JAYARAJ ANNAPACKIAM COLLEGE FOR WOMEN (AUTONOMOUS)

A Unit of the Sisters of St. Anne of Tiruchirappalli
Accredited with 'A+' Grade (Cycle 4) by NAAC
DST FIST Supported College
Affiliated to Mother Teresa Women's University, Kodaikanal

PERIYAKULAM – 625 601, THENI DT.
TAMIL NADU.

M.Sc. ZOOLOGY

(2023-2026)

P.G.AND RESEARCH CENTRE OF ZOOLOGY

P.G. PROGRAMME OUTCOMES

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Instill knowledge and evaluate analytically in their specific disciplines.
2.	Analyze and apply the acquired knowledge to solve the complex problems in professional and social life.
3.	Evolve new technologies in the specific discipline leading to innovation and employability.
4.	Develop critical thinking required to pursue research.
5.	Apply the computational skills, life skills to the challenging problems in life.
6.	Design and develop independent projects.

P.G. PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PO MAPPED
1.	Develop deeper understanding of key concepts of biology at biochemical, molecular and cellular level, physiology and reproduction at organism level and ecological impact on animal behavior.	PO - 1
2.	Acquire theoretical basis and practical skills in the use of basic tools, technologies and methods common for inter and intra disciplines of sciences.	PO - 3
3.	Enhance research-oriented knowledge by accumulating practical skills in specific areas of research.	PO - 4
4.	Imbibe the applications of biology to fetch job and become an entrepreneur.	PO - 2, PO - 6
5.	Prepare for competitive exams at National level and exhibit their potential in teaching and lecture.	PO - 5

P.G. COURSE PATTERN (2023 - 2026) (UGC/ TANSCHE/ MTU)

Sem.	Part	Code	Title of the Course	Hours	Credit
I	A	23PZO1C01	Structure and Function of Invertebrates and Chordates	6	5
		23PZO1C02	Biological Chemistry	6	5
		23PZO1P01	Invertebrata, Chordata and Biological Chemistry - Lab	6	5
		23PZO1E1A/ 23PZO1E1B/ 23PZO1E1C	**Elective Course I** Research Methodology/ Stem cell Biology/ Aquaculture	6	3
	B	23PZO1SE1	**Skill Enhancement Course - 1 (SEC-1)**: Sericulture	4	2
		23PAE1SK1	**Ability Enhancement Course - 1(AEC-1):** Soft Skill	2	2
			Total	**30**	**22**
II	A	23PZO2C03	Cell and Molecular Biology	6	5
		23PZO2C04	Developmental Biology	6	5
		23PZO2P02	Cell Biology and Developmental biology - Lab	6	5
		23PZO2ID1	**IDC:** Human Physiology	6	3
	B	23PZO2SE2	**Skill Enhancement Course - 2 (SEC-2):** Poultry farming	4	2
		23PAE2SK2	**Ability Enhancement Course - 2 (AEC- 2):** Cyber Security	2	2
	C	23PSL2EX1	Extension Activity (Can be carried outside the class hours)	-	1
			Total	**30**	**23**
III	A	23PZO3C05	Genetics	6	5
		23PZO3C06	Animal Physiology	6	5
		23PZO3P03	Animal physiology and Biotechnology - Lab	6	5
		23PZO3E2A/ 23PZO3E2B/ 23PZO3E2C	**Elective Course - II** Biotechnology and Genetic Engineering/ Molecules and their interaction relevant to Biology/ Endocrinology	6	4
	B	23PZO3SE3	**Skill Enhancement Course -3 (SEC- 3)** Medical Laboratory Techniques	6	3
		23PZO3IN1/ 23PZO3IT1	Internship/Industrial Activity (Carried out in summer vacation at the end of Semester II) / (at least 10 Days)	-	2
			Total	**30**	**24**
IV	A	23PZO4C07	Immunology	6	6
		23PZO4C08	Ecology and Evolution	6	5
		23PZO4P04	Immunology, Microbiology and Ecology - Lab	5	4
		23PZO4E3A/ 23PZO4E3B/ 23PZO4E3C	**Elective Course - III** Microbiology/ Nanobiology/ Industrial Zoology	5	3
		23PZO4R01	Project with Viva Voce	6	3
	B	23PZO4SE4	**Skill Enhancement Course -4 (SEC - 4)** Training for competitive examinations	2	1
			Total	**30**	**22**
			Total for All Semesters	**120**	**91**

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA) - 2023-2026

THEORY

Component	Marks	Marks
Internal test I	40	Converted to 25
Internal test II	40	
Quiz	10	
Assignment	5	
Attendance	5	
Total	**100**	**25**

PRACTICAL

Continuous Internal Assessment (CIA) - 40 Marks

External Practical Exam - 60 Marks

PROJECT WORK

The ratio of marks for Internal and External Examination is 50:50. The Internal Components of project work are given below:

The Internal Components of Project

Component	Marks
Project Report	10
External Viva Voce	10
Final Review (Internal Viva Voce)	30
Total	**50**

External Valuation of Project Work

Component	Marks
First Review	25
Second Review	25
Total	**50**

Internship

Component		Marks
Internal	:	50 Marks
External	:	50 Marks
Total	**:**	**100 Marks**

INTERNAL COMPONENTS

Components		Marks
Report Submission	:	25 Marks
Presentation and viva (internal)	:	25 Marks
External (Awarded by the Respective Guide / Intern site)	:	50 Marks

Continuous Internal Assessment Component (CIA) for the practicals can be decided by the respective Dept.

TRAINING FOR COMPETITIVE EXAMS (INTERNAL ONLY)

COMPONENTS	MAXIMUM MARKS
Test 1	40
Test 2	40
Panel Discussion	15
Class Activity	05

TEST TYPE	K LEVEL	NO OF QUESTIONS
Objective type questions	KI	15
Objective type questions	K2	15
Objective type questions	K3	10

PG - INTERNAL QUESTION PATTERN

Max. Marks - 40; **Duration - 2 Hours**

Section	Bloom's level	Course Outcome	Questions
A MCQs (10×1=10)	K1	CO1	1.
		CO1	2.
		CO1	3.
		CO1	4.
		CO1	5.
		CO1	6.
		CO1	7.
		CO1	8.
		CO1	9.
		CO1	10.
B Answer all the Questions (2×5=10)	K2	CO2	11. a) (or) 11. b)
	K3	CO3	12. a) (or) 12. b)
C Answer all the questions (2×10=20)	K4	CO4	13. a) (or) 13. b)
	K5, K6	CO5	14. a) (or) 14. b)

PG - INTERNAL QUESTION PATTERN (FULLY INTERNAL PAPERS)

Max. Marks - 40; **Duration - $1\frac{1}{2}$ Hours**

Section	Bloom's level	Course Outcome	Questions
A MCQs (10×1=10)	K1	CO1	1.
		CO1	2.
		CO1	3.
		CO1	4.
		CO1	5.
		CO1	6.
		CO1	7.
		CO1	8.
		CO1	9.
		CO1	10.
B Answer all the Questions (2×5=10)	K2	CO2	11. a) (or) 11. b)
	K3	CO3	12. a) (or) 12. b)
C Answer all the questions (2×10=20)	K4	CO4	13. a) (or) 13. b)
	K5, K6	CO5	14. a) (or) 14. b)

PG - EXTERNAL QUESTION PATTERN

For Credits 5 and above

Sections	Bloom's level	Course Outcome	Questions
A MCQs 15×1=15	K1	CO1	1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12
			13
			14
			15
B Answer All the Questions 5×2=10	K2	CO2	16
			17
			18
			19
			20
C Answer ALL the Questions 5×5=25	K1	CO1	21. a)
			Or
			21. b)
	K2	CO2	22. a)
			Or
			22. b)
	K3	CO3	23. a)
			Or
			23. b)
	K4	CO4	24. a)
			Or
			24. b)
	K5	CO5	25. a)
			Or
			25. b)

D Answer All the Questions 5×10=50	K2	CO2	26. a)
			Or
			26. b)
	K3	CO3	27. a)
			Or
			27. b)
	K4	CO4	28. a)
			Or
			28. b)
	K5	CO5	29. a)
			Or
			29. b)
	K6	CO5	30. a)
			Or
			30. b)

PG - EXTERNAL QUESTION PATTERN

For Below 5 Credits

Sections	Bloom's level	Course Outcome	Questions
A MCQs 15×1=15	K1	CO1	1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12
			13
			14
			15
B Answer ALL the Questions 5×6=30	K2	CO2	16. a)
			Or
			16. b)
	K3	CO3	17. a)
			Or
			17. b)
	K4	CO4	18. a)
			Or
			18. b)
	K5	CO5	19. a)
			Or
			19. b)
	K6	CO5	20. a)
			Or
			20. b)
C Answer All the Questions 3×10=30	K2	CO2	21. a)
			Or
			21. b)
	K4	CO4	22. a)
			Or
			22. b)
	K5	CO5	23. a)
			Or
			23. b)

K1-Remember; **K2**-Understand; **K3** -Apply; **K4** -Analyze; **K5** -Evaluate; **K6** -Create

STRUCTURE AND FUNCTION OF INVERTEBRATES AND CHORDATES

Semester: I **Hours: 6**

Code : 23PZO1C01 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Define and recall concepts related to structure and functions of Invertebrates and Chordates.	PSO - 1	K1
CO - 2	Understand the physiological processes that underline the key organ systems in Invertebrates and Chordates.	PSO - 2	K2
CO - 3	Relate the anatomy to their functional organization in Invertebrates and Chordates.	PSO - 4	K3
CO - 4	Compare and contrast the structural anatomy and functions of organ and organ system in Invertebrates and Chordates.	PSO - 5	K4
CO - 5	Evaluate the exceptional attributes of different classes of Invertebrates and Vertebrates.	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**STRUCTURE AND FUNCTION OF INVERTEBRATES AND CHORDATES**							**Hours: 6**
Code : 23PZO1C01											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	3	3	4	3	5	3	3	3	4	3.55
CO - 2	3	3	5	3	4	3	3	5	3	3	4	3.55
CO - 3	3	5	3	2	3	5	3	3	2	5	3	3.36
CO - 4	3	3	2	3	5	3	3	2	3	3	5	3.18
CO - 5	2	4	4	5	4	4	2	4	5	4	4	3.82
Overall Mean Score												**3.49**

Result: The Score for this Course is **3.49** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Nomenclature -Binomial, trinomial and rules of nomenclature. Symmetry and its significance in animal organization. Coelom -Types of coelom and origin of coelom. Metamerism - Characters, Types, Origin and significance of metamerism. Classification: Grouping of invertebrates into phyla, distinctive characters of phyla with one example each. **(18 Hours)**

UNIT II

Locomotion: Flagella and ciliary movement in protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata. Nutrition -Filter feeding in Polychaeta, Mollusca and Echinodermata. Respiration - Gills, book lungs lungs and trachea in Arthropods and molluscs, Respiratory pigments. Different types of excretory organs in invertebrates and their structure and function. Mechanism of excretion, Excretion and osmoregulation. **(18 Hours)**

UNIT III

Nervous system -Primitive nervous system (Coelenterata and Echinodermata), Advanced nervous system (Annelida, Arthropoda and Mollusca). Larval forms and their evolutionary significance. Parasitic adaptations of helminth parasites. Helminth and human diseases -Nematodiasis (Ascariasis and Filariasis), Trematodiasis (Schistosomiasis and Fascioliasis) and Cestodiasis (Taeniasis and Echinococcosis). **(18 Hours)**

UNIT IV

Concept of prochordate -The nature of vertebrate morphology -Definition, Scope and general comparison of protochordate subphyla at a glance. Salient features and classification of chordates upto classes with one example each. Integumentary system -Structure of skin, Functions of integument, Derivatives of the integument, Epidermal derivatives, Epidermal glands, Epidermal scales and scutes, horns, digital structures, feathers and hairs. Circulatory system -Comparative account of circulatory organs (Amphibian and Reptiles. **(18 Hours)**

