

E.M.G. YADAVA WOMENS COLLEGE, MADURAI -14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)

Re –accredited (3rd cycle) with Grade A⁺ and CGPA 3.51 by NAAC**TANSICHE – CBCS with OBE****DEPARTMENT OF ZOOLOGY – UG**

(with Allied Chemistry and Allied Botany)

(w.e.f. 2023-2024 batch onwards)

COURSE STRUCTURE

Semester	Part	Course Code	Course Title	Teaching hrs (per week)	Duration of Exam (hrs.)	Marks Allotted			Credits
						CIA	SE	Total	
I	I	23OU1TA1/ 23OU1HIN1/ 23OU1FR1	Tamil / Hindi/ French	6	3	25	75	100	3
	II	23OU2EN1	General English -I	6	3	25	75	100	3
	III	23OUZO11	Core Course 1: Invertebrata	5	3	25	75	100	5
		23OUZO1P	Core lab 1: Lab in Invertebrata	3	3	40	60	100	3
		23OUZOGECH1	GEC 1: Chemistry for Biological Sciences -I	4	3	25	75	100	3
		23OUZOGECH1P	GEC Lab 1: Chemistry Practical for Biological Sciences -I	2	3	40	60	100	2
	IV	23OUZOSECN1	SEC 1 (NME) : Ornamental Fish Farming and Management	2	3	25	75	100	2
		23OUZOFC1	FC: Foundation Course in Zoology	2	3	25	75	100	2
		TOTAL		30					23
II	I	23OU1TA2/ 23OU1HIN2/ 23OU1FR2	Tamil / Hindi/ French /	6	3	25	75	100	3
	II	23OU2EN2	General English - II	6	3	25	75	100	3
	III	23OUZO21	Core Course 2: Chordata	5	3	25	75	100	5
		23OUZO2P	Core Lab 2: Lab in Chordata	3	3	40	60	100	3
		23OUZOGECH2	GEC 2: Chemistry for Biological Sciences -II	4	3	25	75	100	3
		23OUZOGECH2P	GEC lab 2 : Chemistry Practical for Biological Sciences -II	2	3	40	60	100	2
	IV	23OUZOSECN2	SEC 2 (NME) : Basic Course in Ornithology	2	3	25	75	100	2
		23OUZOSEC3	SEC 3 : Basics of Marine Biology	2	3	25	75	100	2
		TOTAL		30					23

III	I	23OU1TA3/ 23OU1HIN3/ 23OU1FR3	Tamil / Hindi/ French	6	3	25	75	100	3
	II	23OU2EN3	General English -I	6	3	25	75	100	3
	III	23OUZO31	Core Course 3: Cell Biology	5	3	25	75	100	5
		23OUZO3P	Core lab 3: Lab in Cell Biology & Bio instrumentation	3	3	40	60	100	3
		23OUZOGEB03	GEC 3: Allied Botany –I Plant Biology - I	4	3	25	75	100	3
		23OUZOGEB03P	GEC Lab 3: Allied Botany –I Lab in Plant Biology - I	2	3	40	60	100	2
	IV	23OUZOSEC31	SEC 4 : Bioinstrumentation	2	3	25	75	100	2
		23OUZOSEC32	SEC 5: Economic Zoology	1	2	25	75	100	1
			Environmental Studies	1	-	-	-	-	-
			TOTAL	30					22
IV	I	23OU1TA4/ 23OU1HIN4/ 23OU1FR4	Tamil / Hindi/ French	6	3	25	75	100	3
	II	23OU2EN4	General English - II	6	3	25	75	100	3
	III	23OUZO41	Core Course 4: Developmental Biology	4	3	25	75	100	5
		23OUZO4P	Core Lab 4: Lab in developmental biology& Agricultural Entomology	3	3	40	60	100	3
		23OUZOGEB04	GEC 4: Allied Botany –II Plant Biology - II	4	3	25	75	100	3
		23OUZOGEB04P	GEC lab 4: Allied Botany –II Lab in Plant Biology - II	2	3	40	60	100	2
	IV	23OUZOSEC41	SEC 6 : Agricultural entomology	2	3	25	75	100	2
		23OUZOSEC42	SEC 7 : Medical Laboratory Techniques	2	3	25	75	100	2
		23OU4EV4	Environmental Studies	1	2	25	75	100	2
			TOTAL	30					25
V	III	23OUZO51	Core Course 5 – Genetics and Molecular Biology	5	3	25	75	100	4
		23OUZO52	Core Course 6 – Animal Physiology	5	3	25	75	100	4
		23OUZO53	Core Course 7 – Biochemis try	5	3	25	75	100	4
		23OUZO51P	Core Lab 5 – Lab in Genetics, Molecular Biology, Animal Physiology, Biochemistry, Bio composting for Entrepreneurship and Animal behavior	7	3	40	60	100	4
			DSEC I	3	3	25	75	100	3
			DSEC II	3	3	25	75	100	3
	IV	23OU4VE5	Value Education	2	3	25	75	100	2
		23OUZOIN5	Internship/Industrial training (Summer vacation at the end of IV semester)	-	-	-	-	-	2

			TOTAL	30					26
VI	III	23OUZO61	Core Course 8- Animal Biotechnology	6	3	25	75	100	4
		23OUZO62	Core Course 9 -Microbiology and Immunology	6	3	25	75	100	4
		23OUZO63	Core Course 10-Ecology and Evolution	6	3	25	75	100	4
		23OUZO61P	Core Lab 6 :Lab in Animal Biotechnology and Microbiology and Immunology	4	3	40	60	100	2
		23OUZODSEPR6A/ 23OUZODSE6B	DSEC III Project with Viva- voce / Wild life conservation and Management	3	- 3	20 25	80 75	100	2
		23OUZODSE6CP	DSEC IV :Lab in Ecology and Evolution, Biostatistics and Bioinformatics	3	3	40	60	100	2
	IV	23OUZOSEC6	SEC 8: Biophysics, Biostatistics and Bioinformatics	2	3	25	75	100	2
			TOTAL	30					20
	V	23OU5PE6/ 23OU5NS6	Extension Activity Physical Education / NSS (I & II UG students)	-	-	-	-	-	1
			TOTAL						140

Semester - V (DSEC– I & II – Choose any two)

1. Biocomposting for Entrepreneurship - 23OUZODSE5A
2. Animal behavior - 23OUZODSE5B
3. Nanobiology - 23OUZODSE5C

Semester- VI (DSEC - III - Choose any one)

1. Project work with Viva –Voce - 23OUZODSEPR6A
2. Wild Life Conservation and Management - 23OUZODSE6B

Note :

FC: Foundation Course

GEC: Generic Elective Course

SEC: Skill Enhancement Course

DSEC: Discipline Specific Elective Course

Year	Semester	Nature of Course	Course code	Title of the Course	Hours	Offered to
I	I	Add on Course	22ZOAOC 22ZOAACP	Entrepreneurial bee keeping Lab in Entrepreneurial bee keeping	30	I B.Sc., Zoology
II	III & IV	Certificate Course	23ZC1 23ZCP 25BOC 25BOCP	1. Theory : Vermitechnology Lab in Vermitechnology 2.Theory : Horticulture Lab in Horticulture	90 90	II year students of all other disciplines II year students of all other disciplines (2025 -26 Batch onwards)
III	V	Value Added Course	25ZOVAC 25ZOVACP	Fundamentals of Health care –ITES (FH -ITES) Lab in Fundamentals of Health care –ITES (FH -ITES)	30	III B.Sc., Zoology (2025- 26 Batch onwards)

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	Core Course 5	23OUZO51	Genetics and Molecular Biology	4	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To comprehend the importance of genetic variation in evolution.
2. To know about the harmful effects of genetic variations in humans, their cumulative effect in human population and the molecular basis of variations.
3. To understand pedigree analysis and its importance to diseases.
4. To understand the structure and functions of nucleic acids in the cell.
5. To know the causes and effects of mutations.

Unit - I Mendelian experiments and Laws of Inheritance: Monohybrid cross and Di-hybrid cross in pea plant – Law of Segregation, Law of Independent Assortment. Back cross and Test Cross. Gene interactions : Complementary genes: Flower colour in sweet peas, Supplementary genes: Coat colour in mice, Epistasis: Plumage colour in poultry.

Unit - II Linkage and Crossing over: Linkage in Drosophila, Linkage types. Crossing over in Drosophila- Mechanism and types of crossing over - Sex linkage: Sex linked inheritance in man - Haemophilia and colour blindness. Sex determination: Chromosomal theory of sex determination- XX-XY, XX-XO types, Genic balance theory of Bridges, Environment and Sex determination, Hormonal control of sex determination (free martin).

Unit - III Chromosomal aberrations: Definition, Deletions, Duplications, Translocations and Inversions, Euploidy (Monoploidy, Polyploidy) and Aneuploidy (Monosomes, Nullisomes and Trisomes). Extra Chromosomal Inheritance: Kappa particles (Paramecium). Pedigree Analysis : Symbols used in pedigree analysis; Pedigree analysis of important genetic disease like Hemophilia. Human Chromosomes: Normal human Karyotype, Syndromes: Allosomal (Klinefelter's syndrome and Turner's syndrome) Autosomal (Down's syndrome). Eugenics, Euthenics and genetic counselling. Genetics and society: Human genome project.

Unit - IV Nucleic Acid: DNA Structure, Types and Replication – RNA Types and Structure – Chemical basis of heredity- Experimental Proof of DNA and RNA as genetic material. Gene

Mutation: Types of gene mutations. Genetics of bacteria - Recombination in bacteria, Transformation, Conjugation, Transduction and Sexduction.

Unit -V Genetic Code: Features of Genetic code. Gene Action: Protein Synthesis – Transcription and Translation in Prokaryotes – Regulation of Gene Expression in Prokaryotes – Operon Concept (Lac Operon). Insertional elements and transposons – Transposon elements in *Drosophila*.

Books for Study:

1. David E Sadava., (1993) “*Cell Biology - Organelle Structure and Function*”, Jones Bartlett Publishers.
2. Gupta G. K., (2013). “*Genetics Classical to Modern*”, Rastogi publishers, Meerut.
3. Veer Bala Rastogi., (2019). “*Text Book of Genetics*”, Med tech
4. Verma P.S and Agarwal V.K., (2006). “*Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*”, S. Chand & Company Ltd.

Books for Reference:

1. Cooper, Geoffrey M., (2018) “*The cell: A Molecular Approach*”, Eighth Edition, Oxford University Press.
2. De Robertis, E. D. P and Robertis.E.M.F., (2017). “*Cell and Molecular Biology*”, 8th Edition, Lea & Febiger, U.S.
3. Dobzhansky T., (1982). “*Genetics and The Origin of Species*”, Columbia University.
4. Fletcher H and Hickey I., (2015). “*Genetics*”, IV Edition. GS, Taylor and Francis Group, New York and London.
5. Gardner, Anne., (2009). “*Human Genetics*”, Scion Publishing Ltd.

