones and motivation, aggregation	3	Lecture-2, Peer teaching-1
UNIT V			
5.1	Reproductive behavior - Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection, parental care.	5	Lecture-3, Video -2
5.2	Social behaviour, aggregations, schooling in fishes	3	Lecture – 2, Video -1
5.3	Flocking in birds, herding in mammals	2	Lecture-2
5.4	Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness	3	Lecture -3
5.5	Social organization in insects and primates.	2	Lecture-2

Course Outcomes (COs)	Programme outcomes (POs)					Programme specific outcomes (PSOs)							Mean scores of COs
	PO1	PO 2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	5	-	3	3	-	4	-	3	3	3	-	-	2.08
CO2	5	4	3	-	3	4	3	4	-	3	-	-	2.25
CO3	4	-	4	3	-	-	3	4	4	-	4	-	2.16
CO4	5	-	4	4	-	4	3	4	-	5	-	-	2.4
CO5	5	-	5	-	4	-	4	3	3	5	5	-	2.8
Mean overall score													**2.3**

Result: The score for this course is 2.3 (Medium relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = Total of Value Total No. of Pos & PSOs			Mean Overall Score of COs =Total of Mean Score Total No. of COs		

BLOOM'S TAXANOMY	INTERNAL	EXTERNAL
KNOWLEDGE	20%	20%
UNDERSTANDING	20%	20%
APPLY	30%	30%
ANALYSE	30%	30%