UNIT V

Respiratory system -Comparative account of respiratory organs (Pisces, Aves and Mammals). Exoskeletal structures and their modifications. Evolution of urinogenital system in vertebrate series. Sense organs in vertebrates -, Olfactory organs, taste and hearing, lateral line sense organ. Nervous system -Brain, spinal cord, Cranial nerves, spinal nerves and visceral nerves. Autonomic nervous system - Sympathetic and Parasympathetic. **(18 Hours)**

REFERENCE BOOKS:

1. Jordan E.L and Verma P.S (2022). Invertebrate Zoology. S.Chand Publications
   Unit I: Chapter 2.
   Unit II: Chapter 23,30,59, 64,68,70,73,84.
   Unit III: Chapter 51.
   Unit IV: Chapter 8,41,45.
   Unit V: Chapter 44,46,47,48.50
2. Sr. Nirmala T and Shanthi V (2003), A book of chordate diversity, Acca Publications
   Unit IV: Chapter 2, 3
3. Fatik Baran Mandal (2012), Invertebrate Zoology, PHI Publications
   Unit I: Chapter 3.1, 4.1, 5.1, 10.1, 11.1, 12.1, 13.1, 14.1, 15.1
4. Barrington, E. J.W. (1979). Invertebrate Structure and Function. The English Language Book Society and Nelson.
5. Barnes, R. D. (1974). Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition.
6. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. (2013). The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
7. Dechenik, J. A. (2015). Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited.
8. J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
9. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.
10. Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.
11. Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.
12. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol - II, S. Viswanathan Pvt. Ltd. Chennai.
13. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.

INTERNET SOURCES

UNIT I

https://www.biologydiscussion.com/invertebrate-zoology/phylum-annelida/metamerism-occurrence-features-and-types/33321

UNIT II

https://www.notesonzoology.com/invertebrates/notes-on-respiration-in-invertebrates-zoology/2008
https://www.notesonzoology.com/invertebrates/excretory-organs-in-invertebrates-zoology/2095

http://www.rdscollege.ac.in/studymaterial/1594394996.pdf?uid=

UNIT III

https://www.zoologytalks.com/nervous-system-of-coelenterate-and-echinoderm/
https://www.zoologytalks.com/advanced-nervous-system-in-annelids/

https://www.zoologytalks.com/advanced-nervous-system-in-arthropoda/

https://www.zoologytalks.com/advanced-nervous-system-in-mollusca/

https://www.biologydiscussion.com/invertebrate-zoology/arthropods/parasitic-adaptations-of-helminths-parasitology/62108

BIOLOGICAL CHEMISTRY

Semester: I **Hours: 6**

Code : 23PZO1C02 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the basic concepts and principles of biological chemistry.	PSO - 1	K1
CO - 2	Explain the structure, classification and functions of biomolecules.	PSO - 5	K2
CO - 3	Apply the knowledge of metabolism of biomolecules to lead a healthy life.	PSO - 3	K3
CO - 4	Analyse the metabolic pathways of biomolecules.	PSO - 2	K4
CO - 5	Evaluate the biosynthesis of biomolecules.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**BIOLOGICAL CHEMISTRY**							**Hours: 6**
Code : 23PZO1C02											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	3	4	3	2	5	3	4	2	3	3.27
CO - 2	4	3	3	2	5	3	4	3	2	3	5	3.36
CO - 3	3	3	3	5	3	3	3	3	5	3	3	3.36
CO - 4	3	2	5	3	4	2	3	5	3	2	4	3.27
CO - 5	3	5	2	4	4	5	3	2	4	5	4	3.73
Overall Mean Score												**3.40**

Result: The Score for this Course is **3.40** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Ionization of water, Weak acids and weak bases. pH scale, pH of various human body fluids and tissues, Acid and base, Maintenance of blood pH, buffers, biological buffer system (Phosphate, bicarbonate, protein, amino acid and haemoglobin), Respiratory acidosis and alkalosis, Metabolic acidosis and alkalosis, Henderson -Hasselbalch equation. **(18 hours)**

UNIT II

Carbohydrates - Structure and classification. Metabolism of Carbohydrates - Glycolysis, Kreb's cycle, Hexose monophosphate shunt (HMP shunt), Gluconeogenesis, Cori's cycle, Galactose metabolism, Fructose metabolism. **(18 hours)**

UNIT III

Aminoacid -Structure and classification. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Catabolism of phenylalanine, tyrosine and tryptophan. Metabolism of heme and bilirubin. Biosynthesis of nucleic acids. **(18 hours)**

UNIT IV:

Classification of lipid, β- oxidation of Palmitic acid (Saturated fatty acid) and Oleic acid (Unsaturated fatty acid), and its bio energetic. Bio synthesis of long chain fatty acid (Palmitic acid). Formation of ketone bodies, role of liver in fat metabolism, Prostaglandins, Chylomicrons, VLDL, LDL, HDL, Triglycerides. **(18 hours)**

UNIT V

Classification of enzymes, Factors affecting enzyme activity, Nutrition biochemistry - Fat soluble and water-soluble vitamins. Hormones -Classification and functions of hormones. Bio chemical techniques- Principle and applications of Ultra Centrifuge, Chromatography (Paper and Thin Layer Chromatography), Electrophoresis, Spectrophotometry. **(18 hours)**

BOOKS FOR REFERENCE:

1. Ambika Shanmugam., (2008). Fundamentals of Biochemistry for Medical students. 7th Edition, Nagaraj and Company Private Limited, Chennai.
   Unit I: Chapter 14.
   Unit II: Chapter 1, 17.
   Unit III: Chapter 3, 6, 21.
   Unit IV: Chapter 2, 19.
   Unit V: Chapter 4, 5.
2. David.L.Nelson and Michael.M.Cox (2008). Lehninger's Principles of Biochemistry. 4th edition, W. H. Freeman and Company, New York.
   Unit I: Chapter 2.
   Unit II: Chapter 7, 14, 16.
   Unit III: Chapter 3, 4, 18.
   Unit IV: Chapter 10, 17.
   Unit V: Chapter 6, 10.
3. Veerakumari. L. (2006). Bioinstrumentation. MJP Publishers, Chennai.
   Unit V: Chapter 5, 9, 10, 11.
4. Dr. J.L. Jain, Sunjaj Jain, Nitin Jain. (2010). - Fundamentals of biochemistry for university and College Students in India and Abroad S. Chand and Company Ltd., Ram Nagar, New Delhi- 110 055.
5. Prem Prakash Gupta. (2009). Text book of biochemistry CBS Publishers & Distributors, New Delhi.
6. T. Van Bruggen., (2004). Edward Staunton West, Wilbert R. Todd, Howard S. Mason, and John Text Book of Biochemistry. 4th edition, Oxford and IBH Publicity Co, PVT, LTD, New Delhi.
7. Geoffrey L. Zubay., (1996). Biochemistry. 4th edition, New Delhi.
8. Thomas M. Devlin., (2002). Text book of Biochemistry with Clinical Correlations. 4th edition, New Delhi.
9. Christopher K.Mathews and K.E. Van Holde (1996). Biochemistry. 2nd edition. The Benjamin Cummings Publishing Company Inc,Menlo Park.
10. Sawhney S.K., (1996). Introductory Practical Biochemistry. Narosa Publishing House, Mumbai.

INVERTEBRATA, CHORDATA AND BIOLOGICAL CHEMISTRY- LAB

Semester: I **Hours: 6**

Code : 23PZO1P01 **Credit: 5**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the structure and functions of various systems in animals	PSO - 1	K1
CO - 2	Learn the adaptive features of different groups of animals	PSO - 2	K2
CO - 3	Learn the mounting techniques	PSO - 3	K3
CO - 4	Impart comprehensive knowledge on the methodology for quantitative analysis of biomolecules.	PSO - 4	K4
CO - 5	Gain knowledge on working principles and applications of biochemical instruments.	PSO - 5	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** -Create

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**INVERTEBRATA, CHORDATA AND BIOLOGICAL CHEMISTRY- LAB**							**Hours: 6**
Code :23PZO1P01											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	3	2	5	4	3	2	3	3.27
CO - 2	4	3	5	3	4	3	4	5	3	3	4	3.73
CO - 3	3	4	3	5	3	4	3	3	5	4	3	3.64
CO - 4	4	5	3	3	4	5	4	3	3	5	4	3.91
CO - 5	3	4	2	3	5	4	3	2	3	4	5	3.45
Overall Mean Score for COs												**3.60**

Result: The Score for this Course is **3.60** (High Relationship)

Note:

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

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

INVERTEBRATA

DISSECTION:

Earthworm - Nervous system

Cockroach - Digestive and Nervous system

MOUNTING:

Earthworm - Body setae

Cockroach - Mouth parts

Honey bee - Mouth parts and sting

SPOTTERS:

Amoeba, Euglena, Paramecium, Hydra, Liver fluke -Miracidium, Redia, and Cercaria larva, Tape worm, Ascaris - Male and Female, Nereis, Scorpion, Nauplius larva, Octopus, Star fish.

CHORDATA

1. Feet and Beak adaptations of any five birds
2. Study of any five venomous and non-venomous snakes
3. Collection and submission of feathers of any five birds.
4. Comparison of Pectoral girdle and pelvic girdle.
5. Comparison of Fore limbs and Hind limbs.

MOUNTING:

Placoid scale, Cycloid scale and Ctenoid scale

SPOTTERS:

Amphioxus, Ascidian, Scoliodon, Narcine, Mugil, Clarias, Tilapia, Bufo.

BIOLOGICAL CHEMISTRY

1. Determination of pH of different samples using pH meter.
2. Preparation of standard graph for carbohydrate
3. Quantitative estimation of carbohydrate in liver / muscle
4. Preparation of standard graph for protein
5. Quantitative estimation of protein in liver / muscle
6. Quantitative estimation of ascorbic acid.
7. Chromatographic separation of amino acids.
8. Determination of salivary amylase activity in relation to temperature.

INSTRUMENTS

Colorimeter, pH Meter, Centrifuge, Chromatogram, Electrophoretic unit.