Web Resources:

1. <https://go.nature.com/2XE8V1>
2. <https://bit.ly/3zoTt6B>
3. <https://bit.ly/2XAm7oa>
4. <https://bit.ly/2XEbhxi>
5. <https://bit.ly/3AB4bso>
6. <https://bit.ly/39pZSE4>
7. <https://www.genome.gov/genetics-glossary/Sex-Linked>
8. <https://www.vedantu.com/biology/mutagens>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students aware of human genetics and molecular biology.

Activities to be given: Students shall be grouped into different groups and make them speak details of syndromes.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	Understand the basis of inheritance and expression of genes.	K1 to K3
CLO2	Correlate changes in genetic makeup and phenotypic changes in progeny.	K1 to K3
CLO3	Analyze the causes of variations in genetic material and predict the effect in a population using different techniques.	K1 to K4
CLO4	Explain the role of cellular processes and different genetic elements in the expression of genes.	K1 to K3
CLO5	Compile the factors which contribute to changes in gene expression and specify the changes which contribute to evolution.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level**2- Intermediate Level****3- Advanced Level**

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Mendelian experiments and Laws of Inheritance: Monohybrid cross and Di-hybrid cross in pea plant – Law of Segregation, Law of Independent Assortment. Back cross and Test Cross. Gene interactions : Complementary genes: Flower colour in sweet peas. Supplementary genes: Coat colour in mice. Epistasis: Plumage colour in poultry.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Linkage and Crossing over: Linkage in Drosophila, Linkage types. Crossing over in Drosophila- Mechanism and types of crossing over - Sex linkage: Sex linked inheritance in man - Haemophilia and colour blindness. Sex determination: Chromosomal theory of sex determination- XX-XY, XX-XO types, Genic balance theory of Bridges, Environment and Sex determination, Hormonal control of sex determination (free martin).	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Chromosomal aberrations (Deletions, Duplications, Translocations and Inversions)- Euploidy (Monoploidy, Polyploidy) and Aneuploidy (Monosomes, Nullisomes and Trisomes)-Extra Chromosomal Inheritance: Kappa particles (Paramecium) and Plastid (Mirabilis). Pedigree studies: Symbols used in pedigree analysis- Pedigree analysis of important genetic disease like Hemophilia. Human Chromosomes: Normal human Karyotype, Inherited disorders: Allosomal (Klinefelter's syndrome and Tuners syndrome) Autosomal (Down syndrome). Eugenies and Euthenics and genetic counselling. Genetics and society: Human genome project. Mendelian Traits in human.	15	Chalk and Talk, PPT, group discussion , OHP
IV	Nucleic Acid: DNA Structure, Types and Replication – RNA Types and Structure – Chemical basis of heredity- Experimental Proof of DNA and RNA as genetic material – Gene Mutation : Types of gene mutations - Genetics of bacteria : Recombination in bacteria : Transformation, conjugation, Transduction and Sexduction.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Genetic Code: Features of Genetic code – Gene Action: Protein Synthesis – Transcription and Translation in Prokaryotes – Regulation of Gene Expression in Prokaryotes – Operon Concept (Lac Operon). Insertional elements and transposons – Transposon elements in Drosophila.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer:**Dr.(Mrs).G. Indira Rani**

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	Core Course 6	23OUZO52	Animal Physiology	4	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		

Course Objectives:

1. To familiarize students with the principles and basic facts of Animal Physiology.
2. To give students an insight about the molecular and cellular basis of physiological functions in animals.
3. To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.
4. To make the students aware about how the structure-function relationships and its synchronisation with the molecular signals.
5. To understand the effect of hormonal imbalance.

Course Content:

Unit-I Nutrition: Food and feeding mechanisms, Process of Digestion (Mechanical & Chemical digestion), Digestive enzymes and their role, absorption of carbohydrates, proteins and lipids.

Unit-II Respiration: Respiratory organs, Respiratory pigments and functions, Transport of Gases (CO₂ and O₂)- Chloride Shift and Bohr's effect. Composition, Properties and functions of Blood, Mechanism of blood clotting. Structure of human heart – Cardiac cycle, Origin of heart beat, ECG, Blood Pressure.

Unit -III Excretion: Kidney, Nephron – structure and mechanism of urine formation in mammals. Hormonal control of excretion. **Osmoregulation**–definition, Osmo-regulators, osmo-conformers, stenohaline and euryhaline organisms. Osmoregulation in fishes only-

Thermoregulation – poikilotherms & homeotherms – Hibernation, Aestivation, Diapause. Types of muscles, Structure of skeletal muscle, Mechanism of muscle contraction.

Unit-IV Nervous coordination: Neuron – Structure, types of neurons – Nerve impulse in myelinated and non- myelinated, action potential, Synapse, Synaptic transmission of Impulses, Neuromuscular junction and reflex arc. Photoreceptor – Structure of a mammalian eye, Retina

– Visual pigments, Physiology of vision. Phono receptor – Structure of mammalian ear, Mechanism of hearing, Physiology of equilibrium, Chemoreceptors.

Unit – V Endocrine glands –Definition, Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal, Islets of langerhans and Gonads.

Books for Study:

1. Agarwal R A., Anil K Srivastava., Kaushal Kumar., (1978). “*Animal Physiology and Biochemistry*”, S. Chand & Co. Ltd., New Delhi Publishing., 377 pp.
2. Berry A.K., (1998). “*A text book of Animal Physiology and Biochemistry*”. Emkay Publications, New Delhi, 320 pp.52
3. Parameswaran, Anantakrishnan and Ananta Subramanian., (1975). “*Outlines of Animal Physiology*”, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 329 p p.
4. Verma P.S., Tyagi B.S & Agarwal V.K., (2010). “*Animal Physiology*”, S. Chand & Co. Ltd., New Delhi, 417 pp.

Books for Reference:

1. Guyton, A.C. and Hall, J.B., (2011). “*Text Book of Medical Physiology*”, 9th Edition, W.B. Sanders Company, Prism Books (Pvt.) Ltd., Bangalore., 1064 pp.
2. Ganong, W.F., (2019). “*Review of Medical Physiology*”, McGraw Hill, New Delhi., 340pp.
3. SaradaSubrahmanyam, Madhavan Kutty, K., & Singh H.D., (2018). “*Text Book of Human Physiology*”, S. Chand & Co, New Delhi.
4. Singh, H.R and Kumar, N. (2017). “*Animal physiology and biochemistry*”, Vishal publishing company, Jalandhar, 864 pp.
5. Sreekumar, S. (2010). “*Basic physiology*”, PHI learning private ltd., New Delhi. 210 pp
6. Tortora G.J. & Derrickson B., (2016). “*Principles of Anatomy and Physiology*”, John Sons, Inc. 1232 pp.

Web Resources:

1. <https://microbenotes.com/category/biochemistry/>
2. <https://www.stem.org.uk/resources/collection/3931/animal-physiology>
3. <https://animalphys4e.sinauer.com>
4. <https://nptel.ac.in/courses/102/104/102104042/>
5. <https://biochem.oregonstate.edu>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students aware of physiological functions of various organs.

Activities to be given: Students shall be grouped into different groups and to undergo practical training in various instruments.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	Be able to explain how the various organ systems are coordinated and controlled.	K1 to K3
CLO2	Be able to list the functions of various organs in relation to physiological process.	K1 to K3
CLO3	Be able to develop the idea of multi-level controlling and feedback mechanism in relation to various physiological functions.	K1 to K4
CLO4	Be able to understand the basic physiological process related to adaptation, metabolism and major requirements.	K1 to K3
CLO5	Be able to correlate and understand human physiology.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Nutrition: Food and feeding mechanisms, Process of Digestion (Mechanical & Chemical digestion), Digestive enzymes and their role, absorption of carbohydrates, proteins and lipids.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Respiration: Respiratory organs, Respiratory pigments and functions, Transport of Gases (Co ₂ and O ₂)- Chloride Shift and Bohr's effect. Composition, Properties and functions of Blood, Mechanism of blood clotting. Structure of human heart – Cardiac cycle, Origin of heart beat, ECG, Blood Pressure.	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Excretion: Kidney, Nephron – structure and mechanism of urine formation in mammals. Hormonal control of excretion. Osmoregulation–definition, Osmo-regulators, osmo-conformers, stenohaline and euryhaline organisms. Osmoregulation in fishes only-Thermoregulation – poikilotherms &	15	Chalk and Talk, PPT, group discussion, OHP

	homeotherms – Hibernation, Aestivation, Diapause. Types of muscles, Structure of skeletal muscle, Mechanism of muscle contraction.		
IV	Nervous coordination: Neuron – Structure, types of neurons – Nerve impulse in myelinated and non- myelinated, action potential, Synapse, Synaptic transmission of Impulses, Neuromuscular junction and reflex arc. Photoreceptor – Structure of a mammalian eye, Retina – Visual pigments, Physiology of vision. Phono receptor – Structure of mammalian ear, Mechanism of hearing, Physiology of equilibrium, Chemoreceptors.	15	Chalk and Talk, OHP, PPT presentations, quiz,
V	Endocrine glands –Definition, Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal, Islets of langerhans and Gonads.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer:

Ms.R.S.Rajalakshmi

Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	Core Course 7	23OUZO53	Biochemistry	4	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	-

Course Objectives:

1. To Learn the structure, properties and functions of biomolecules.
2. To Understand metabolism of nucleic acid, amino acid and lipid.
3. To Appreciate the various carbohydrate metabolic pathways.
4. To Analyze enzymes and concepts of bioenergetics
5. To learn about enzyme structure, function, kinetics, and regulation, and understand how enzymes catalyze biochemical reactions.

Course content

Unit -I Introduction: Scope of Biochemistry, Acids, Bases, pH, Buffers, Electrolytes, isotopes, isomerism. Biologically important chemical bonds (Covalent Bonds, Ionic Bonds & Hydrogen Bonds) and their importance.

Unit – II Carbohydrates: Outline classification, properties and biological importance. Structure of Monosaccharide (Glucose), Disaccharide (Sucrose) and Polysaccharide (Starch). Carbohydrate metabolism – Glycolysis, Glyco genolysis and Citric acid cycle.

Unit- III Amino acids: structure and classification- Protein structure-primary, secondary and tertiary structure, Functions of proteins. Structure, function and significance of Collagen. Protein metabolism – Deamination, Transamination and Urea cycle.

Unit – IV Lipids: Structure, classification with examples – Simple lipids, Compound lipids, Derived lipid, Biological significance of lipids. Cholesterol – structure and its biological importance. Lipid metabolism – β oxidation of fatty acids.