RESEARCH METHODOLOGY

Semester: I **Hours: 6**
Code : 23PZO1E1A **Credit: 3**
COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	State the various aspects of research methods, working principles of bio instruments and define the terminologies and concepts of Biostatistics.	PSO - 2	K1
CO - 2	Demonstrate the methodology of scientific writing and identify the methods to analyse the data.	PSO -1	K2
CO - 3	Solve biostatistical problems and choose appropriate instruments for the research purpose.	PSO - 3	K3
CO - 4	Analyze biological samples and statistical data with relevant statistical methods and tools.	PSO - 5	K4
CO - 5	Hypothesize the project work, design experiments / Project, develop strategic methods for biological assay and data handling.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**RESEARCH METHODOLOGY**							**Hours: 6**
Code : 23PZO1E1A											**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	4	2	5	3	3	2	4	5	3	2	3	3.27
CO - 2	5	4	4	2	3	4	5	4	2	4	3	3.64
CO - 3	2	4	3	5	4	4	2	3	5	4	4	3.64
CO - 4	2	4	3	3	5	4	2	3	3	4	5	3.45
CO - 5	2	5	3	3	4	5	2	3	3	5	4	3.55
Overall Mean Score												**3.51**

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

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: EXPERIMENTAL DESIGN AND REPORT WRITING

Experimental designs - Basic principles and types. Literature collection - Need for review of literature, review process and bibliography. Literature citations - Different systems of citing references, name year system and alphabet - number system. Technical writing: Writing a research report - synopsis, research paper and review article. Plagiarism - Avoiding plagiarism during documents / thesis / manuscripts / scientific writing. Bibliographic index and research quality parameters: Citation index, impact factor, h- index, i10 index, etc. Research engines: Google scholar, scopus and web of science. **(18 Hours)**

UNIT II: BIO - INSTRUMENTATION

Principle of micro techniques - Fixatives and fixation, histological stains and staining, Freeze etching microtomy. Principle and applications of Electron microscopy - Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Scanning and Transmission Electron Microscope (STEM). Principle and applications of Chromatography - Paper, Column, High Pressure Liquid Chromatography (HPLC) and Gas Liquid Chromatography (GLC). Principle and applications of Electrophoresis - Paper, Poly Acrylamide Gel Electrophoresis (PAGE), Principle and applications of Calorimetry - Wet combustion, Bomb calorimeter, Warburg's apparatus, Oxygen analyser. Principle and applications - Autoradiography, Radiation measuring devices - Geiger Muller Counter, scintillation counter. **(18 Hours)**

UNIT III: DESCRIPTIVE STATISTICS

Define - Data, variable, sample and population. Types of variables and measurement scales. Accuracy and precision, parameters, statistics, data collection, classification, tabulation and presentation. Measures of central tendency - Mean, median and mode. Measures of variation - Range, mean deviation, quartiles and quartile deviation, inter quartile range, standard deviation, variance, coefficient of variations and standard error. **(18 Hours)**

UNIT IV: PROBABILITY AND DATA DISTRIBUTION

Probability: Terminologies, addition and multiplication theorem. Binomial, Poisson and normal distribution. Skewness and Kurtosis. Correlation analysis - types, methods - Scatter plot, Karl Pearson's correlation coefficient, Spearman's Rank correlation. Simple regression analysis - predicting X on Y and Y on X. **(18 Hours)**

UNIT V: Inferential Statistics

Hypothesis - H0 and H1, hypothesis testing, significance level, degrees of freedom, statistical errors - Type I and II, paired and unpaired tests, one tailed and two tailed tests. Chi Square test - contingency tables. Comparing means of two samples - Student's t test. Comparing more than two samples - Analysis of variance (ANOVA). Statistical packages - SPSS and R. tool. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Gurumani, N. (2017). Research Methodology for Biological Sciences. MJP Publishers, Chennai.

   Unit I: Chapter 1, 2, 3, 4, 5, 6, 7, 8
   Unit II: Chapter 9,12,13,14
2. Gupta, S. P. (2014). Statistical Methods. 44th Revised Edition. Sultan Chand & Sons Educational Publishers. New Delhi.

   Unit III: Volume I, Chapter 3, 4, 5, 6, 7, 8
   Unit IV: Volume I, Chapter 9, 10, 11
   Unit V: Volume II, Chapter 3, 4, 5
3. Zar, J. H. (2011) Biostatistical Analysis. IVth Edition. Dorling Kindersely (India) Pvt Ltd. Licenses of Pearson Education in South Asia.

   Unit III: Chapter 2, 3, 4, 5, 12
4. Daniel, W. W. (2009). Biostatistics: Basic Concepts and Methodology for the Health Sciences. IXth Edition. Wiley India Pvt. Ltd. New Delhi.

   Unit V: Chapter 7, 12
5. Anderson N Durston., (1970). Thesis and Assignment Writing. Polle Wiley Eastern Limited.
6. Kothari C.R., (2004). Research Methodology. 2nd edition, New Age International Publishers, New Delhi.
7. Parsons C.J. George Allen., (1973). Thesis and Project work Guide to Research and Writing. Unwin Ltd, London.
8. Veerakumari, L. (2006). Bioinstrumentation. Chennai: MJP Publishers.
9. Robert L. Dryer & Gene F. Lata (1989). Experimental Biochemistry. New York: Oxford University Press.
10. Ana, S.V.S. (2002). Biotechniques. Meerut: Rastogi Publications.
11. Keith Wilson & John Walker (2000). Principles and Techniques of Practical Biochemistry (5th ed.). United Kingdom: Cambridge University Press.
12. Marimuthu, R. (2008). Microscopy and Microtechnique. Chennai: MJP Publishers.
13. Khan, I. & Khanum, A. (2014). Fundamentals of Biostatistics (3rd ed.): Hyderabad. Ukaaz Publications.
14. Bailey, N.T.J. (1997). Statistical methods in Biology (3rd ed.). New York: Cam. University Press.
15. Sokal, R. & James, F. (1973). Introduction to Biostatistics. Tokyo, Japan: W.H. Freeman and Company Ltd.
16. Banerjee, P.K. (2005). Introduction to Biostatistics. New Delhi: S. Chand and Company Ltd.

REFERENCE LINKS:

UNIT I

https://scholar.google.co.in/intl/en/scholar/about.html.

https://scholar.google.co.in/intl/en/scholar/help.html

https://paperpile.com/g/google-scholar-guide/

https://clarivate.libguides.com/directlinks

https://wos-journal.com/

https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/scopus

https://libguides.graduateinstitute.ch/metrics/author_impact

https://guides.library.cornell.edu/impact/author-impact-10

https://www.researchgate.net/publication/230646373_Citation_Index_and_Impact_facto

UNIT V

https://www.spss-tutorials.com/spss-what-is-it/

https://www.simplilearn.com/what-is-r-article

https://www.educba.com/r-tools-technology/

STEM CELL BIOLOGY

Semester: I **Hours: 6**

Code : 23PZO1E1B **Credit: 3**

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the basic knowledge of stem cells and their origin.	PSO - 1	K1
CO - 2	Illustrate the embryonic and adult stem cells.	PSO - 2	K2
CO - 3	Explain the current stem cell therapies for their research.	PSO - 3	K3
CO - 4	Predict the role of stem cells in cell repair and ageing.	PSO - 5	K4
CO - 5	Summarize the applications of stem cells in therapeutics.	PSO - 4	K5, K6

COURSE OUTCOMES

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** -Create

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**STEM CELL BIOLOGY**							**Hours: 6**
Code : 23PZO1E1B											**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	4	4	2	3	5	4	4	3	2	3.55
CO - 2	4	3	5	3	2	3	4	5	3	3	2	3.36
CO - 3	2	4	3	5	3	4	2	3	5	4	3	3.45
CO - 4	2	3	3	4	5	3	2	3	4	3	5	3.36
CO - 5	2	5	3	4	4	5	2	3	4	5	4	3.73
Overall Mean Score												**3.49**

Result: The Score for this Course is **3.49** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: INTRODUCTION TO STEM CELL BIOLOGY

Stem cell definition, origin and hierarchy, stem cell properties, Identification and Characterization, potency and differentiation, niche of stem cell, overview of different stem cell types (embryonic stem cells, adult stem cells and induced pluripotent stem cells). **(18 Hours)**

UNIT II: Embryonic Stem Cell

Characterization and properties of ES cells, pluripotency and self-renewal of ES cells; molecular mechanisms regulating pluripotency and maintenance of the stem state, progressive differentiation of ES cells into ectoderm lineage organs (skin, brain and nerve), mesoderm lineage organs (heart, kidney, muscle, bone and blood), and endoderm lineage organs (lung, liver, stomach, pancreas and intestine). **(18 Hours)**

UNIT III: ADULT STEM CELLS

Mesenchymal stem cells (MSCs) - sources, properties (plasticity, homing and engraftment), potency and characterization; Hematopoietic stem cells (HSCs) - sources, properties, potency and characterization; steps involved in production of induced pluripotent stem cells (iPSCs); role of Yamanaka factor in iPSCs.**(18 Hours)**

UNIT IV: STEM CELL AND AGING

Aging theory; cell cycle; telomere and telomerase; senescence of stem cell; role of stem cell in aging; tissue repair and regeneration of adult stem cell. **(18 Hours)**

UNIT V: CURRENT STEM CELL THERAPIES

Advantages and disadvantages of ES cells and adult stem cells (MSCs and HSCs) therapy; Ethical concern on stem cell therapy; current stem cell therapy for various diseases; clinical outcome of stem cell therapy; state of clinical trials in adult stem cells for various diseases. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Kiessling, A.A. (2006). Human Embryonic Stem Cells (Second Ed.), Jones & Barlett Publishers.
2. Lanza, R. and A. Atala. (2005). Essentials of Stem Cell Biology. Academic Press.
3. Turksen, K. (2004). Adult Stem Cells. Humana Press, Inc.
4. Lanza, R. *et al*. (2004). Handbook of Stem Cells: Embryonic/Adult and Fetal Stem Cells (Vol. 1 & 2). Academic Press.
5. Institute of Medicine, (2002). Stem cells and the future of regenerative medicine. National Academy Press.
6. Marshak, D., R.L. Gardener and D. Gottlieb. (2001). Stem Cell Biology, Cold Spring Harbour Monograph Series, 40.

AQUACULTURE

Semester: I **Hours: 6**

Code : 23PZO1E1C **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the fish farm and their maintenance.	PSO - 1	K1
CO - 2	Apply the knowledge on feed formulation and feeding methods of fishes.	PSO - 3	K2
CO - 3	Analyze different culture methods in aquaculture.	PSO - 2	K3
CO - 4	Identify different fish diseases, diagnosis and their management strategies.	PSO - 5	K4
CO - 5	Create interest in self-employment and to earn income by developing the skills in ornamental fish culture.	PSO - 4	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** -Create

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				AQUACULTURE							Hours: 6
Code : 23PZO1E1C											Credit: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	3	3	2	4	5	3	3	4	2	3.45
CO - 2	3	4	3	5	2	4	3	3	5	4	2	3.45
CO - 3	3	4	5	4	2	4	3	5	4	4	2	3.64
CO - 4	4	2	3	3	5	2	4	3	3	2	5	3.27
CO - 5	2	5	3	4	3	5	2	3	4	5	3	3.55
Overall Mean Score												3.47

Result: The Score for this Course is **3.47** (High Relationship)

Note:

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

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$

UNIT I

Importance of Aquaculture, Present status, prospects and scope in India. Freshwater aquaculture, Brackish water aquaculture, Mariculture, Metahaline culture in India. Types of fish culture, Types of fish ponds for culture practice. Topography - site selection, water quality, soil condition and quality. Structure and construction design and layout, inlet and outlet. Water quality management for aquaculture. Control of parasites, predators and weeds in culture ponds. Fish farm implements - Secchi disc, aerator, pH meter, tools for hypophysation, feeding trays, Fishing gears used in aqua farming. **(18 Hours)**

UNIT II

Procurement of seed from natural resources - Collection methods and segregation. Hatchery technology for major carps and freshwater prawn. Artificial seed production -Breeding under control conditions, induced breeding technique, larval rearing, packing and transportation. Commercial substitute for pituitary extracts. Classification of fish feed - Artificial feeds, Types, Feed formulation, Feeding methods. Live feed - Microalgae, Rotifer, Artemia and their culture.