Unit – V Enzymes- properties and classification, mechanism of enzyme action- Coenzymes and iso-enzymes– Factors affecting enzyme action (Temperature, pH, Substrate concentration. Enzyme concentration) Enzyme inhibition (Competitive Inhibition, Non-Competitive Inhibition, Allosteric Inhibition).

Books for Study:

1. Ambika Shanmugam., (2001). “*Fundamentals of Biochemistry for Medical students*”. Kartik Offset Printers, Chennai.
2. Prem Prakash Gupta. (2009). “*Text book of biochemistry*”, CBS Publishers & Distributors, New Delhi.

Books for Reference:

1. Thomas M. Devlin., (2002). “*Text book of Biochemistry with Clinical Correlations*”. 4th edition, New Delhi.
2. T. Van Bruggen., Edward Staunton West, Wilbert R. Todd, Howard S. Mason, and John., (2004). “*Text Book of Biochemistry*”. 4th edition, Oxford and IBH Publicity Co, PVT, LTD, New Delhi.
3. B.D. Hames and N.M. Hooper., (2005) “*Biochemistry*”, 3rd Edn, Taylor & Francis group Pvt. Ltd.
4. Dr. J.L. Jain, Sunjaj Jain, Nitin Jain. (2010). – “*Fundamentals of biochemistry for university and College Students in India and Abroad*” S. Chand & Company Ltd., Ram Nagar, New Delhi- 110055.
5. David.L. Nelson and Michael.M. Cox (2021). “*Lehninger’s Principles of Biochemistry*”. 8th edition, W.H. Freeman and CO., New York.

Web Resources / E.Books:

1. <https://www.youtube.com/watch?v=6xHwx6Y1TgA>
2. <https://www.youtube.com/watch?v=TVlh9OH4H3Y>
3. <https://www.youtube.com/watch?v=Bsk9hvXDJp8>
4. <https://adpcollege.ac.in/online/attendance/classnotes/files/1625570709.pdf>
5. https://www.youtube.com/watch?v=spwDq9ZG_Tg

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students aware of Biochemistry with combined knowledge of biology and chemistry, focusing on the chemical processes within living organisms.

Activities to be given: Students shall be assigned with assignment work of data collection of different biochemical studies including normal and abnormal conditions.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	To Acquire knowledge in key biochemical concepts, outlining the scope of biochemistry and its foundational chemical principles.	K1 to K3
CLO2	To be able to understand the Carbohydrates: Outline classification, properties and biological importance. Carbohydrate metabolism	K1 to K3
CLO3	To be able to understand the Amino acids-structure and classification, Protein metabolism.	K1 to K4
CLO4	To be able to understand the Biological significance of lipids. Lipid metabolism	K1 to K3
CLO5	To be able to understand the enzymes, mechanism of enzyme action and its regulation.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level**2- Intermediate Level****3- Advanced Level****LESSON PLAN: TOTAL HOURS (75 Hrs)**

UNIT	DESCRIPTION	Hrs	MODE
I	Introduction: Scope of Biochemistry, Acids, Bases, pH, Buffers, Electrolytes, isotopes, isomerism. Biologically important chemical bonds (Covalent Bonds, Ionic Bonds & Hydrogen Bonds) and their importance.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Carbohydrates: Outline classification, properties and biological importance. Structure of Monosaccharide (Glucose), Disaccharide (Sucrose) and Polysaccharide (Starch). Carbohydrate metabolism – Glycolysis, Glycolysis and Citric acid cycle.	18	Chalk and Talk, OHP quiz, on the spot test and YouTube Links
III	Amino acids: structure and classification- Protein structure-primary, secondary and tertiary structure, Functions of proteins. Structure, function and significance of Collagen. Protein metabolism – Deamination, Transamination and Urea cycle.	15	Chalk and Talk, PPT, group discussion, OHP
IV	Lipids: Structure, classification with examples – Simple lipids, Compound lipids, Derived lipid, Biological significance of lipids. Cholesterol – structure and its biological importance. Lipid metabolism – β oxidation of fatty acids.	15	Chalk and Talk, OHP, PPT presentations,

V	Enzymes- properties and classification, mechanism of enzyme action- Coenzymes and iso-enzymes– Factors affecting enzyme action (Temperature, pH, Substrate concentration. Enzyme concentration) Enzyme inhibition (Competitive Inhibition, Non-Competitive Inhibition, Allosteric Inhibition).	15	Chalk and Talk, PPT, group discussion , OHP
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Course Designer
Dr.M.A.Soniya

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/Week	CIA	SE	Total
V	DSEC	23OUZODSE5A	Biocomposting For Entrepreneurship	3	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		✓

Course Objectives:

1. To highlight the importance of Bio-composting for entrepreneurship in waste management.
2. To enable students for setting up Bio-compost units and bins for waste reduction.
3. To gain knowledge about the process of Bio-composting.
4. To demonstrate Bio-composting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc.
5. To gain knowledge about the economic cost of establishing small Bio-compost units as a cottage industry.

Course Content:

Unit – I Bio-composting: Definition, types and ecological importance. Compost and Vermicomposting – Differences.

Unit – II Types: Bio-composting technology – Field pits and bed using different amendments -ground heaps, tank, large-scale, batch and continuous methods.

Unit – III Vermiculture: scope and importance -Types and ecological classifications of earthworms – Physical, chemical and biological changes caused by earthworms in the soil – Natural enemies of earthworms. Harvesting of vermicompost, vermicast, vermiwash and its applications.

Unit – IV Applications of Bio-compost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction- -Essential parameters for vermiculture: bedding, worm food, moisture, aeration and temperature control.

Unit – V Economics of establishment of a small bio-compost unit – project report proposal for Self Help Group, Packing and marketing of Bio-compost.

Books for Study:

1. Lekshmy, M. S., Santhi R. (2012) “*Vermitechnology*”, Sara Publications, New Delhi, India.
2. Van der Wurff, A.W.G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J. (2016). “*Handbook for Composting and Compost Use in Organic Horticulture*”. Bio Greenhouse COST Action FA 1105

Books for Reference:

1. Bhatt J. V. & S. R. Khambata (1959) “*Role of Earthworms in Agriculture*” Indian Council of Agricultural Research, New Delhi.
2. Edwards, C.A. and J.R. Lofty (1977) “*Biology of Earthworms*” Chapman and Hall Ltd., London.
3. Lee, K.E. (1985) “*Earthworms: Their ecology and Relationship with Soils and Land Use*” Academic Press, Sydney.
4. Satchel, J.E. (1983) “*Earthworm Ecology*” Chapman Hall, London.
5. Dash, M. C. (2012) “*Charles Darwin’s Plough Tool for Vermitechnology*”, I. K. International Publishing House Pvt Ltd. New Delhi, India.

Web Resources:

- <https://www.youtube.com/watch?v=g4LnpHGGF6c>
- <https://www.youtube.com/watch?v=w75w5Jzipqc>
- <https://www.bhumipublishing.com/wp-content/uploads/2025/04/Textbook-of-Vermiculture-and-Vermicomposting.pdf>
- https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students learn types and ecological importance of Vermicomposting and Applications of Bio-composting technology.

Activities to be given: Students shall be assigned to prepare a Report after visiting a vermicomposting unit.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom’s Taxonomy (Upto K level)
CLO1	The students will gain knowledge about the process of Biocomposting	K1 to K3
CLO2	To Acquire knowledge in various Types of Bio-composting technology	K1 to K3
CLO3	Distinguish between Vermicompost, Vermiwash and Vermicast	K1 to K4

CLO4	Students will be able to demonstrate Biocomposting techniques for various end applications like solid waste management, industrial waste recycling using sugarcane bagasse, etc.	K1 to K3
CLO5	To gain knowledge about the economic cost of establishing small Biocompost units as a cottage industry	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Bio-composting – Definition, types and ecological importance, Compost and Vermicomposting – Differences.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Types of Bio-composting technology – Field pits and bed using different amendments /ground heaps / tank / large-scale / batch and continuous methods.	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Vermiculture: scope and importance -Types and ecological classifications of earthworms – Physical, chemical and biological changes caused by earthworms in the soil – Natural enemies of earthworms. Harvesting of vermicompost, vermicast, vermiwash and its applications.	15	Chalk and Talk, PPT, group discussion, OHP
IV	Applications of Bio-compost in soil fertility maintenance, promotion of plant growth, value added products, waste reduction- -Essential parameters for vermiculture: bedding, worm food, moisture, aeration and temperature control.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Economics of establishment of a small bio-compost unit – project report proposal for Self Help Group, Packing and marketing of Bio-compost.	15	Chalk and Talk, PPT, group discussion, OHP

Course Designer
Dr.M.A.Soniya

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	DSEC	23OUZODSE5B	Animal Behaviour	3	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	-

Course Objectives:

1. To learn the origin and development of animal behaviour and to understand the influence of genetics, environment on animal behaviours.
2. To understand the biological properties of animal behaviour, with an evolutionary and ecological emphasis.
3. To Compare innate and learned behaviour and differentiate between various mating system.
4. To impart the knowledge about visual and auditory communication; courtship, mate choice, and mating systems; social behaviour and social systems; and animal personality.
5. To discuss how movement and migration behaviours are a result of natural selection

Course Content:

Unit - I Introduction to Animal Behaviour: Origin and history of Ethology; Profiles of Karl Von Frish, Ivan Pavlov. Mechanism of Behaviour, Proximate and causes of behaviour, Methods and recording of a behavior.

Unit - II Innate Behaviour: Characteristics, Types – Tropism, Orientation - Kinesis & Taxis, Instincts – Fixed Action Patterns (FAP), Instincts as the Neuromotor apparatus, Reflexes - Tonic reflexes & Phasic reflexes and Motivation – Intrinsic & Extrinsic motivation.

Unit - III Learned Behaviour: Classification – Non Associative Learning - Habituation, Sensitization, Associative Learning - Classical conditioning and Operant conditioning (Trial & Error learning), Phase specific learning - Imprinting and Insight learning - Reasoning & Intelligence.

Unit - IV Social and Complex Behaviour: Sexual selection, pheromones of importance, Altruism, Communication- Definition, components and Types of communication - Visual communication, Auditory communication, Tactile communication, Olfactory communication and Echolocation, Decision making behaviour in Animals, Mechanism of Decision making, Defensive behavior in octopus, Courtship display in Great Crested Grebe, Social behavior in Elephants.

Unit - V Chronobiology: Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Photoreception and photo- transduction. The biological clock and measurement of day length, The relevance of biological clocks for human welfare - Clock function (dysfunction)- Tidal rhythms and Lunar rhythms.