(18 Hours)

UNIT III

Shrimp Hatchery Technology - Hatchery design, brood stock management, spawning, larval rearing, Shrimp developmental stages, algal culture, packing and transportation. Shrimp culture technology - extensive culture methods, semi-intensive, intensive culture methods, Biofloc technology, harvesting, preservation and marketing. Brackish water fish culture. Edible and Pearl oyster culture - pearl production. Crab culture. Economic importance of Lobster, Sea urchin and Sea cucumber - their by-products. Types of Seaweeds - species and methods of culture -by-products. **(18 Hours)**

UNIT IV

Fish and Shrimp Diseases and health management -infectious diseases - Bacterial, Fungal, Viral, Protozoan; Non-infectious - environmental and nutritional diseases. Diseases diagnosis, prevention and control measures. **(18 Hours)**

UNIT V

Types of ornamental fishes - Freshwater and marine, their breeding behavior and biology. Oviparous, Ovo-viviparous and Viviparous fishes. Setting and maintenance of freshwater Aquarium tanks. Central aquaculture research organizations- CMFRI, CIBA, CIFT, CIFA, CIFE, MPEDA and its activities. **(18 Hours)**

REFERENCE BOOKS:

1. Rajendra Kumar Rath, (2011), Freshwater Aquaculture, 3rd Edition, Scientific publishers, India.
   Unit I: Chapter 3, 4,6
   Unit II: Chapter 10
   Unit III: Chapter 13
   Unit IV: Chapter 11
   Unit V: Chapter 17
2. Arumugam N., (2014), Aquaculture and Fisheries, Saras Publication, Nagercoil.
   Unit I: Chapter 12,
   Unit II: Chapter 25, 26
   Unit III: Chapter 17, 19, 20
   Unit IV: Chapter 27
   Unit V: Chapter 23
3. Santhanakumar G., Selvaraj A. M., Nagarajan T., (1997), Problems and Prospects of Aquaculture, ISCT, Nagercoil.
4. Pillay, T. V. R. (1990). Aquaculture: Principles and Practices. Blackwell Scientific Publications Ltd.
5. Santhanam, R. (1990). Fisheries Science. Daya Publishing House.
6. Sinha, V.R. P. and Srinivastava, H. C. (1991). Aquaculture Productivity. Oxford and IBH Publications CO., Ltd., New Delhi.
7. Yadav, B. N. (1997). Fish and fisheries.Daya Publishing house, New Delhi.
8. Das M. C. and Patnaik, P. N. (1994) Brackish water culture. Palani paramount Publications, Palani, T. N.
9. Day, F (1958). Fishes of India, VoL I and Vol. II. William Sawson and Sons Ltd., London.
10. Jhingran, V. G. (1991). Fish and Fisheries of India. Hindustan Publishing Co., India

SERICULTURE

Semester: I **Hours: 4**

Code : 23PZO1SE1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall and state key terms and stages in sericulture.	PSO - 1	K1
CO - 2	Explain the cultivation of mulberry plants, life cycle of silkworms and the process of silk production.	PSO - 2	K2
CO - 3	Explain the types of fibres and methodology of moriculture and sericulture.	PSO - 4	K3
CO - 4	Evaluate sericulture scenario in India, factors influencing silk quality and identify potential challenges in sericulture.	PSO - 3	K4
CO - 5	Integrate knowledge to optimize sericulture practices for improved silk yield and develop entrepreneurial skill.	PSO - 5	K5,K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				SERICULTURE								Hours: 4
Code : 23PZO1SE1												Credit: 2
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	3	4	2	2	3	5	4	2	3	2	3.18
CO - 2	4	4	5	3	2	4	4	5	3	4	2	3.64
CO - 3	3	5	4	3	2	5	3	4	3	5	2	3.55
CO - 4	4	3	3	5	3	3	4	3	5	3	3	3.55
CO - 5	4	3	4	2	5	3	4	4	2	3	5	3.55
Overall Mean Score												3.49

Result: The Score for this Course is **3.49** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Introduction to textile fibers; types- natural and synthetic fibers; sources of silk fiber- Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel; properties and importance of silk fiber. History, development, status, characteristics and advantages of sericulture in India. **(12 Hours)**

UNIT II

Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry. **(12 Hours)**

UNIT III

Bombyx mori- morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation. **(12 Hours)**

UNIT IV

Rearing houses and equipment. Rearing operations- disinfection, brushing, feeding and spacing. Moulting and spinning. Harvest. Rearing methods- chawki, lasso, showa, shelf-rearing, floor-rearing and shoot rearing. Diseases of *Bombyx mori*- protozoan, bacterial, viral and fungal. Pests of silkworm- Uzi fly, desmestids, mites, ants, nematodes, aves and mammals. **(12 Hours)**

UNIT V

Physical and commercial characteristics of cocoons. Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling and re-reeling. Weaving. By-products of sericulture industry. **(12 Hours)**

BOOKS FOR REFERENCE:

1. Johnson M., M. Kesary, (2019), Sericulture, Saras Publication, Nagercoil.

   Unit I: Chapter
   Unit II: Chapter 2,3
   Unit III: Chapter 4,5,6,7
   Unit IV: Chapter 8,9,10
   Unit V: Chapter 10,11,12,13,14,15,16
2. Ganga C., J. Sulochana Chetty (2021), An Introduction to Sericulture, 2nd Edition, Oxford and IBH Publishing, India.
3. Narayana Reddy (2002), The Essentials of Forensic Medicine and Toxicology,21st edition, Om Sai Graphics, Hyderabad.
4. Saferstein R. Criminalistics -An Introduction to Forensic Science.
5. Y. Tazima., 1978.The silkworm: An important laboratory tool. Kodansha Publication.

SOFT SKILL

Semester: I **Hours: 2**

Code : 23PAE1SK1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	State their short and long term goals	PSO - 1	K1
CO - 2	Associate their social, interpersonal, cognitive, ethical, professional, reading and communication skills	PSO-5	K2
CO - 3	Administer their self - esteem and confidence	PSO - 4	K3
CO - 4	Formulate their resumes wisely	PSO - 2	K4
CO - 5	Assess the mock group discussions and interviews with a challenge to choose their right career	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I				**SOFT SKILL**							**Hours: 2**
Code : 23PAE1SK1											**Credit: 2**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	4	2	2	5	2	4	5	2	2	2	4	3.09
CO - 2	5	4	4	3	4	5	3	4	4	4	5	4.09
CO - 3	4	2	5	2	2	4	2	2	2	5	4	3.09
CO - 4	4	2	2	2	5	4	2	5	2	2	4	3.09
CO - 5	4	5	3	2	2	4	2	2	5	3	4	3.27
Overall Mean Score												**3.33**

Result: The score for this course is **3.33** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: SOFT SKILLS-INTRODUCTION

What are soft skills? - Importance of Soft skills-Difference between hard skills and soft skills-Top 60 soft skills. SWOC analysis-Self-Discovery-Advantages of SWOC analysis-Identifying your soft skills. **(6 Hours)**

UNIT II: ATTITUDE AND PERCEPTION

what is attitude? -formation of attitudes-positive and negative attitudes -power of positive attitude-developing positive attitude-obstacles in developing positive attitudes-results of positive attitude-overcoming negative attitude and its impacts. Perception - factors influencing perception-changing and improving perception towards positive attitude. **(6 Hours)**

UNIT III: TIME AND STRESS MANAGEMENT

Value of time-Sense of time management-Difficulties in time management-Evils of not planning-Reasons for procrastination-Overcoming procrastination- Effective scheduling-Steps to and Tips for Time Management-Deciding upon priorities-Grouping activities. Stress-Definition -Causes of Stress-Effects of Stress-Signs of stress-Stress as appositive and negative reinforcer-spotting stress in you-Behaviours identified with stress- for stress management. **(6 Hours)**

UNIT IV: EMOTIONAL BALANCE-TEAM BUILDING AND LEADERSHIP QUALITIES

What is Emotional Intelligence? -Emotional IQ-Intellectual IQ-Why emotional balance is important-Benefits of Emotional IQ-Four important Elements of Emotional IQ-Control of your reaction to situation. Skills needed for teamwork-Role of a team leader-challenges faced in collaboration-advantages of team-spirit. **(6 Hours)**

UNIT V: INTERVIEW SKILLS, GROUP DISCUSSION, PREPARING RESUME/CV

Types of interview-One to one Interview-Interview panel-Dress code at interview-punctuality-interview etiquettes-Group Discussion- Why group discussion-Types of group discussion-Skills required-GD Etiquette-Movement and gestures to be avoided-initiating a GD-Resolving conflicts. Preparing Resume/CV-Tips.**(6 Hours)**

COURSE BOOK:

- Dr. K. Alex, *Soft skills,* Chand & company Pvt. Ltd., New Delhi, 2010.

BOOK FOR REFERENCE:

- Kumar, Suresh, Sreehari and Savithri. *Communication Skills and Soft Skills: An Integrated Approach,* Pearson India, 2010.

INTERNAL QUESTION PATTERN

SOFT SKILL - 23PAE1SK1

INTERNAL COMPONENTS

Test 1	40
Test 2	40
Term Paper	5
Seminar	10
Attendance	5
Total	**100**

CELL AND MOLECULAR BIOLOGY

Semester: II **Hours: 6**

Code : 23PZO2C03 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the key concepts on molecular structure and functional mechanism of cell organelles.	PSO - 1	K1
CO - 2	Explain the transportation of materials, formation of cell components, cell communication and central dogma of gene expression.	PSO - 2	K2
CO - 3	Apply the knowledge of cell organelle, cellular signaling, manipulation in gene expression to improve organism's health.	PSO - 3	K3
CO - 4	Assess cellular adaptability, nuclear coordination, tissue homeostasis, environmental factors and epigenetic modifications on gene expression.	PSO - 4	K4
CO - 5	Examine the role of cell organization in evolution, dysregulated cell signaling, DNA repair in genomic stability.	PSO - 5	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester:				**CELL AND MOLECULAR BIOLOGY**							**Hours:**
Code : 23PZO2C03											**Credit:**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	4	2	5	4	3	2	4	3.45
CO - 2	4	2	5	2	4	2	4	5	2	2	4	3.27
CO - 3	4	2	3	5	4	2	4	3	5	2	4	3.45
CO - 4	4	5	4	3	4	5	4	4	3	5	4	4.09
CO - 5	4	3	4	2	5	3	4	4	2	3	5	3.55
Overall Mean Score												**3.56**

Result: The score for this course is **3.56** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: CELL TRANSPORT AND SIGNALING ACROSS CELL

Plasma Membrane -Transport across membranes, Active and Passive transport. Facilitated transport Cell junctions, Tight junctions, Desmosomes, Gap junction - connexin. Extracellular matrix - Collagen and non- collagen components. Cell and cell matrix interaction. Calcium dependent and Calcium independent homophilic. Cell Signaling -Extra cellular signaling, signaling molecules and their receptors. Functions of cell surface receptors. Pathways of intracellular signal transduction- G protein coupled receptors - Cyclic AMP pathways - Receptor Tyrosine Kinases (RTKs) - Ras, Raf and MAP kinase pathway - second messengers - signaling from plasma membrane to nucleus. **(18 Hours)**

UNIT II: STRUCTURE & FUNCTIONS OF CELL ORGANELLES

Mitochondria- Structure, semi-autonomous nature, endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemiosmotic hypothesis. Cytoskeleton - Structure and functions, microtubules, microfilaments and intermediate filaments. Nucleus - Structure of nucleus, nuclear envelope, nuclear pore complex, and nucleolus. Chromatin - Euchromatin and Hetrochromatin and packaging (nucleosome). Nuclear Transport -Import and Export of protein, export of different RNAs. Structure and functions - endoplasmic reticulum, Golgi apparatus, lysosomes. Biology of ageing, role of anti-oxidants and free radicals. **(18 Hours)**

UNIT III: CHEMICAL NATURE OF GENETIC MATERIALS

Nucleic Acids - Salient features of DNA and RNA, Watson and Crick model of DNA, DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres. Transcription - RNA polymerase and transcription, mechanism of transcription in prokaryotes and eukaryotes, Post transcriptional modifications and processing of eukaryotic RNA, Concept of introns and exons, Transcription factors. **(18 Hours)**

UNIT IV: TRANSLATION, PROCESSING AND TRANSPORT

Genetic code, Translation in prokaryotes - Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA, Inhibitors of translation. Post translational modifications. Protein - Protein trafficking - sorting: Secretary and endocytic pathway - transport from endoplasmic reticulum to Golgi - Anterograde and retrograde transport - transport to lysosome - exocytosis - endocytosis. Membrane protein and secretary proteins. **(18 Hours)**

UNIT V: GENE REGULATION

Gene Regulation - Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon, Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements, Gene silencing, Genetic imprinting. DNA repair mechanisms - Pyrimidine dimerization and mismatch repair. Regulatory RNAs - Ribo-switches, RNA interference, miRNA, siRNA. **(18 Hours)**

BOOKS FOR REFERENCE:

1. De Robertis, E.D.P. (2011). Cell and Molecular Biology (8th ed.). New York: Lippincott.

   Unit II: Chapter -2-2,2-4
   Unit III: Chapter 20-1,20-2,20-3
   Unit IV: Chapter 21-1,21-3,21-5,21-6
2. Ajoy Paul, (2007). Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd. Kolkata.

   Unit II: Chapter 15,16,17
   Unit III: Chapter 29,30
   Unit IV: Chapter 33
   Unit V: Chapter 37,38
3. David Friefelder (2012) Molecular Biology 2nd edition. Narosa Publishing House

   Unit III: Chapter 13

   Unit IV: Chapter 14,15,16
4. C.B Powar (2011) Cell Biology, 3rd edition, Himalaya Publishing House, New Delhi

   Unit I -Chapter 6,15,22

   Unit II -Chapter 27,28,29
5. Alexander McLennan, Andy Bates (2017) 4th edition, Bios Instant Notes, Molecular Biology, Taylor and Francis Group,NewJersy
6. Kapoor, V.C. (2001). Practice of Animal Taxonomy (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd New Delhi.
7. Lodish, H. & Berk, A. (2016). Molecular Cell Biology (8th ed.). W.H. Freeman and Company Limited Publication, New York.
8. Gupta, P.K. (2014). Cell and Molecular Biology (4th ed.). Rastogi Publication, New Delhi.
9. Geoffrey M. Cooper & Robert E. Hausman (2013). The cell: A Molecular Approach (6th ed.). Sinauer Associates Publication, Massachusetts, USA.
10. Alberts B., Johnson. A., Lewis, J., Raff, M., Roberts, K. and Watter, P. (2008). Molecular Biology of the Cell (5th ed.). Garland Science Publication, New York.

REFERENCE LINK

UNIT 1

1. https://www.lecturio.com/magazine/cell-surface-receptors-types-downstream-mechanisms/
2. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/09%3A_Cell_Communication/9.03%3A_Signaling_Molecules_and_Cellular_Receptors_-_Types_of_Receptors
3. https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/cell-communication/a/introduction-to-cell-signaling

UNIT II

1. https://www.kenhub.com/en/library/anatomy/cellular-organelles
2. https://www.geeksforgeeks.org/cell-organelles-definition-structure-types-functions/

UNIT V

1. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_Biology_(Kimball)/05%3A_DNA/5.13%3A_DNA_Repair
2. https://cshperspectives.cshlp.org/content/4/2/a003566
3. https://www.news-medical.net/life-sciences/What-is-MicroRNA.aspx

DEVELOPMENTAL BIOLOGY

Semester: II **Hours: 6**

Code : 23PZO2C04 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Define and recall concepts related to embryonic development, post embryonic development and medical implications of developmental biology.	PSO - 1	K1
CO - 2	Explain the sequence of events during embryonic development and formation of tissues and organs, the genetic basis of developmental process and regulation of post developmental process.	PSO - 5	K2
CO - 3	Apply knowledge of developmental principles related to embryonic development, organ formations in medical field.	PSO - 4	K3
CO - 4	Appraise proficiency in equipping for advanced research medical applications and contribution to the field of developmental biology.	PSO - 3	K4
CO - 5	Evaluate intricate molecular and cellular mechanism underlying embryogenesis.	PSO - 2	K5,K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II				**DEVELOPMENTAL BIOLOGY**								**Hours: 6**
Code : 23PZO2C04												**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	3	2	5	4	3	2	3	3.27
CO - 2	4	2	3	2	5	2	4	3	2	2	5	3.09
CO - 3	3	5	3	3	3	5	3	3	3	5	3	3.55
CO - 4	4	3	4	5	3	3	4	4	5	3	3	3.73
CO - 5	4	3	5	3	4	3	4	5	3	3	4	3.73
Overall Mean Score												**3.47**

Result: The score for this course is **3.47** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: PATTERN OF ANIMAL DEVELOPMENT

Chief events in animal development; Gametogenesis: Origin of germ cells, Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians, Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitaion in mammals, Acrosome reaction. Sperm -egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation. **(18 Hours)**

UNIT II: CLEAVAGE AND GASTRULATION

Pattern of embryonic cleavage, mechanisms of cleavage, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, *Amphioxus*, Amphibians, Aves, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation -Formation of primary germ layers. Nucleocytoplasmic interaction. **(18 Hours)**

UNIT III: EMBRYONIC DEVELOPMENT

Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian -Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation. Gene and development; Anterior- posterior axis in determination in drosophila, Maternal effect genes - *Bicoid* and *Nanos* proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation -Gap genes; pair rule genes; Homeotic genes. **(18 Hours)**

UNIT IV: POST EMBRYONIC DEVELOPMENT METAMORPHOSIS

Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis. Regeneration: Formation of ectodermal cap and regeneration blastema -Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration -Biochemical changes assosciated with regeneration. Aging and senescences: Biology of senescences- cause of aging- mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy, Induced ovulation in humans - Cryopreservation of gametes/embryos - Ethical issues in cryopreservation.

(18 Hours)

UNIT V: MEDICAL IMPLICATIONS OF DEVELOPMENTAL BIOLOGY

Infertility, Defects in reproductive organ-Ovarian cysts, fibroid, endometrial thickening and mullerian anomalies. ART (Assisted Reproductive Technology). Stem cells and therapeutic cloning. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Chattopadhyay S., (2019), An Introduction to Developmental Biology, Books and Allied Pvt. Ltd., Kolkatta.
   Unit I: Chapter 8, 9
   Unit II: Chapter 10,11
   Unit III: Chapter 14,
   Unit IV: Chapter 20, 21, 22
2. Subramanian M. A., (2012), Developmental Biology, MJP Publishers, New Delhi.
   Unit I: Chapter 3, 4, 5, 6
   Unit II: Chapter 9, 10, 11
   Unit III: Chapter 15,
   Unit IV: Chapter 19, 20
3. Scott F. Gilbert, (2006), Developmental Biology, Eighth Edition, Sinauer Associates, inc., Publishers, USA.
   Unit II: Chapter 8, 11
   Unit III: Chapter 11
   Unit IV: Chapter 9, 18
4. Arumugam N., (2015), Developmental Zoology, 2nd Edition, Saras Publication, Nagercoil.
   Unit V: Chapter 25, 29, 30, 31.
5. Balinsky, B. I. (1981). Introduction to Embryology (5th Edition), CBS College Publishers, New York.
6. Gilbert. S. F. (2006). Developmental Biology, 8th Edition, INC Publishers, USA.
7. Berrill, N.J. (1974). Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi.
8. Tyler, M.S. (2000). Developmental Biology - A Guide for Experimental Study, Sunderland, MA.
9. Subramaniam, T. (2011). Molecular Developmental Biology (2nd Edition), Narosa Publishers, India.

CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY - LAB

Semester: II **Hours: 6**

Code : 23PZO2P02 **Credit: 5**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the skills pertaining to cell biology, and Developmental Biology.	PSO - 1	K1
CO - 2	Show the Mitotic stages in root meristematic cells of plants.	PSO - 2	K2
CO - 3	Analyze the variations in cell types and significance of various cells.	PSO - 3	K3
CO - 4	Assess the developing stages of chick embryo.	PSO - 5	K4
CO - 5	Prepare the human blood smear to identify the WBC.	PSO - 4	K5,K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** -Create

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II				CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY - LAB							Hours: 6
Code : 23PZO2P02											Credit: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	4	3	4	4	5	4	3	4	4	4.00
CO - 2	4	3	5	3	4	3	4	5	3	3	4	3.73
CO - 3	3	4	4	5	3	4	3	4	5	4	3	3.82
CO - 4	4	4	4	3	5	4	4	4	3	4	5	4.00
CO - 5	3	5	4	3	4	5	3	4	3	5	4	3.91
Overall Mean Score for COs												3.89

Result: The Score for this Course is **3.89** (High Relationship)

Note:

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

Values Scaling:

Mean Score of Cos = Total of Values / Total No. of Pos & PSOs	Mean Overall Score for Cos = Total of Mean Scores / Total No. of Cos

CELL BIOLOGY

1. Determination of cell size using micrometer.
2. Mitosis in root meristematic cells of plants.
3. Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus.
4. Preparation of Human blood smear.
5. Identification of blood cells in the hemolymph of the of the cockroach.
6. Preparation of squamous epithelial cells.
7. Observation of adipocytes from fat body of cockroach.
8. Isolation of genomic DNA from eukaryotic tissue.

DEVELOPMENTAL BIOLOGY

1. T.S of testis and ovary of frog and mammal.
2. Observation of cleavage, blastula, gastrula of frog.
3. Observation of 24-, 48-, 72- and 96-hour's chick embryo.
4. Observation of sperm and egg of mammal.
5. Observation of any two congenital abnormalities - chart.
6. Early stages of development in chick - cleavage, blastula and gastrula.
7. Late stage of development in chick embryo - Organogenesis.
8. Observation and whole mount preparation of the chick blastoderm.
9. Regeneration in Frog Tadpoles.
10. Blastema formation.
11. Role of thyroxine on the metamorphosis of tadpole.

HUMAN PHYSIOLOGY

Semester: II **Hours: 6**

Code : 23PZO2ID1 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the principles and basic facts of human physiology.	PSO - 1	K1
CO - 2	Explain the basic anatomical structure of major organs in the human body.	PSO - 5	K2
CO - 3	Illustrate the physiology of different organs and their disorders.	PSO - 2	K3
CO - 4	Analyze the implications of physiological concepts in real life scenarios.	PSO - 3	K4
CO - 5	Critically assess the coordination of organs and organ systems in maintaining homeostasis and considering their role in health.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II												**Hours: 6**
Code : 23PZO2ID1				**HUMAN PHYSIOLOGY**								**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	3	2	5	4	3	2	3	3.27
CO - 2	3	3	4	3	5	3	3	4	3	3	5	3.55
CO - 3	4	2	5	4	3	2	4	5	4	2	3	3.45
CO - 4	4	3	3	5	4	3	4	3	5	3	4	3.73
CO - 5	3	5	4	2	3	5	3	4	2	5	3	3.55
Overall Mean Score												**3.51**

Result: The score for this course is **3.51** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: NUTRITION AND GASTROINTESTINAL PHYSIOLOGY

Nutritional requirements for normal adult - carbohydrates, proteins, fats, minerals and vitamins, calorific values and daily requirements. Balanced diet, Malnutrition, Energy balance and BMR. Digestion - Functional anatomy of the digestive system (human Digestion and absorption of nutrients- carbohydrates, fats and proteins), Gastro intestinal disorders - Gall stones, liver cirrhosis, gastritis, peptic ulcer and appendicitis. **(18 Hours)**

UNT II: CARDIOVASCULAR PHYSIOLOGY

Functional anatomy of human heart, Components and functions of blood, blood grouping, heartbeat, cardiac cycle and ECG - its principles and significance. sphygmomanometer, heart diseases (Atherosclerosis and coronary thrombosis).