Books for Study:

1. David McFarland.,(1985). “*Animal Behaviour*”, Longman Scientific & Technical, UK.576pp.
2. Harjindra Singh.,(1990). “*A Text Book of Animal Behaviour*”, Anomol Publication,293pp.
3. Hoshang .S.Gundevia and Hare Goving Singh.,(1996). “*Animal Behaviour*”, S.Chand&Co, 280pp.

Books for Reference:

1. Michael D. Breed and Janice Moore., (2012). “*Animal Behaviour*”, Academic Press, USA, 359pp.
2. Aubrey Manning and Martin Stamp Dawkins., (2012). “*An Introduction to Animal Behaviour*”, 6th Edition, Cambridge University Press, UK. 458pp.
3. Davis E.Davis, 1970. “*Integral Animal Behaviour*”, Mac Millan Company, London,118pp.
4. Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. “*Chronobiology Biological time Keeping*”, Sinauer Associates Inc, Publishers, Sunderland, MA.
5. Vinod Kumar, (2002). “*Biological Rhythms*”. Narosa Publishing House, Delhi.

Web Resources:

1. <https://www.ncbs.res.in/content/animal-behaviour>
2. <https://bit.ly/3i6wUxR>
3. <https://www.behaviour.univie.ac.at/>
4. <https://www.ru.nl/bsi/>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students learn the behavior of animals in their habitats.

Activities to be given: Students shall be taken to nearest forest area for animal observation.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom’s Taxonomy (Upto K level)
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CLO1	Recall and record genetic basis and evolutionary history of behaviour.	K1 to K3
CLO2	Classify movement and migration behaviors and explain environmental influence upon behaviour.	K1 to K3
CLO3	Analyze and identify innate, learned and cognitive behavior and differentiate between various mating systems.	K1 to K4
CLO4	Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction.	K1 to K3
CLO5	Discuss the rhythmicity of behavioural expressions and the scientific concepts in behavior and behavioral ecology.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Introduction to Animal Behaviour: Origin and history of Ethology; Profiles of Karl Von Frish, Ivan Pavlov. Mechanism of Behaviour, Proximate and causes of behaviour, Methods and recording of a behavior.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Innate Behaviour: Characteristics, Types – Tropism, Orientation - Kinesis & Taxis, Instincts – Fixed Action Patterns (FAP), Instincts as the Neuromotor apparatus, Reflexes - Tonic reflexes & Phasic reflexes and Motivation – Intrinsic & Extrinsic motivation.	18	Chalk and Talk, OHP quiz, on the spot test and YouTube Links
III	Learned Behaviour: Classification – Non Associative Learning - Habituation, Sensitization, Associative Learning - Classical conditioning and Operant conditioning (Trial & Error learning), Phase specific learning - Imprinting and Insight learning - Reasoning & Intelligence.	15	Chalk and Talk, PPT, group discussion, OHP
IV	Social and Complex Behaviour: Sexual selection, pheromones of importance, Altruism, Communication- Definition, components and Types of communication - Visual communication, Auditory communication, Tactile communication, Olfactory communication and Echolocation, Decision making behaviour in Animals, Mechanism of Decision making, Defensive behavior in octopus, Courtship display in Great Crested Grebe, Social behavior in Elephants.	15	Chalk and Talk, OHP, PPT presentations, quiz,
V	Chronobiology: Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Photoreception and photo-transduction. The biological clock and measurement of day length, The relevance of biological clocks for human welfare - Clock function (dysfunction)- Tidal rhythms and Lunar rhythms.	15	Chalk and Talk, PPT, group discussion, OHP

Course Designer
Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	DSEC	23OUZODSE5B	Nano biology	3	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	-

Course Objectives:

1. This course provides knowledge about the basic concepts of nanobiology.
2. The learners will be able to acquire skills in the assembly, design and types of nanomaterials and nanoparticles
3. they will be able to appreciate the applications of nanobiology in diverse fields.
4. This introductory course explains the interaction of nano materials with biology.
5. By the end of the course, the students, demonstrate the ability to understand the interaction of nanomaterials, biological membrane, DNA, and microbial surfaces.

Course Content:

Unit-I Nanobiology- Definition-concepts and scope. History of nanotechnology and nano-science in Nature; Structure and Properties of nano-materials: size, surface charge, conductivity, optical properties and biocompatibility.

Unit-II Synthesis and characterization of nano-materials, Fabrication of nanostructures, Metallic nanoparticles, semiconductor, bio-polymeric-nano-structures and nanoparticles.

Unit-III Composition and functional properties of nanostructures: Protein and peptide-based nanostructures, carbohydrate and nucleic acid based nanomaterials; Use of gold, silver and other metallic nanoparticles.

Unit-IV Strategies to design biologically active nanostructure-based biomaterials. Interaction of nanoparticles with biomolecules to study their conformational and functional properties.

Unit-V Biological Applications of Nanomaterials and nanoparticles – therapeutics – biomaterials - Immobilized enzymes - drug delivery systems – Biosensors - Cellular imaging tools and diagnostics.

Books for study:

1. Arumugam.N., (2021) “*Nanotechnology*”, saras publication. ISBN :9789384826956

2. Pradeep, T. (2012) “*Textbook of Nanoscience and Nanotechnology*”, McGraw Hill Education (India) Private Limited

Books for References :

1. Pradeep, T. (2017) “*The Essentials: Understanding Nanoscience and Nanotechnology*” McGraw-Hill Education.
2. Phoenix, D.A. and Ahmad, W (2014) “*Nanobiotechnology*”. One Central Press Ltd.

Web resources:

1. <https://ec.europa.eu/programmes/erasmus-plus/project-result-content/fe710461-5da6-42bd-9351-828558ab56da/Nanotechnology%201%20Fundamentals%20of%20Nanotechnology.pdf>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students learn applications of Nanobiology in diverse fields..

Activities to be given: Students shall be assigned with assignment work of designing of nanomaterials and nanoparticles.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom’s Taxonomy (Upto K level)
CLO1	Understand basics of Nano-science and Nano-biology.	K1 to K3
CLO2	Gain knowledge on nanomaterials and nanoparticles.	K1 to K3
CLO3	Know the biological applications of nanomaterials and nanoparticles.	K1 to K4
CLO4	Apply their knowledge in their career development in higher education, research and development.	K1 to K3
CLO5	To gain knowledge on some of the therapeutic knowledge of nano materials.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level**2- Intermediate Level****3- Advanced Level****LESSON PLAN: TOTAL HOURS (75 Hrs)**

UNIT	DESCRIPTION	Hrs	MODE
I	Nanobiology- Definition-concepts and scope. History of nanotechnology and nano-science in Nature; Structure and Properties of nano-materials: size, surface charge, conductivity, optical properties and biocompatibility.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Synthesis and characterization of nano-materials, Fabrication of nanostructures, Metallic nanoparticles, semiconductor, bio-polymeric-nano-structures and nanoparticles.	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Composition and functional properties of nanostructures: Protein and peptide-based nanostructures, carbohydrate and nucleic acid based nanomaterials; Use of gold, silver and other metallic nanoparticles.	15	Chalk and Talk, PPT, group discussion , OHP
IV	Strategies to design biologically active nanostructure-based biomaterials. Interaction of nanoparticles with biomolecules to study their conformational and functional properties.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Biological Applications of Nanomaterials and nanoparticles – therapeutics – biomaterials - Immobilized enzymes - drug delivery systems – Biosensors - Cellular imaging tools and diagnostics.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer
Dr.G.Indira Rani

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
V	Core Lab 5	23OUZO51P	Lab in Genetics and molecular biology Animal Physiology, Biochemistry and Biocomposting for Entrepreneurship Animal behavior	4	7	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To provide hands-on experience in basic techniques of genetics and molecular biology such as DNA extraction, gel electrophoresis, PCR, and plasmid isolation.
2. To develop skills in using molecular tools for studying gene structure, expression, and inheritance patterns.
3. To enhance analytical thinking through the interpretation of experimental results, data analysis
4. To develop practical skills in setting up and managing small-scale and large-scale biocomposting units.
5. To train students in quality control, packaging, and marketing strategies of compost products for local and commercial use.

Genetics:

1. Observation of Simple Mendelian Traits in the class
2. Mendelian Monohybrid Cross Experiment with Beads.
3. Ishihara Test - Test for Colour blindness.

Spotters: 4. Human Blood Grouping - A, B, AB & O

Molecular Biology :

1. Isolation of Genomic DNA from Bacteria. (Virtual demo)

Spotters

2. Charts on tRNA
3. DNA Double Helix Model and DNA Replication
4. DNA fingerprinting, RFLP

Experimental Setup

5. Detection of nucleic acid by gel electrophoresis (PAGE)

Animal Physiology:

1. Amylase activity in human saliva in relation to Temperature.
2. Estimation of Oxygen consumption of fish with reference to body weight.
3. Effect of Temperature on Ciliary activity of freshwater mussel.(Virtual Demo)
4. Qualitative analysis of nitrogenous waste products in fish tank water, bird excreta and mammalian urine.
- 5.Preparation of haemin Crystals(Demo)

Spotters

- 6.Kymograph, ECG, B.P. apparatus, BMI Chart
- 7.Hormonal disorders – Gigantism, Cretinism, Diabetes & Goitre

Biochemistry

1. Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test and Iodine test.
2. Qualitative analysis of Proteins: Biuret test and Ninhydrin test
3. Qualitative analysis of lipids: Saponification Test and Iodine Absorption test and Test for Cholesterol
4. Qualitative analysis of Ketone bodies – Rothera's Test.
5. Estimation of Protein by Lowry's method.

Bio-Composting:-

- 1.Charts on vermicomposting, vermicast, vermiwash
- 2.Preparation procedures for Biocompost pit.
- 3.Selection of Biocompost material, separation of Compostable and Non-compostable materials.
- 4.Packing and marketing of Biocompost.
- 5.Field visit to Biocomposting unit

Animal behavior:**Observing and recording of behavior in various animals**

1. Social Behavior - Study of group behavior in ants and honeybees.
2. Response of earthworms or insects to chemical stimuli (e.g., vinegar, sugar solution).
3. Feeding Behavior – foraging patterns
4. Reproductive Behavior – courtship displays and nest building
5. Defensive behavior – Camouflage and mimicry.

Books for Reference:

- 1.Snustad, D.P. & Simmons, M.J.(2015). “*Principles of Genetics*”, 7th Edition, Publisher: Wiley.