(18 Hours)

UNIT III: RESPIRATORY PHYSIOLOGY

Structure of lungs - Transport of carbon dioxide and oxygen in blood and tissues, respiratory quotient (RQ), factors affecting gaseous transport. Respiratory problems - bronchial asthma, pneumonia and pulmonary tuberculosis. **(18 Hours)**

UNIT IV: NEUROMUSCULAR PHYSIOLOGY

Structure of neuron, Synaptic transmission of impulses. Structure and mechanism of photo and phonoreceptors. Eye diseases- Myopia, Hypermetropia, eye allergies, diabetic retinopathy. Osteosclerosis and middle ear infection. Ultrastructure of skeletal muscle and mechanism of muscle contractions. **(18 Hours)**

UNIT V: URINOGENITAL PHYSIOLOGY

Structure and function of Kidney and nephron. Mechanism of urine formation in brief. Renal disorders - nephritis, renal calculi, Dialysis. Menstrual cycle and contraception. Pregnancy, gestation and Parturition. Factors of Infertility, Artificial insemination, surrogate motherhood, IVF, test tube baby. **(18 Hours)**

REFERENCE BOOKS:

1. N. Arumugam and Mariakuttikan A, 2019, Animal Physiology 12th edition, Saras Publications

Unit I: Chapter: 7, 9, 31, 34, 35, 36, 37, 40, 74, 75, 84, 85, 86, 87

Unit II: Chapter: 162, 170, 171, 173, 176, 183, 339

Unit III: Chapter: 149, 152, 153, 154, 156, 302, 303

Unit IV: Chapter: 260, 265, 272, 275, 278, 284

Unit V: Chapter: 197,198,203,204,206,324,325,326

2. Arumugam N, 2019, Developmental Biology, Saras Publications
   Unit V : Chapter: 25, 26, 27, 28
3. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology (12th edition) John Wiley and Sons, Inc.
4. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology (9th edition) McGraw Hill.
5. Guyton, A.C. and Hall, J.E. (2011) Textbook of Medical Physiology (12th edition) Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
6. Marieb, E. (1998) Human Anatomy and Physiology (4th edition) Addison- Wesley.
7. Kesar, S. and Vashisht, N. (2007) Experimental Physiology, Heritage Publishers.
8. Dee Unglaub Silverthorn, (2015) Human Physiology: An integrated Approach, VII edition, Pearson Education limited, Edinburgh gate, England.
9. Sawant, K.C. (2011). Human Physiology. New Delhi: Wisdom Press/ Dominant Publishers and Distributors Pvt Ltd.
10. Sarada Subrahmanyam and Madhavankutty, K. (2001). Text Book of Human Physiology (6th ed.). New Delhi: S. Chand and Company Ltd.

REFERENCE LINKS

UNIT I

1. https://en.wikipedia.org/wiki/Gastrointestinal_physiology
2. https://www.mayoclinic.org/diseases-conditions/gallstones/symptoms-causes/syc-20354214
3. https://www.mayoclinic.org/diseases-conditions/cirrhosis/symptoms-causes/syc-20351487
4. https://www.mayoclinic.org/diseases-conditions/gastritis/symptoms-causes/syc-20355807
5. https://www.mayoclinic.org/diseases-conditions/peptic-ulcer/symptoms-causes/syc-20354223
6. https://www.hopkinsmedicine.org/health/conditions-and-diseases/appendicitis

UNIT II

1. https://www.biologydiscussion.com/blood/blood-volume/blood-volume-regulation-and-causes-blood-biology/81201
2. https://my.clevelandclinic.org/health/diseases/16753-atherosclerosis-arterial-disease
3. https://www.healthline.com/health/coronary-artery-disease/coronary-thrombosis

UNIT III

1. https://www.mayoclinic.org/diseases-conditions/asthma/symptoms-causes/syc-20369653
2. https://www.mayoclinic.org/diseases-conditions/pneumonia/symptoms-causes/syc-20354204
3. https://www.houstonmethodist.org/pulmonology/tuberculosis/

UNIT IV

1. https://www.webmd.com/eye-health/nearsightedness-myopia
2. https://patient.info/eye-care/long-sight-hypermetropia
3. https://acaai.org/allergies/allergic-conditions/eye-allergy/
4. https://www.mayoclinic.org/diseases-conditions/diabetic-retinopathy/symptoms-causes/syc-20371611
5. https://www.pennmedicine.org/for-patients-and-visitors/patient-information/conditions-treated-a-to-z/otosclerosis
6. https://www.hopkinsmedicine.org/health/conditions-and-diseases/myasthenia-gravis
7. https://www.mayoclinic.org/diseases-conditions/multiple-system-atrophy/diagnosis-treatment/drc-20356157
8. https://www.medicalnewstoday.com/articles/muscle-hypertrophy

UNIT V

1. https://www.britannica.com/topic/surrogate-motherhood
2. https://www.mayoclinic.org/diseases-conditions/ovarian-cysts/symptoms-causes/syc-20353405
3. https://www.mayoclinic.org/diseases-conditions/uterine-fibroids/symptoms-causes/syc-20354288
4. https://familydoctor.org/condition/endometrial-hyperplasia/

POULTRY FARMING

Semester: II **Hours: 4**

Code : 23PZO2SE2 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	understand the various practices in Poultry farming.	PSO - 1	K1
CO - 2	Know the needs for Poultry farming and the status of India in global market.	PSO - 5	K2
CO - 3	Apply the techniques needed in Poultry farming.	PSO - 4	K3
CO - 4	Analyze, diagnose and control infectious diseases of livestock.	PSO - 3	K4
CO - 5	Overcome the difficulties in Poultry farming and propose plans against it.	PSO - 2	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** -Create

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II				**POULTRY FARMING**							**Hours: 4**
Code : 23PZO2SE2											**Credit: 2**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	2	2	5	4	3	2	2	3.09
CO - 2	4	4	2	3	5	4	4	2	3	4	5	3.64
CO - 3	4	5	2	3	3	5	4	2	3	5	3	3.55
CO - 4	2	3	4	5	3	3	2	4	5	3	3	3.36
CO - 5	2	3	5	3	3	3	2	5	3	3	3	3.18
Overall Mean Score												**3.36**

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

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India - Principles of poultry housing - Poultry houses - Systems of poultry farming. **(12 Hours)**

UNIT II

Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance. **(12 Hours)**

UNIT III

Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding. **(12 Hours)**

UNIT IV

Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme. **(12 Hours)**

UNIT V

Selection, care and handling of hatching eggs - Egg testing. Methods of hatching. - Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste. **(12 Hours)**

BOOKS FOR REFERENCE:

1. Singh R.A 2011, Poultry Production 3rd edition, Kalyani Publishers
   Unit II: Chapter 9.
   Unit III: Chapter 11.
   Unit IV: Chapter 15,16.
   Unit V: Chapter 8.
2. Gnaamani M.R, 1988, Profitable Poultry farming, 4th edition,Vijaya printers,Madurai
   Unit I: Chapter 1
   Unit II: Chapter 2
   Unit III: Chapter 3
   Unit IV: Chapter 4
3. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi 2.
4. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi"
5. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow."
6. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
7. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
8. http://ecoursesonline.iasri.res.in/course/view.php?id=335
9. https://swayam.gov.in/nd2_nou19_ag09/preview

CYBER SECURITY

Semester: II **Hours: 2**

Code : 23PAE2SK2 **Credit: 2**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	State the need of Cyber Security and history of Internet	PSO-1	K1
CO-2	Understand history and types of Cyber Crime	PSO-2	K2
CO-3	Apply critical thinking in Security Policies and Cyber Laws	PSO-3	K3
CO-4	Discuss and demonstrate the cyber security components and infrastructure security	PSO-4	K4
CO-5	Diagnose the ways and means of fighting Cyber Attacks	PSO-5	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II				**CYBER SECURITY**							**Hours: 2**
Code : 23PAE2SK2											**Credit: 2**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO-1	5	3	3	3	3	3	5	3	3	3	3	3.36
CO-2	4	3	3	5	3	3	4	5	3	3	3	3.55
CO-3	3	5	3	4	3	3	3	4	5	3	3	3.55
CO-4	3	3	5	4	5	3	3	4	3	5	3	3.73
CO-5	2	3	3	2	3	5	2	2	3	3	5	3.00
Overall Mean Score												**3.44**

Result: The score for this course is **3.44** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Introduction: Cyber Security – The need of the Hour - History of Internet – Impact of Internet – Internet in India **(6 Hours)**

UNIT II

Introduction to Cyber Security: Cyber Security – CIA Triad - Reasons for Cyber Crimes – Why we need Cyber Security – Damage to the Organizations – History of Cyber Crimes – Types of Cyber Crimes **(6 Hours)**

UNIT III

Cyber Security Components: OSI Layer – Zero Day Attacks – Types of Network Attacks – Application Security – Endpoint Security – Identify and Access Management (IAM) – Mobile Security – Data Security - Drive-By Download - Infrastructure Security - Disaster Recovery (DR) - End-user Education **(6 Hours)**

UNIT IV

Fighting Cyber Attacks: Defense in Depth – Authentication - Cryptography – Firewall - Data Loss Prevention - Antivirus Software - Virtual Private Network (VPN)- Web browsers - Data Backup – Conclusion **(6 Hours)**

UNIT V

Introduction to Security Policies and Cyber Laws: Need for an Information Security Policy - Information Security Standards – ISO - Introducing Various Security Policies and Their Review Process - Introduction to Indian Cyber Law - Objective and Scope of the IT Act, 2000 - Intellectual Property Issues - Overview of Intellectual-Property- Related Legislation in India - Patent - Copyright - Law Related to Semiconductor Layout and Design - Software License **(6 Hours)**

BOOKS FOR STUDY

1. **"Introduction to Cyber Security: Guide to the World of Cyber Security",** Anand Shinde, Notion Press, 2021

   Unit I : Chapter: 1
   Unit II : Chapter: 2.
   Unit III : Chapter: 3
   Unit IV : Chapter: 4.

2. "Introduction to information security and cyber laws", Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI, Dreamtech Press, 2014

   Unit V : Chapter: 4

BOOKS FOR REFERENCE

1. **"Information and Cyber security: Principles and Practices",** S U, Aswathy; Faizal, Ajesh; V, Antony Asir Daniel, Noor Publishing, 2020
2. "**Security in the Digital Age: Social Media Security Threats and Vulnerabilities**", Henry A. Oliver, Create Space Independent Publishing Platform, 2015
3. "**Cybersecurity for Beginners**", Raef Meeuwisse, Second Edition, 2017
4. "**Auditing IT Infrastructures for Compliance**", Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning, 2017

WEB RESOURCES

1. https://www.coursera.org/professional-certificates/google-cybersecurity
2. https://www.coursera.org/learn/cybersecurity-for-everyone
3. https://www.coursera.org/specializations/intro-cyber-security
4. https://www.udemy.com/course/cybersecurity-from-beginner-to-expert/
5. https://www.udemy.com/course/it-law-cyber-crimes-and-data-protection-laws/

JACEP - EXTENSION

P.G. PROGRAMME OUTCOMES (2023 - 2026)

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Acquire comprehensive knowledge and evaluate analytically in their specific disciplines.
2.	Apply the acquired knowledge in professional and social life.
3.	Evolve new methodologies in the specific disciplines leading to innovation and employability.
4.	Develop critical thinking required to pursue research.
5.	Apply the computational and life skills to the challenging problems in life.
6.	Design and develop independent projects.

P.G. PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO. NO.	UPON COMPLETION OF THIS PROGRAM THE STUDENTS WILL BE ABLE TO	PO MAPPED
PSO - 1	Understand and identify the needs of the community and articulate viewpoints both practically and theoretically.	PO-1
PSO - 2	Develop among themselves a sense of social and civic responsibility to be more culturally equipped.	PO-2,
PSO - 3	Apply their education in finding practical solutions to individual, community problems to exercise their rights properly.	PO- 3,
PSO - 4	Acquire leadership qualities and a democratic attitude by carrying out their duties as effective citizens of the country.	PO- 4
PSO - 5	Develop the capacity to think clearly and cogently to meet emergencies and national disasters and practise national integration and social harmony.	PO- 5, PO-6

JACEP - EXTENSION

Semester: II **Hours: 30**

Code : 23PSL2EX1 **Credit: 1**

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Impart knowledge of the importance of education	PSO-1	K1
CO - 2	Apply Knowledge to the society	PSO-2	K2
CO - 3	Analyse the reasons for health problems and impart knowledge on a balanced diet.	PSO-3	K3
CO - 4	Develop a concern for the voiceless and faceless	PSO-4	K4
CO - 5	Get awareness of environmental issues	PSO-5	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II				**JACEP - EXTENSION**							**Hours: 30**
Code : 23PSL2EX1											**Credit: 1**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	4	3	3	3	5	4	3	3	3	3.54
CO - 2	3	5	3	3	4	3	4	5	4	3	2	3.54
CO - 3	3	4	5	3	4	4	3	3	5	3	4	3.72
CO - 4	2	4	3	5	3	3	3	3	5	5	3	3.54
CO - 5	3	4	5	3	4	5	3	4	3	3	5	3.81
Overall Mean Score												**3.63**

Result: The score for this course is **3.63** (High relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I: LITERACY GROUP:

Giving orientation to the students about JACEP - focusing on School dropouts and counseling the parents to re-admit the school dropouts - conducting awareness programs through kindling culturals - organizing games based on the disciplines - conducting competitions for school children – educating the school children about the positives and negatives of social media.

UNIT II: HEALTH AND HYGIENE GROUP:

Doing a survey on health problems - organizing medical camps and talks - organizing general check-ups by B. Voc. students of JAC to the adopted villages.

UNIT III: LIAISON GROUP AND PEOPLE ORGANIZATION GROUP:

Motivating NREGA workers to access government savings schemes - celebrating important days - organizing income generation skill training for self-help groups. organizing population education programmes - conducting awareness programmes on emerging social issues - fostering tie-ups with non-governmental organizations and local bodies to ensure the development of the villages - organizing youth, farmers and self-help group to function democratically.

UNIT IV: ENVIRONMENTAL GROUP:

Tree and sapling plantation - promotion of Herbal Gardens - organizing personal hygiene awareness talk – observing environmental-related days –awareness campaign to educate the villagers to protect the environment.

UNIT V: APPLICATION OF KNOWLEDGE:

Conducting Special Skill Training for self-employment based on discipline to the target group with the help of JAC SARWODEEP and government organizations – serving as intermediaries between unorganized sector workers and government welfare schemes.

SCHEME OF EVALUATION

Continuous Internal Assessment		
1.	Attendance (30 hours)	10 Marks
2.	Field Visit & Report	50 marks
3.	Assignment	40 Marks
Total		**100 marks**

GENETICS

Semester: III **Hours: 6**

Code : 23PZO3C05 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the basic concepts and functions of genetic materials.	PSO - 1	K1
CO - 2	Understand how genes are expressed and regulated.	PSO - 5	K2
CO - 3	Apply the principles of inheritance to lead a healthy life.	PSO - 2	K3
CO - 4	Analyze the variations in genetic materials.	PSO - 3	K4
CO - 5	Compile the interaction of genes and flow of genetic information from DNA to RNA and protein.	PSO- 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III	GENETICS	Hours: 6
Code : 23PZO3C05		Credit: 5

Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	3	3	4	4	5	3	3	4	4	3.82
CO - 2	3	3	4	3	5	3	3	4	3	3	5	3.55
CO - 3	3	3	5	4	4	3	3	5	4	3	4	3.73
CO - 4	3	3	4	5	4	3	3	4	5	3	4	3.73
CO - 5	2	5	3	4	3	5	2	3	4	5	3	3.55
Overall Mean Score												**3.68**

Result: The score for this course is **3.68** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Basic concept of Genetics: Mendelian principles - inheritance of one gene and two gene (monohybrid and dihybrid), back cross and test cross, Mendelian laws. Concept of genes. Gene interactions - complementary genes, supplementary genes, epistasis, duplicate genes, lethal genes, complete, incomplete and codominance, penetrance and expressivity, pleiotropy. Genomic imprinting - phenocopy. Multiple alleles - ABO blood grouping, Rh factor in man, coat colour in rabbits. **(18 Hours)**

UNIT II

Linkage and Crossing over: Linkage maps, mapping with molecular markers, cytological evidence (Stern's experiment and Tetrad analysis). Crossing over - Chromosome map - two point and three-point cross. Sex determination - primary and secondary, non-disjunction in man and drosophila. Syndromes - Down's syndrome, Turner's syndrome, Klinefelter's syndrome, Blue man syndrome and Irritable male syndrome. **(18 Hours)**

UNIT III

Population Genetics: Hardy Weinberg equilibrium - calculation of gene frequency, factors affecting gene frequency. Inbreeding, out breeding and heterosis. Microbial Genetics - Bacterial Genetics - transformation, conjugation, transduction. **(18 Hours)**

UNIT IV

Human Genetics: Karyotype and idiogram, Polygeneic inheritance - Height in man. Genetics and society - eugenics, euthenics and euphenics, genetic prognosis - genetic counseling, pedigree analysis. Human genome project. Mutation - gene mutation, chromosomal mutation, genomatic mutation, mutagens. **(18 Hours)**

UNIT V

Molecular Genetics: Structure of gene, genetic code. Genome analysis - functional genomics. Transcription - factors, mechanism, RNA processing and regulation. Translation - mechanism, control, post translational processing. Regulation of gene expression - Lac and arabinose operon. transposons. **(18 Hours)**

COURSE BOOKS:

1. Verma P.S., Agarwal V. K and Norman S. Cohn, Principles of Genetics. S. Chand and company Ltd, Ram Nagar, New Delhi, 1989.
2. Benjamin Lewin, Genes VIII. Pearson Prentice Hall, Pearson Education, Inc, 2004.
3. Ajoy Paul, Genetics-from genes to genomes. Books and Allied (P) Ltd., September, 2011, ISBN: 81-87134-53-4, Kolkata, 1960.

UNIT	BOOK	CHAPTERS
I	1 2 3	Book 1 - Genetics:1,2,3,4, 5 and 10 Book 2: Part-1 Book 3: Chapter:1-5
II	1 3	Book 1 - Genetics:7,8 and 9 Book3: Chapter:5-10
III	1 3	Book 1 - Genetics:6,14,15,16 and 17 Book:3 Chapter:33-36
IV	1 3	Book 1 - Genetics:14,15,16,17 and18 Book:3: Chapter:24-25
V	1 2	Book 1 - Molecular Biology-Chapter: 5,6 and 11 Book 2- Part-3 and 4

BOOKS FOR REFERENCE:

1. Gardner, E.J., Michael J. Simmons, Peter Sunstad, D, Principles of Genetics. 8th edition, John Wiley and Sons, INC, 1990.
2. Strickberger, M.W, Genetics. 3rd edition, Macmillan Publishing Co., New Delhi, 1985.
3. Daniel L. Haartl and Elizabeth W. Jones, Genetics. 5th edition, Jones and Bartlett Publishers, Sudbury, 2001.
4. Charlotte J. Avers, Genetics. D. Van Nostrand and Company, New York, 1980.
5. Gurbachans Miglani, Narosa Publishing, Daryaganj, New Delhi, 2015.
6. Benjamin Lewin, Genes VII. 7th edition, Oxford University Press Inc., New York, 2000.
7. Verma, P.S. and Agarwal, A.K, Genetics. 9th edition, Rajendra Ravindra Printer's Pvt. Ltd., New Delhi, 2012.
8. Gardner A. and Davies T, Human genetics. 2nd edition, Viva books Private limited, Ansari Road, Daraganj, 2010.
9. Dipak Kumar Kar Sona Halder, Cell Biology, Genetics, Molecular Biology. New Central Book Agency (P) Ltd., Chintamoni Das Lane, 2009.
10. Alice Marcus, Genetics. HJP Publisher, Chennai, 2009.
11. Gupta P.K, Molecular Biology and Genetic Engineering. Rastogi Publications, Meerut, 2011.
12. Primrose S.B, Twyman R, Principles of gene manipulation and genomics. John Wiley and Sons; 2013 May 28, 2011.
13. Strickberger M.W, Genetics, Pearson Publishers, 2007.

ANIMAL PHYSIOLOGY

Semester: III **Hours: 6**

Code : 23PZO3C06 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the anatomy and functions of different organs and organ systems in human.	PSO - 1	K1
CO - 2	Explain the physiological process and control mechanism of organ system.	PSO - 3	K2
CO - 3	Apply the knowledge of Physiology to lead a healthy life.	PSO - 2	K3
CO - 4	Survey the disorders in the mechanism of different organs and organ systems.	PSO - 4	K4
CO - 5	Compare the physiology of organs in different animals and aspire for a vibrant life style.	PSO - 5	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				**ANIMAL PHYSIOLOGY**							**Hours: 6**
Code : 23PZO3C06											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	3	3	4	3	5	3	3	3	4	3.55
CO - 2	4	4	3	5	4	4	4	3	5	4	4	4.00
CO - 3	4	3	5	3	3	3	4	5	3	3	3	3.55
CO - 4	4	5	2	4	4	5	4	2	4	5	4	3.91
CO - 5	4	3	2	4	5	3	4	2	4	3	5	3.55
Overall Mean Score												**3.71**

Result: The score for this course is **3.71** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Blood and Cardiovascular system: Blood - Composition and functions of blood, blood volume, blood volume regulation, blood groups, haemostasis, mechanism of blood coagulation. Cardiovascular system - comparative anatomy of heart structure in vertebrates, functional anatomy of human heart. ECG - principle and significance, pacemaker, cardiac cycle, blood pressure, nervous and hormonal regulation of heart rate, bradycardia and tachycardia. **(18 Hours)**

UNIT II

Digestive and Respiratory system: Digestive system - functional anatomy of human digestive tract, mechanism of digestion and absorption of digested food, BMR, peptic ulcer, irritable bowel syndrome. Respiratory system - respiratory organs in different animals, functional anatomy of human respiratory system, respiratory pigments, transport and exchange of respiratory gases, neural and chemical regulation of respiration, Respiratory disorders - hypoxia, cyanosis, asphyxia. **(18 Hours)**

UNIT III

Excretory system and Osmoregulation: Excretory system - Excretory organs in different animals, functional anatomy of human kidney, urine formation, urine concentration, micturition, regulation of urine formation, nephritis, kidney stones. Osmoregulation - osmoregulators and osmoconformers, osmoregulation in aqueous and terrestrial environment. **(18 Hours)**

UNIT IV

Neuromuscular system: Neurons, central and peripheral nervous system of human, propagation of nerve impulses, impulse through synapse, chemical events at the synapse, neuromuscular impulse transmission, microscopic structure of striped muscle, mechanism and control of muscle contraction, changes during muscle contraction. **(18 Hours)**

UNIT V

Endocrine system and Animal behaviour: Endocrine glands - structure and functions and disorders of pituitary, thyroid, parathyroid, pancreas, adrenal, testis and ovary. Thermoregulation - temperature relations of homeotherms - physical, chemical and neural heat regulation, acclimatization. Chronobiology - kinds of biological rhythms, biological clock. Behaviour - tropism, taxis, kinesis, reflexes, learned behaviour. **(18 Hours)**

COURSE BOOKS:

1. Verma, P. S, Tyagi, B. S, Agarwal, V. K. Animal Physiology, S Chand and Company Limited, 2021.
2. Suresh, R. Essentials of Human Physiology, Books and Allied (P) Ltd., Kolkata, 2013.
3. Sarada Subramanyam, Madhavankutty, K and Singh, H. D. Textbook of Human Physiology, 6th edition, S. Chand & Company Ltd., Ram Nagar, New Delhi. 2001.