2. Misra, R.N. (2007), “*Experiments in Molecular Biology: A Laboratory Manual*”, 1st Edition, Publisher: Narosa Publishing House.
3. Watson, J.D., Baker, T.A., Bell, S.P. et al. (2013), “*Molecular Biology of the Gene*”, 7th Edition, Publisher: Pearson.
4. Singh, H.R and Kumar, N. (2017). “*Animal physiology and biochemistry*”, Vishal publishing company, Jalandhar, 864 pp.
5. Lekshmy, M. S., Santhi R. (2012), “*Vermitechnology*”, Sara Publications, New Delhi, India.
6. Hoshang S. Gundevia and Hare Govind Singh., (1996). “*Animal Behaviour*”, S.Chand & Co, 280pp.

Web Resources / E.Books:

1. <https://www.youtube.com/watch?v=PLhbRulwNV0>
2. https://ijpbs.com/ijpbsadmin/upload/ijpbs_5bb1b4fa9dfd9.pdf
3. <https://www.youtube.com/watch?v=f9hC8lpPNTg>
4. https://www.youtube.com/watch?v=I_HwCeKr4Xg

Pedagogy:

Demonstrations, PPT, Group Discussion, Interaction, Quiz, Virtual Labs, You tube Links and Virtual Labs.

LESSON PLAN: TOTAL HOURS (105 Hrs)

Cycle	Description	Hrs	Mode
Genetics:			
1	Observation of Simple Mendelian Traits in the class	15	Demo and Hands on Training, Data Collection Spotter / Chart
2	Mendelian Monohybrid Cross Experiment with Beads.		
3	3. Ishihara Test - Test for Colour blindness.		
4	Spotters: .Human Blood Grouping - A, B, AB & O		
Molecular Biology:			
1	Isolation of Genomic DNA from Bacteria.	15	Virtual demo, Model and Chart
2	tRNA		
3	DNA Double Helix Model and DNA Replication		
4	DNA sequencing, DNA fingerprinting, RFLP		
5	Detection of nucleic acid by gel electrophoresis (PAGE)		
Animal Physiology:			
1	Amylase activity in human saliva in relation to Temperature.		Demo and Hands on

2	Estimation of Oxygen consumption of fish with reference to body weight.	15	Training, Data Collection Spotter / Chart
3	Effect of Temperature on Ciliary activity of freshwater mussel.(Virtual Demo)	10	
4	Qualitative analysis of nitrogenous waste products in fish tank water, bird excreta and mammalian urine.		
5	Preparation of haemin Crystals(Demo)		
6	Spotters Kymograph, ECG, B.P. apparatus, BMI Chart		
7	Hormonal disorders – Gigantism, Cretinism, Diabetes & Goitre		
Biochemistry:			
1	Qualitative analysis of Carbohydrates: Barford's Test, Fehling's test and Iodine test.	15	Demo and Hands on Training, Data Collection Spotter / Chart
2	Qualitative analysis of Proteins: Biuret test and Ninhydrin test	10	
3	Qualitative analysis of lipids: Saponification Test and Iodine Absorption test and Test for Cholesterol		
4	Qualitative analysis of Ketone bodies – Rothera's Test.		
5	Estimation of Protein by Lowry's method.		
Bio-Composting for Entrepreneurship			
1	Charts on vermicomposting, vermicast, vermiwash.	15	Charts, Demo and Hands on Training and Model
2	Preparation procedures for Biocompost pit.		
3	Selection of Biocompost material, separation of Compostable and Non-compostable materials.		
4	Packing and marketing of Biocompost.		
5	Field visit to Biocomposting unit		
Animal behavior:			
1	Social Behavior - Study of group behavior in ants and honeybees.	10	Demo and Hands on Training, Data Collection Spotter / Chart
2	Response of earthworms or insects to chemical stimuli (e.g., vinegar, sugar solution).		
3	Feeding Behavior – foraging patterns		
4	Reproductive Behavior – courtship displays and nest building		
5	Defensive behavior – Camouflage and mimicry		

Course Designer
Ms.R.S.Rajalakshmi
Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
VI	Core Course 8	23OUZO61	Animal Biotechnology	4	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To impart the skills required to explain the protocols for genetically manipulating cells and produce transgenic animals.
2. To encourage the use of the apt molecular techniques to evaluate and analyze animal traits and diseases at the genomic level and employ methods for easy taxonomical identification and classification for biodiversity and environmental studies.
3. To study methods of transgenesis and to consider their use in improving animal husbandry and animal health.
4. To motivate students to review the ethics and speculate on the environmental implications of animal biotechnological methods.
5. To make students learn the preparation and advantages of spirulina, biodiesel and superbug.

Course Content:

Unit – I Recombinant DNA Technology: Introduction & Scopes - Tools for Gene cloning: Restriction enzymes and DNA ligases. Gene cloning vector types (pBR322) Plasmids, Bacteriophage (Lambda) and Cosmids. Major steps involved in cloning of human insulin gene. Molecular biology techniques in Gene transfer: i) Microinjection, ii) Electroporation.

Unit – II Application of r-DNA technique in Human health Recombinant DNA proteins and their uses: i) Interferon, ii) Interleukin, iii) Tissue plasminogen activator. Recombinant vaccines: Hepatitis-B and FMD Vaccine. Commercial production of Penicillin. Molecular markers: RFLP, DNA fingerprinting and application Forensic science.

Unit –III Applied Biotechnology: Hybridoma technology: Production and Applications of Monoclonal antibodies. Cloning of animals: Cloning in sheep - Methods and uses. Transgenic Animals: Transgenic Fish. Transgenic plant - Golden rice.

Unit – IV Intellectual Property Rights - Introduction to IPRs, Basic concepts and needs– Procedure of obtaining patents in India. Some important examples of IPR.

Unit –V Environmental and Industrial Biotechnology - Super Bug to control oil pollution. -

Technique of mass culture of Algae – Spirulina, Advantages of Single Cell Proteins (SCP), - Biodiesel preparation and advantages (Ethanol only).

Books for study:

- 1.Singh B. D., (2015), “*Biotechnology: Expanding horizon*”, Kalyani publishers.
- 2.Sasidhara, R.,(2015), “*Animal biotechnology*”, MJP publishers.
- 3.Dubey R. C., (2014), “*A text Book of Biotechnology*”, S. Chand & Co Ltd, Ram Nagar, New Delhi.

Books for reference:

- 1.Primrose S.B., R. M. Twyman and R. W. Old, (2001), “*Principles of gene manipulation*”, Wiley- Blackwell, UK.
- 2.Peters, P.,(2009), “*Biotechnology –A guide to genetic engineering*”, WMC brown publisher, UK.
- 3.Ramawat, K.G and Shailey Goyal, (2009), “*Comprehensive Biotechnology*”, S.Chand company, New Delhi, India.
- 4.Godbey W.T., (2014), “*An Introduction to Biotechnology*”, Academic press, New York, USA.
- 5.Michael Crichton, (2014), “*Essentials of Biotechnology*”, Medtech, Maine, USA.
- 6.Veer Bala Rastogi, (2016), “*Principles of Molecular biology*”, Medtech, Maine, USA.

Web Resources:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612824/>
2. <https://www.isaaa.org/resources/publications/pocketk/40/default.asp>
3. <https://www.ncbi.nlm.nih.gov/books/NBK207574/>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students gain understand molecular techniques and biotechnological tools for genetic improvement, disease diagnosis, and reproductive technologies in animals.

Activities to be given: Students can be assigned hands-on activities such as DNA extraction, PCR simulation, or case studies on transgenic animals and cloning techniques.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	To explain the principles and tools of recombinant DNA technology, describe vector systems, outline the steps in cloning the human insulin gene, and demonstrate understanding of gene transfer techniques such as microinjection and electroporation.	K1 to K3
CLO2	To illustrate the applications of recombinant DNA technology in human health, explain the production and uses of recombinant proteins and vaccines, describe the commercial production of penicillin, and analyze the role of molecular markers like RFLP and DNA fingerprinting in forensic science.	K1 to K3
CLO3	To explain hybridoma technology and monoclonal antibody production, describe animal cloning methods and applications, demonstrate knowledge of cell culture techniques and media, and analyze the development and significance of transgenic animals and plants.	K1 to K4
CLO4	To understand the fundamental concepts of Intellectual Property Rights, explain the Indian Patent Act and its procedures, and differentiate between patents, trademarks, geographical indications, copyrights, trade secrets, and their real-world applications.	K1 to K3
CLO5	To explain the role of biotechnology in environmental and industrial applications, including the use of super bugs for oil pollution control, advantages of single cell proteins, mass cultivation of Spirulina, enzyme immobilization techniques, and the process and benefits of ethanol-based biodiesel production.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Recombinant DNA Technology: Introduction - Tools for Gene cloning: Restriction enzymes and DNA ligases. Gene cloning vector types: – pBR322 Plasmids, Bacteriophage (Lambda) and Cosmids. Major steps involved in cloning of human insulin gene. Molecular biology techniques: i) Microinjection, ii) Electroporation.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Application of r-DNA technique in Human health Recombinant DNA proteins and their uses: i) Interferon, ii) Interleukin, iii) Tissue plasminogen activator. Recombinant vaccines: Hepatitis-B and FMD Vaccine. Commercial production of Penicillin. Molecular markers: RFLP, DNA fingerprinting and application Forensic science.	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Applied Biotechnology: Hybridoma technology: Production and Applications of Monoclonal antibodies. Cloning of animals: Cloning in sheep - Methods and uses. Basic requirements and techniques of cell culture, natural and synthetic culture media, primary culture and cell lines; Transgenic Animals:	15	Chalk and Talk, PPT, group discussion, OHP

	Transgenic fish & Elite cows. Transgenic plant-golden rice and bioluminescent plant		
IV	Intellectual property Rights - Introduction to IPRs, Basic concepts and needs– Patent Acts 1970 and its amendments. Procedure of obtaining patents in India. Meaning of Patents, Trade Marks, Geographical Indications, works protected under copyright law, Confidential Information and Trade Secrets: Some important examples of IPR.	15	Chalk and Talk, OHP, PPT presentations, quiz,
V	Environmental and Industrial Biotechnology - Super Bug to control oil pollution. -Advantages of Single Cell Proteins (SCP), Technique of mass culture of Algae – Spirulina. - Enzyme immobilization: Methods and advantages- Biodiesel preparation and advantages (ethanol only).	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer
Dr.G.Indira Rani

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
VI	Core Course 9	23OUZO62	Microbiology and Immunology	4	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To become familiar with the foundation concepts of history of Microbiology
2. To understand the structure and functions of a typical prokaryotic cell
3. To gain the knowledge of food microbiology.
4. To understand the fundamentals of immunology in protection against disease and also the key principles of antigen- antibody reaction in the immune system.
5. To promote critical thinking and provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics and cell biology.

Course Content:

Unit – I - Introduction to Microbiology -The history and scope of Microbiology – Classification of Microorganisms: Classification based on Robert H. Whittaker (Five Kingdom system). Outline classification for bacteria as per the second edition of Bergey’s Manual of Systematic Bacteriology and Classification of Fungi (Alexopoulos and Mims). Bacterial growth curves, Bacterial media-complex and selective media.

Unit – II - Control of microbes- Sterilization, disinfection, antiseptic, tyndallisation, pasteurization: Physical- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Chemical methods. Bacterial staining techniques: Simple staining and Gram’s staining, Pure culture methods (streak plate, spread plate, Pour plate, stab culture, slant culture).

Unit – III – Food Microbiology : Food as a medium for the growth of microorganism - Microorganisms in food contamination and spoilage, Physical preservation methods: Asepsis, filtration & centrifugation, high & low temperature & Pasteurization, desiccation, radiation, anaerobiosis, canning and controlled atmosphere. Chemical preservation methods: Salt, Sugar, organic acid , nitrates, nitrites, sulfur dioxide, ethylene dioxide, propylene oxide, wood smoke and antibiotics– Types, Methods of transmission of infections, Sources of Infections. Nosocomial infections -Bacterial infections- Cholera, Viral infections- Hepatitis-B, Fungal infections – Candidiasis, Probiotics and prebiotics – Benefits & applications.

Unit – IV – Immunology: Types of immunity: Innate and Acquired immunity. Ontogeny of Lymphoid organs – Myeloid Lineage and Lymphoid Lineage. Cells of Immune system – Stem cells, B cells and T cells. Lymphoid Organs: Thymus, Bone marrow, Bursa of Fabricius, Spleen and lymph node. Antigen, Antibodies- Structure, properties and functions – IgG, Haptens.

Unit – V - Antigen – Antibody Interactions – In vitro method, Precipitation, Agglutination. Humoral mediated immune response and Cell mediated immune response. Major Histocompatibility complex- Hypersensitivity - Type I- Anaphylactic reactions, Type II – Cytotoxic reactions, Type III – Immune complex reactions, Type - IV – Delayed type hypersensitivity reactions. Vaccines- Inactivated, attenuated. Immunization- Active and Passive immunization.

Books for study:

1. Pelczar M.J, Chan E.C.S and Krieg N.R (1993). “*Microbiology*”, 5th edition, Tata McGraw Hill.
2. Raj Khanna, (2011). “*Immunology*”, Oxford University press, New Delhi. 428 pp.

Books for reference:

1. Collins C.H, Patricia M, and Lyne J.M, Collins and Lynes., (1995), “*Microbiological Methods*” 7th edition. Grange, Butter Worth, Oxford.
2. Cappucino.J.G and Sherman.N., (1996), “*Microbiology, A Laboratory Manual*”, 4th edition. Benjamin Cumings Inc. California.
3. Chapel. H, Haeney. M, Misbah. S, and Snowden. N, (2006), “*Essentials of Clinical Immunology*”, 5th Edition. Blackwell Publishing, 368 PP.
4. Madigan MT, Martinko JM and Parker J (2012). “*Brock Biology of Microorganism*”, 11th edition Prentice Hall International Inc. London.
5. Abul A. Andrew, Lichtman. H, Shiv. P, (2014), “*Cellular and Molecular Immunology*”, 8th Edition, Published by W.B. Saunders, 544 PP.

Web Resources

1. <https://vlab.amrita.edu/?sub=3&brch=73>
2. <https://learn.chm.msu.edu/vibl/>
3. <https://mvi-au.vlabs.ac.in/>
4. <https://virtuallab.tlc.ontariotechu.ca/intro.php>
5. <https://www.merlot.org/merlot/viewMaterial.htm?id=79694>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students gain foundational knowledge of microorganisms and immune responses, along with practical skills in microbial culture, staining, and immunological assays.

Activities to be given: Students can be given activities such as microbial staining techniques, culture preparation, and antigen-antibody interaction experiments like ELISA or agglutination tests.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	To understand history, relevance of microbiology and classification of bacteria	K1 to K3
CLO2	To understand the working of various microscopes and their application. To understand the structure of bacterial cells, its organelles, physiology and behaviour.	K1 to K3
CLO3	To gain knowledge of various (physical and chemical) methods of control of microorganisms and safety measures to be followed while handling microbes	K1 to K4
CLO4	Classify and explain types of immunity, state the significance of antigen and examine their relevance to immunizations.	K1 to K3
CLO5	Compare and rate the mechanism of various types of hypersensitivity reactions, assess and identify the different types of autoimmune diseases.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Introduction to Microbiology -The history and scope of Microbiology – Classification of Microorganisms: Classification based on Robert H. Whittaker (Five Kingdom system). Outline classification for bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology and Classification of Fungi (Alexopoulos and Mims). Bacterial growth curves, Bacterial media-complex and selective media.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Control of microbes- Sterilization, disinfection, antiseptic, tyndallisation, pasteurization: Physical- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Chemical methods. Bacterial staining techniques: Simple staining and Gram's staining, Pure culture methods (streak plate, spread plate, Pour plate, stab culture, slant culture).	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Food Microbiology : Food as a medium for the growth of microorganism - Microorganisms in food contamination and spoilage, Physical preservation methods: Asepsis, filtration & centrifugation, high & low temperature & Pasteurization, desiccation, radiation, anaerobiosis, canning and controlled atmosphere. Chemical preservation methods: Salt, Sugar, organic	15	Chalk and Talk, PPT, group discussion , OHP

	acid,nitrates, nitrites, sulfur dioxide, ethylene dioxide, propylene oxide, wood smoke and antibiotics– Types, Methods of transmission of infections, Sources of Infections. Nosocomial infections -Bacterial infections- Cholera, Viral infections- Hepatitis-B, Fungal infections – Candidiasis, Probiotics and prebiotics – Benefits & applications.		
IV	Immunology: Types of immunity: Innate and Acquired immunity. Ontogeny of Lymphoid organs – Myeloid Lineage and Lymphoid Lineage. Cells of Immune system – Stem cells, B cells and T cells. Lymphoid Organs: Thymus, Bone marrow, Bursa of Fabricius, Spleen and lymph node. Antigen, Antibodies- Structure, properties and functions – IgG, Haptens.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Antigen – Antibody Interactions – In vitro method, Precipitation, Agglutination.Humoral mediated immune response and Cell mediated immune response. Major Histocompatibility complex- Hypersensitivity - Type I- Anaphylactic reactions, Type II – Cytotoxic reactions, Type III – Immune complex reactions, Type - IV – Delayed type hypersensitivity reactions. Vaccines- Inactivated, attenuated. Immunization- Active and Passive immunization.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer

Dr.M.A.Soniya

Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
VI	Core Course 10	23OUZO63	Ecology and Evolution	4	6	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To understand the structure and functions of the ecosystem.
2. To explain the relationship between biotic and abiotic factors in an ecosystem.
3. To understand the important processes, principles, and concepts on evolution.
4. To provide adequate information on the Lamarckism - Neo Lamarckism – Darwinism, Neutral Theory of Molecular Evolution, and Human Genome Project.
5. To explain the importance of the fossil records in evolutionary studies, and the role of phylogenetic studies in the wider context of biodiversity and conservation.

Course Content:

Unit I – Ecology -Definition, Scope, Branches of Ecology, Biotic and Abiotic factors. Water as medium- properties of water, Temperature: Range of temperature- Thermal Stratification – biological effects of temperature. Light: spectral composition, Light on water – biological effects of light.

Unit II – Population ecology: Characteristics of population – Density, Natality, Mortality, Age distribution, Population growth, dispersal, dispersion, Regulation of population density and Carrying capacity. Animal relationship: Commensalism, Mutualism, Parasitism, predation. Community ecology - definition, Characteristics of a community - structure, ecotone and edge effect, niche, Ecological succession – Process, Types and Patterns. Wild life conservation (*In situ* and *Ex situ* conservation).

Unit III – Evolution - Biochemical origin of life, Urey and Miller’s experiment, Geological time scale- Evidences of evolution - Morphological, Physiological, Biochemical evidences - Connecting link – Archaeopteryx

Unit IV - Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism, Modern Synthetic theory of Evolution. De Vrie’s Mutation theory – modern concepts of mutation - Mutation and their role in evolution -sources of Variations.

Unit V- Isolating mechanism: Geographic isolation, Reproductive isolation - Speciation - types,

mechanism of Allopatric and Sympatric speciation - Human evolution: Organic evolution of man. Fossils -Types, Methods of Fossilization, Methods of dating of fossils. Indian Fossils – Trilobite and Nautilus. Living fossils - Salient features.

Books for study:

1. Ridley, M., (2004), “*Evolution.*”, III Edition. Blackwell Publishing.
2. Sanyal, K. Kundu, M. and Rana, s. (2009), “*Ecology and environment*”, Books and allied, Kolkata.

Books for Reference:

1. Odum E.P.(1983), “*Basic Ecology*”, Saunders, New York
2. Wilkinson, D.M.,(2007), “*Fundamental Processes in Ecology: An Earth system Approach*”, Oxford University Press, UK.
3. Saha, T.K. (2010), “*Ecology and Environmental biology*”, Books and Allied, Kolkata.
4. Eli C.Minkoff.(2006) “*Evolutionary Biology*”,1st Edition, Jones & Bartlett Learning.
5. Douglas J.Futuyma.(2013) “*Evolution*” by – 3rd Edition, Sinauer Associates.

Web Resources:

1. <https://bit.ly/2VYWOM5>
2. <https://bit.ly/2VZQFiT>
3. <https://bit.ly/3kqdXYA>
4. <https://bit.ly/39rvvgt>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: Students gain an understanding of ecological principles and immune system functions, along with skills in analyzing ecosystem interactions and performing basic immunological techniques.

Activities to be given: Students can be engaged in activities such as ecosystem field surveys, population sampling, and laboratory experiments like blood grouping and antigen-antibody reaction tests.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom’s Taxonomy (Upto K level)
CLO1	Understand the fundamental structure and functions of the ecosystem.	K1 to K3

CLO2	Assess the inter-relationship between organisms and between biotic and abiotic factors in an ecosystem.	K1 to K3
CLO3	To understand the Primordial earth and theories on origin of life	K1 to K4
CLO4	To integrate and assess Lamarckism - Neo Lamarckism – Darwinism	K1 to K3
CLO5	To explain the Nature of fossils- Dating of fossils, evidences of evolution, Adaptive radiation in reptiles and mammals	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level

2- Intermediate Level

3- Advanced Level

LESSON PLAN: TOTAL HOURS (75 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Ecology -Definition, Scope, Branches of Ecology, Biotic and Abiotic factors. Water as medium- properties of water, Temperature: Range of temperature- Thermal Stratification – biological effects of temperature. Light: spectral composition, Light on water – biological effects of light.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Population ecology: Characteristics of population – Density, Natality, Mortality, Age distribution, Population growth, dispersal, dispersion, Regulation of population density and Carrying capacity. Animal relationship: Commensalism, Mutualism, Parasitism, predation. Community ecology - definition, Characteristics of a community - structure, ecotone and edge effect, niche, Ecological succession – Process, Types and Patterns. Wild life conservation (Insitu and Exsitu conservation).	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Evolution - Biochemical origin of life, Urey and Miller's experiment, Geological time scale- Evidences of evolution - Morphological, Physiological, Biochemical evidences -Connecting link – Archaeopteryx	15	Chalk and Talk, PPT, group discussion , OHP
IV	Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism, Modern Synthetic theory of Evolution. De Vrie's Mutation theory – modern concepts of mutation - Mutation and their role in evolution -sources of Variations.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Isolating mechanism: Geographic isolation, Reproductive isolation - Speciation - types, mechanism of Allopatric and Sympatric speciation - Human evolution: Organic evolution of man. Fossils -Types, Methods of Fossilization, Methods of dating of fossils. Indian Fossils –Trilobite and Nautilus. Living fossils - Salient features.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer

Ms.R.S.Rajalakshmi

Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
VI	Core Lab 6	23OUZO61P	Lab in Animal Biotechnology and Microbiology and Immunology	2	4	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To develop practical skills in microbial culture techniques, including media preparation, inoculation, and identification of microorganisms.
2. To make students learn molecular biology techniques such as DNA extraction, gel electrophoresis, and PCR relevant to animal biotechnology.
3. To understand and carry out immunological assays, including ELISA, agglutination, and blood grouping tests.
4. To learn aseptic techniques and biosafety practices essential for working in biotechnology and microbiology labs.
5. To demonstrate proficiency in the preparation and maintenance of cell cultures and study their application in transgenic research and monoclonal antibody production.

ANIMAL BIOTECHNOLOGY

1. Isolation of DNA from goat spleen (Demo only)
2. Plant tissue culture techniques: Preparation of MS media, callus Formation.

Micropropagation techniques

Experimental Set up

2. DNA finger printing
3. Super Bug construction

Spotters

4. pBR322 Plasmids
5. Bam HI
6. Spirulina

MICROBIOLOGY:

1. Simple staining

2. Gram Staining.
3. Serial Dilution Method
4. Culture Techniques a. Streak Method b. Pour Plate Method c. Spread Plate Method
5. Isolation of Bacteria from soil, water and air.

Spotters

1. Autoclave
2. Laminar Air Flow
3. Biomanure – Azolla.

IMMUNOLOGY:

1. Estimation of Haemoglobin by Haemoglobinometer
2. Agglutination & Precipitation Reactions (virtual demo)

Spotters

3. Bursa of Fabricius in Birds
4. Lymphoid Organs in Man - a. Thymus, b. Spleen, c. Lymph node,
5. Ig-G

Books for Reference:

1. Godbey W.T., (2014), “An Introduction to Biotechnology”, Academic press, New York, USA.
2. Michael Crichton, (2014), “Essentials of Biotechnology”, Medtech, Maine, USA.
3. Cappucino.J.G and Sherman.N., (1996), “Microbiology, A Laboratory Manual”, 4th edition. Benjamin Cummings Inc. California.
4. Chapel. H, Haeney. M, Misbah. S, and Snowden. N, (2006), “Essentials of Clinical Immunology”, 5th Edition. Blackwell Publishing, 368 PP.

Web Resources / E.Books:

1. <https://www.youtube.com/watch?v=PLhbRulwNV0>
2. https://ijpbs.com/ijpbsadmin/upload/ijpbs_5bb1b4fa9dfd9.pdf
3. <https://www.youtube.com/watch?v=f9hC8lpPNTg>

Pedagogy:

Demonstrations, PPT, Group Discussion, Interaction, Quiz, Virtual Labs, You tube Links and Virtual Labs.

LESSON PLAN: TOTAL HOURS (60 Hrs)

Cycle	Description	Hrs	Mode
LAB IN ANIMAL BIOTECHNOLOGY			
1.	Isolation of genetic molecules: Isolation of DNA from spleen	14	Virtual Demo
	Experimental Set up		
2.	DNA finger printing		
3.	Super Bug construction		
Slides / Spotters:			
4.	pBR322 Plasmids	8	Spotter / Chart
5.	Bam HI		
6.	Spirulina		
LAB IN MICROBIOLOGY:			
7.	Simple Staining.	14	Demo & Hands on Training
8.	Gram Staining.		
9.	Serial Dilution Method		
10.	.Culture Techniques a. Streak Method b. Pour Plate Method c. Spread Plate Method d. Serial Dilution Method		
11.	Isolation of Bacteria from soil, water and air.	10	
Slides / Spotters:			
12.	Autoclave	4	Model
13.	Laminar Air Flow		
14.	Biomanure – Azolla.		
LAB IN IMMUNOLOGY:			
15	Estimation of Haemoglobin by Haemoglobinometer	10	Demo & Hands on Training Spotters/charts
16	Agglutination & Precipitation Reactions (virtual demo)		
	Spotters		
17.	Bursa of Fabricius in Birds		
18.	Lymphoid Organs in Man		
19.	Thymus, b. Spleen, c. Lymph node,		
20.	Ig-G		

Course Designer
Ms.R.S.Rajalakshmi

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contac Hours/ Week	CIA	SE	Total
VI	DSEC	23OUZODSEPR6A	Project with Viva-voce	2	3	20	80	100

COURSE OBJECTIVES

1. This course imparts the conceptual and methodological issues that go into successful conduction of research.
2. To get knowledge of the fundamental framework of the research process.
3. To get a working knowledge of diverse research designs and methodologies.
4. Gain knowledge of the ethical aspects of doing applied research.
5. Recognize and assess the components of academic writing.

Guidelines for Project submission:

Candidate expected to select a project in the field of Zoology and related fields.

- ✚ Project is to be done by a group not exceeding 5 students.
- ✚ Every student should submit typed (A4 paper, Times New Roman - 12 Font, 1.5 Space, 20- 30 pages), spirally bind Project report duly attested by the supervising teacher and the Head of the Department on the day of viva voce examination.
- ✚ The viva-voce based on the project is conducted individually.
- ✚ Two typed copies of the report on the completed project will be submitted to the Head of the Department in the month of April during VI semester.
- ✚ Project topic once chosen shall not be repeated by any later batches of students. List of projects submitted year wise is to be maintained in a register and submitted before the examiners if requested.

The project report contains the following components:

Preliminary (Title page, declaration, certificate of the supervising teacher, content etc.)

- Introduction with relevant literature review and objective
- Material and Methods
- Results
- Discussion
- Conclusion / Summary
- References.

Evaluation will be done internally Project Work and Report : 20 marks

Presentation and Viva-Voce : 80 mark

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/Week	CIA	SE	Total
VI	DSEC	23OUZODSE6B	Wildlife Conservation & Management	2	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	-

Course Objectives:

1. To understand and discuss the importance of wildlife, its values, modern concepts in wildlife management, and relevant conservation policies.
2. To assess and instil strong foundations on wildlife policies and be familiar with a variety of laws and regulations.
3. To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions.
4. To evaluate and integrate all the related areas like Fundamentals in Ecology, Forestry, Natural Resource Conservation approaches and develop the role PVA models for protection of Endangered species.
5. To explain the advanced scientific basis for wildlife management and discuss National and International Efforts for successful wildlife conservation.

Course Content

UNIT - I: Scope and importance in wildlife of India - Definition of Wildlife- Causes of wildlife depletion; Economic importance of wildlife; need for wildlife conservation; rare, endangered, threatened and endemic species of birds and mammals in India- India as a mega wildlife diversity country.

Unit II: Conservation of wildlife -Role of Government and Non-Governmental organizations in conservation; in-situ and ex-situ conservation: Wildlife Sanctuaries (Tamilnadu only), National Parks, Tiger Reserves and Biosphere reserves.

Unit III: Theory and Analysis of Conservation of Populations: Population viability analysis- conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species. Environmental Impact Assessment (EIA) methods and their role in wildlife conservation.

Unit IV: National Efforts for Conservation: Natural and artificial regeneration of forests; nursery techniques-seed technology- Silvicultural systems –Coppice and conversion system; Agro forestry systems - Social/Urban Forestry- Joint Forest, Management-Indian Forest Act 1927, Forest Conservation Act 1980; Wildlife Protection Act 1972, National and State Biodiversity Action Plans.

Unit V: Management of Wildlife: Habitat manipulation: food, water, shade improvement; impact and removal of invasive alien species; Human Wildlife Conflicts -Basic concepts, reasons for conflicts, Identification of damages caused by wild animals and control measures; Basic concepts and applications of Wildlife Census - Remote sensing in Wildlife management.

Books for Study:

- 1.Hosetti, B.B., (1997), “*Concepts in Wildlife Management*”, Daya Publishing House, Delhi.
- 2.Justice Kuldip Singh., (1998). “*Handbook of Environment, Forest and Wildlife Protection Laws in India*”, Natraj Publishers, Dehradun.

Books for Reference:

1. Robinson W L and Eric G Bolen, (1984). “*Wildlife Ecology and Management*”, Maxmillan Publishing Company, New York, p 478.
2. Aaron, N.M.,(1973), “*Wildlife ecology*”, W.H. Freeman Co. San Francisco, U.S.A.
3. Dasmann R F, (1964). “*Wildlife Biology*”, John Wiley & Sons, New York, p 231.
- 4.Sutherland, W.J (2000). “*The conservation handbook: Research, Management and Policy*”. Blackwell Science.
- 5.Caughley.G and Sinclair, A.R.E (1994), “*Wildlife ecology and management*”. Blackwell Science.

Web Resources / E.Books:

1. <https://bit.ly/39oPj44>
2. <https://bit.ly/3IHdEYJ>
3. <https://bit.ly/3CwBCfY>
4. <https://bit.ly/3EDYr3a>
5. <https://bit.ly/3tVtG4U>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students learn various wild animals and habitats.

Activities to be given: Students shall be assigned with assignment work of grouping various endangered and extinct wild animals.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	To understand and recall the importance of wildlife, extinction and Conservation Approaches of wildlife	K1 to K3
CLO2	To integrate and assess the National, international approaches for biodiversity conservation.	K1 to K3
CLO3	To analyse and differentiate threats to wildlife, various action plans, conservation strategies on wildlife of India to turn conflict into tolerance and coexistence.	K1 to K4
CLO4	To explain the role PVA models, Wildlife conservation approaches, and limitations.	K1 to K3
CLO5	To construct and simulate National and International strategies for Conservation, Wild life laws and ethics.	K1 to K4

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	2	1	2	2	3

1-Basic Level**2- Intermediate Level****3- Advanced Level****LESSON PLAN: TOTAL HOURS (75 Hrs)**

UNIT	DESCRIPTION	Hrs	MODE
I	Scope and importance in wildlife of India - Definition of Wildlife- Causes of wildlife depletion; Economic importance of wildlife; need for wildlife conservation; rare, endangered, threatened and endemic species of birds and mammals in India- India as a mega wildlife diversity country.	12	Chalk and Talk, PPT, quiz, on the spot test
II	Conservation of wildlife -Role of Government and Non-Governmental organizations in conservation; in-situ and ex-situ conservation: Wildlife Sanctuaries (Tamilnadu only), National Parks, Tiger Reserves and Biosphere reserves.	18	Chalk and Talk, OHP quiz, on the spot test and You tube Links
III	Theory and Analysis of Conservation of Populations: Population viability analysis-conceptual foundation, uses of PVA models. Management Decisions for small populations using PVA models. Minimum viable populations & recovery strategies for threatened species. Environmental Impact Assessment (EIA) methods and their role in wildlife conservation.	15	Chalk and Talk, PPT, group discussion , OHP

IV	National Efforts for Conservation: Natural and artificial regeneration of forests; nursery techniques-seed technology- Silvicultural systems –Coppice and conversion system; Agro forestry systems - Social/Urban Forestry- Joint Forest, Management-Indian Forest Act 1927, Forest Conservation Act 1980; Wildlife Protection Act 1972, National and State Biodiversity Action Plans.	15	Chalk and Talk, OHP,PPT presentations, quiz,
V	Management of Wildlife: Habitat manipulation: food, water, shade improvement; impact and removal of invasive alien species; Human Wildlife Conflicts -Basic concepts, reasons for conflicts, Identification of damages caused by wild animals and control measures; Basic concepts and applications of Wildlife Census - Remote sensing in Wildlife management.	15	Chalk and Talk, PPT, group discussion , OHP

Course Designer
Dr.M.A.Soniya

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours/Week	CIA	SE	Total
VI	DSEC	23OUZODSE6CP	Lab in Ecology and Evolution, Bio statistics and Bio informatics	2	3	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course Objectives:

1. To provide hands-on experience in ecological and evolutionary field methods, including sampling techniques, biodiversity assessment, population monitoring, and behavioural observations.
2. To apply statistical tools and software for analyzing biological data, including hypothesis testing, regression analysis, ANOVA, and multivariate techniques relevant to ecological and evolutionary research.
3. To introduce students to key bioinformatics tools and databases, enabling them to retrieve, analyze, and interpret genomic, proteomic, and phylogenetic data.
4. To develop skills in experimental design and data interpretation in ecological and evolutionary contexts, promoting critical thinking and scientific inquiry.
5. To enable students to integrate computational approaches with biological questions, preparing them to handle large biological datasets using tools like R, Python, and online platforms (e.g., BLAST, NCBI, ClustalW).

ECOLOGY:

1. Analysis of dissolved oxygen in water sample.
2. Detection of Transparency of water by Secchi disc.
3. Examples illustrating animal association.
 - a). Commensalism- Sucker fish and Shark,
 - b). Mutualism – Hermit crab and Sea Anemone,
 - c). Predation- Tiger checks the Deer
4. Food Chain in pond ecosystem and Food Web in grassland ecosystem.
5. Adaptations:

- a). Parasitic adaptations - Sacculina on crab.
- b). Flight adaptations –Bat
- c). Adaptations of Aquatic Mammals- Blue Whale
- d). Burrowing adaptations - Rat

EVOLUTION:

1. Homologous and Analogous Organs.
2. Vestigial Organs.
3. Fossils -Nautilus
4. Examples of Evolutionary Importance: Peripatus and Limulus, Connecting link- Archaeopteryx
5. Animals with adaptive colouration: Stick Insect and Chameleon.
6. Variation – Finger Print in Man

BIOSTATISTICS

1. Calculate the Measures of central tendency (Mean, Median & Mode) & Measures of dispersion (SD) by counting Neem leaf serrations

BIOINFORMATICS

1. NCBI-National center for Biotechnology Information
2. BLAST

Case Study: Visit to any nearby pond ecosystem

Book References:

1. Odum, E.P. & Barrett, G.W. (2005). *Fundamentals of Ecology* (5th Edition). Brooks/Cole.
2. Daniel, W.W. & Cross, C.L. (2013). *Biostatistics: A Foundation for Analysis in the Health Sciences* (10th Edition). Wiley.
3. Mount, D.W. (2004). *Bioinformatics: Sequence and Genome Analysis* (2nd Edition). Cold Spring Harbor Laboratory Press.

LESSON PLAN: TOTAL HOURS (45 Hrs)

Cycle	Description	Hrs	Mode
LAB IN ECOLOGY:			
1.	Analysis of dissolved oxygen in water sample.	8	Virtual Demo
2.	Detection of Transparency of water by Secchi disc.		
Slides / Spotters:			
3.	Examples illustrating animal association. Commensalism- Sucker fish and Shark Mutualism – Hermit crab and Sea Anemone	14	Spotter / Chart

	Predation- Tiger checks the Deer		
4.	Food Chain in pond ecosystem and Food Web in grassland ecosystem.	4	Spotter / Chart
5.	Adaptations: Parasitic adaptations - Sacculina on crab. Flight adaptations –Bat Adaptations of Aquatic Mammals- Blue Whale Burrowing adaptations - Rat		
LAB IN EVOLUTION			
6.	Homologous and Analogous Organs.	8	Demo & Hands on Training, Spotter / Chart
7.	Vestigial Organs.		
8.	Fossils -Nautilus		
9.	Examples of Evolutionary Importance: Peripatus and Limulus, Connecting link- Archaeopteryx		
10.	Animals with adaptive colouration: Stick Insect and Chameleon.		
11.	Variation – Finger Print in Man		
LAB IN BIOSTATISTICS			
12.	Calculate the Measures of central tendency(Mean,Median & Mode) & Measures of dispersion(SD) by counting Neem leaf serrations.	6	Hands on Training,
LAB IN BIOINFORMATICS			
13. 14.	NCBI-National Center for Biotechnology Information BLAST	5	Data collection

Course Designer
Dr.S.Sharmila

Department of Zoology						Class: III B.Sc		
Sem	Category	Course Code	Course Title	Credits	Contact Hours / Week	CIA	SE	Total
VI	SEC 8	23OUZOSEC6	Biophysics, Biostatistics and Bioinformatics	2	3	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓	✓	

Course objectives:

1. To understand the concepts of diffusion, osmosis, centrifugal force, surface tension.
2. To understand the techniques for the separation of biomolecules.
3. To understand radiology, sonography, Laser techniques for biological and medical application.
4. To know to calculate standard deviation, correlation coefficient, chi-square analysis and student 't' test using the formula.
5. To enable the students to appreciate the significance of computational programs in the development and analysis of biological database.

Course Content:

Unit I: Biophysical Principles: Physical laws in living system: Diffusion–Factors affecting diffusion- types of diffusion – Fick’s law – Biological significance of diffusion – Osmosis- Osmotic pressure, endocytosis, pinocytosis, phagocytosis, exocytosis plasmolysis and haemolysis. Principles of viscosity–Brownian movement–surface tension–turgor pressure.

Unit II: Applications of Biophysics: Radioactivity: Types of radioactive decay – Radioactive isotopes – Autoradiography – biological impacts – Geiger-Muller counter: Principle – working procedure – advantages and disadvantages. Medical and biological uses of X-rays, Ultrasound and Laser.

Unit III: Introduction to Biostatistics: Definition –Importance and applications of Biostatistics. Collection of data: Primary – secondary data. Statistical population and sampling in biological studies. Classification and Tabulation of data -Qualitative – quantitative. Variables: discrete – continuous. Frequency distributions.

Unit IV: Presentation of Data: Diagrammatic and graphical representations of data: Bar diagrams (Simple, multiple, subdivided and percentage) – Pie diagram – Frequency diagram:

histograms – frequency polygon – frequency curve – line graphs. Measures of central tendency: Arithmetic mean – median– mode. Measures of dispersion: Range, Standard deviation.

Unit V: Bioinformatics Definition,History,Scope and applications of Bioinformatics. Biological databases- Nucleic acid databases (Genbank, DDBJ and EMBL) Protein databases - primary, secondary, Specialized databases-TIGR, Structural databases –PDB.

Books for study:

1. Das,D.,(1996). “*Biophysics and Biophysical Chemistry for Medical and Biology students*”, Academic, Calcutta. 302pp.
2. Subramanian,M.A.,(2016), “*Biophysics–Principles and Techniques*”, MJP,Chennai. 324pp.
3. Gurumani,N.,(2005), “*An introduction to Biostatistics*”, MJP,Chennai, 250pp.
4. Palanichamy,S and M.Shanmugavelu, (1991), “*Principles of Biostatistics*”. Palani Paramount. India. 350pp

Books for References:

1. Antonisamy, B., Solomon Christopher and P. Prasanna Samuel, (2011). “*Biostatistics: Principles and practices*”. Mac Graw Hill Education Pvt. Ltd. New Delhi. 349pp.
2. BettyKarasek,(2015).”*Advanced concepts of biophysics*”, Callistro Reference, 198pp.
3. Daniel,W.W.,2000.”*Biostatistics:A foundation for analysis in the health sciences*”, 7th Ed. John Wiley & Sons Ltd. New York. 328pp.

Web Resources:

1. <https://bit.ly/2XGFuML>
2. <http://www.life.uiuc.edu/molbio/geldigest/electro.html>
3. http://users.stat.ufl.edu/~winner/sta6934/st4170_int.pdf
4. <http://www.biostathandbook.com/analysissteps.html>
5. <https://bit.ly/3nXUIrD>

Pedagogy:

Chalk and Talk, PPT, Group discussion, OHP presentations, Quiz, On the spot test, You tube Links, Open book test and Virtual Labs.

Rationale for nature of Course:

Knowledge and Skill: To make students learn applications of Bio Physics, Biostatistics and Bioinformatics in diverse fields.

Activities to be given: Students shall be grouped to discuss the impacts of X Rays and Lasers.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	Understand and recall the basic biophysical concepts, statistical data and formula.	K1 to K3
CLO2	Apply suitable physical techniques and statistical methods to solve biological problems.	K1 to K3
CLO3	Identify and relate the bioanalytical techniques and statistical principles for the application of biological experiments.	K1 to K4
CLO4	Select suitable biophysical techniques to study the biological process and statistical approach to assess the experimental results.	K1 to K3
CLO5	Integrate the bioanalytical techniques and statistical methods to validate research investigations.	K1 to K4

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	of data -Qualitative – quantitative. Variables: discrete – continuous. Frequency distributions.		
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**Course Designer
Dr.G.Indira Rani**