UNIT	BOOK	CHAPTERS
I	1, 2, 3	Book 1 - 11 Book 2 - 13, 14, 62, 63,69 Book 3 - Part I - 6, 7, 9
II	1, 2, 3	Book 1 - 5, 8 Book 2 - 23, 85, 87 Book 3 - Part III - 3, 5
III	1, 2, 3	Book 1 - 9, 10 Book 2 - 35, 40 Book 3 - Part VI - 7
IV	1	Book 1 - 12, 13 Book 2 - 89, 95 Book 3 - Part IX - 1, 2. Part X - 6, 7
V	1	Book 1 - 14 Book 2 - 45, 46, 48, 49 Book 3 - Part VII - 1, 2, 3, 4,5, 6, 7

BOOKS FOR REFERENCES:

1. William S. Hoar, General and Comparative Physiology, Prentice Hall Publication, New Delhi, 1983.
2. Richard W. Hill, Gordon A. Wyse and Margaret Anderson Animal Physiology, 3rd edition, Sinauer Associates Inc. ISBN-13: 978-0878935598, 2012.
3. Christopher D. Moyes, Patricia Schulte, Principles of Animal Physiology, Pearson, 2014.
4. Rastogi S. C. Essentials of Animal Physiology, 4th edition, New Age International Publishers, 2008.
5. Pocock G, Richards GD and Daly MDB, Human Physiology, Oxford University Press, London, 1999.

ANIMAL PHYSIOLOGY AND BIOTECHNOLOGY - LAB

Semester: III **Hours: 6**

Code : 23PZO3P03 **Credit: 5**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Examine the effect of temperature on oxygen consumption and opercular movements in fish.	PSO - 1	K1
CO - 2	Interpret the salt gain and salt loss in fish.	PSO - 2	K2
CO - 3	Prepare haemin crystals and urate crystals.	PSO - 4	K3
CO - 4	Analyze the working principles of gel electrophoresis and TLC.	PSO - 5	K4
CO - 5	Design experiments to isolate DNA from animal and plant cell and nitrogen fixing symbiotic bacteria from root nodule.	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				**ANIMAL PHYSIOLOGY AND BIOTECHNOLOGY - LAB**							**Hours: 6**
Code : 23PZO3P03											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	2	2	2	5	4	2	2	2	2.91
CO - 2	3	3	5	4	3	3	3	5	4	3	3	3.55
CO - 3	3	5	4	3	3	5	3	4	3	5	3	3.73
CO - 4	2	4	4	4	5	4	2	4	4	4	5	3.82
CO - 5	2	3	4	5	4	3	2	4	5	3	4	3.55
Overall Mean Score												**3.51**

Result: The score for this course is **3.51** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

ANIMAL PHYSIOLOGY:

1. Experiment on salt gain in fish.
2. Experiment on salt loss in fish.
3. Estimation of oxygen consumption in fish.
4. Estimate the oxygen consumption in fish in relation to temperature.
5. Preparation of Haemin crystals.
6. Opercular movements in fish in relation to temperature.
7. Study of urate crystals in Malpighian tubules of cockroach.

BIOTECHNOLOGY:

1. Isolation of DNA from animal cell.
2. Isolation of DNA from plant cell.
3. Isolation of plasmid DNA.
4. Estimation of DNA by DPA method.
5. Separation of DNA by agarose gel electrophoresis.
6. Separation of protein using Polyacrylamide Gel Electrophoresis (PAGE) - Demonstration
7. Thin layer Chromatography (TLC) - Demonstration.
8. Isolation of nitrogen fixing symbiotic bacteria from root nodule.
9. Enzymatic disaggregation of cells from a tissue (Spleen).

BIOTECHNOLOGY AND GENETIC ENGINEERING

Semester: III **Hours: 6**

Code : 23PZO3E2A **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the fundamental concepts of Genetic Engineering	PSO - 1	K1
CO - 2	Understand the different techniques of Genetic Engineering.	PSO - 2	K2
CO - 3	Integrate the concept of genetic manipulation in the production of transgenic plants and animals.	PSO - 4	K3
CO - 4	Evaluate the potential of transgenic organisms.	PSO - 5	K4
CO - 5	Propose biotechnological strategies to address environmental issues and design a healthy life style.	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				BIOTECHNOLOGY AND GENETIC ENGINEERING							Hours: 6
Code : 23PZO3E2A											Credit: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	3	4	2	4	3	5	4	2	3	4	3.55
CO - 2	2	4	5	4	3	4	2	5	4	4	3	3.64
CO - 3	2	5	2	4	3	5	2	2	4	5	3	3.36
CO - 4	2	3	2	4	5	3	2	2	4	3	5	3.18
CO - 5	2	3	4	5	2	3	2	4	5	3	2	3.18
Overall Mean Score												3.38

Result: The score for this course is **3.38** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Introduction to Genetic Engineering: History and scope. Molecular tools used in genetic engineering - restriction endonucleases, DNA ligases, linkers and adaptors. Gene cloning vectors - plasmid, characteristics, pBR322. Bacteriophage vectors - lambda phage vector, M13 bacteriophage. Plant vector - Ti Plasmid. Viral vectors - SV40, CaMV, shuttle vectors, expression vectors and cosmids. **(18 Hours)**

UNIT II

Construction of r -DNA: Preparation of desired gene - from natural source and m-RNA, isolation of plasmid, insertion of desired gene into the plasmid, introduction of r- DNA into host cell (methods of gene transfer) - physical, chemical and biological methods, screening of recombinants - direct selection, insertional inactivation. Blotting techniques - western, southern and northern blotting. PCR - types and applications. **(18 Hours)**

UNIT III

Animal Biotechnology: Animal tissue culture techniques - types of culture media, primary and secondary culture, applications, stem cell culture. Transgenic animals - transgenic mice, transgenic rabbit, transgenic cattle, transgenic goat, transgenic sheep, transgenic pigs. Cloning mechanism - Dolly. Transgenic animals as bioreactors. **(18 Hours)**

UNIT IV

Plant Biotechnology: Plant tissue culture - definition, micropropagation, protoplast culture and somatic hybridization, haploid plant production. Gene transfer in plants - Agrobacterium mediated gene transfer and virus mediated transfer. Transgenic plants - resistance to biotic stress and abiotic stress, improvement of crop yield, quality and nutrition. **(18 Hours)**

UNIT V

Environmental Biotechnology and IPR: Bioremediation - types - *In situ and Ex situ*, Biodegradation - Biodegradation of hydrocarbons and pesticides, *Pseudomonas putida* - (the Superbug), phytoremediation. Intellectual Property Rights (IPR) - Different forms of IPR, the process of patenting, patenting biotechnological inventions. Biosafety - primary containment for biohazards and biosafety guidelines for industrial operations with GMO. **(18 Hours)**

COURSE BOOKS:

1. Satyanarayana, U., Biotechnology, 12th edition, Uppala Publishers, 2017.
2. Gupta P.K., Elements of Biotechnology, Rastogi publication, 2nd edition, 2010.

UNIT	BOOK	CHAPTERS
I	1	6, 7, 8
II	1	6, 8, 9
III	1	33, 37, 41
IV	2	17.18.19, 21, 22
V	2	35, 39,40
	1	59, 61

BOOKS FOR REFERENCES:

1. Gilman, J.P., Witowski, M and Zoller J.M., Recombinant DNA, 2nd edition, New York: Freeman and Company.
3. Walker J.M. and Rapley R., Molecular Biology and Biotechnology, 4th edition, New Delhi: Panima Publications 2003.
4. Winnacker, E.L. From Genes to Clones: Introduction to Gene Technology. Panima Publishing Corporation, New Delhi, 2003.
5. Ranga M.M. *Animal Biotechnology*. Agrobios India Limited, 2002. Web Links:
6. Brown T.A, Gene cloning and DNA analysis, 7th edition, Wiley Blackwell Publishers, 2016.
7. Ian Freshney R. Culture of Animal Cells, 6th edition, 2010.
8. http://ecoursesonline.iasri.res.in/course/view.php?id=350

MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY

Semester: III **Hours: 6**

Code : 23PZO3E2B **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Define the basic biochemical principles through bonding interactions and bioenergetics.	PSO - 1	K1
CO - 2	Understand the structural conformation of proteins and nucleic acids.	PSO - 3	K2
CO - 3	Analyse the mechanism of biosynthetic pathways and their role in metabolism.	PSO - 5	K3
CO - 4	Relate the principles of enzyme kinetics and their regulation.	PSO - 2	K4
CO - 5	Assess the integration of different metabolic processes in cellular systems.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY								Hours: 6
Code : 23PZO3E2B												Credit: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	2	4	3	4	2	5	4	3	2	4	3.45
CO - 2	4	2	3	5	4	2	4	3	5	2	4	3.45
CO - 3	3	3	3	3	5	3	3	3	3	3	5	3.36
CO - 4	3	3	5	3	3	3	3	5	3	3	3	3.36
CO - 5	3	5	2	3	3	5	3	2	3	5	3	3.36
Overall Mean Score												3.40

Result: The score for this course is **3.40** (High Relationship).

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Basics of biochemistry: Structure of atoms, molecules and chemical bonds - principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). **(18 Hours)**

UNIT II

Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction. Composition, structure, metabolism and functions of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). **(18 Hours)**

UNIT III

Bioenergetics and enzymology: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes. **(18 Hours)**

UNIT IV

Structural conformation of proteins and nucleic acids: Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure, domains, motifs and folds), Conformation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA. **(18 Hours)**

UNIT V

Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage. **(18 Hours)**

COURSE BOOKS:

1. Satyanarayana U and Chakrapani U. Biochemistry. 3rd edition. Books and Allied Ltd. Calcutta, 2006.
2. Satyanarayana U, Biochemistry review, 4th edition, Arunalusen Publication, 4th edition, 2005.
3. Harpers Illustrated Biochemistry, Victor Rodwell, David A, Benzer, McGraw Hill education,30th edition,2014.

UNIT	BOOK	CHAPTERS
I	2	1, 2
II	1	3, 4
III	1	12,13,14
IV	3	4, 32, 34
V	3	7,11

BOOKS FOR REFERENCES:

1. Berg, J. M., Tymoczko, J. L. and Stryer L., Biochemistry. 5th ed., W.H. Freeman and Co., New York, 2002.
2. Kuchel P.W and Ralston G. B., Biochemistry, Mc Graw Hill Private Limited, UP, 2008.
3. McKee T and McKee J.R., Biochemistry, The Molecular basis of life.7th edition. Oxford University Press, US, 2012.
4. Nelson D.L. and Cox, M.M. Lehninger's Principles of Biochemistry. 6th edition.W. H. Freeman Publishers, New York, 2012.

ENDOCRINOLOGY

Semester: III **Hours: 6**

Code : 23PZO3E2C **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the structure and function of various endocrine glands and hormones.	PSO - 1	K1
CO - 2	Comprehend the functions of neurohormones and neurosecretions.	PSO - 3	K2
CO - 3	Explain the role of endocrine system in regulation of metabolism and reproductive organs.	PSO - 5	K3
CO - 4	Assess the synthesis and importance of hormones.	PSO - 2	K4
CO - 5	Develop methods by linking the principles of Invertebrate endocrinology in pesticide development.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				**ENDOCRINOLOGY**							**Hours: 6**
Code : 23PZO3E2C											**Credit: 4**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	2	2	4	2	5	2	2	2	4	2.91
CO - 2	4	3	2	5	4	3	4	2	5	3	4	3.55
CO - 3	4	3	3	3	5	3	4	3	3	3	5	3.55
CO - 4	4	3	5	3	3	3	4	5	3	3	3	3.55
CO - 5	3	5	3	4	3	5	3	3	4	5	3	3.73
Overall Mean Score												**3.46**

Result: The score for this course is **3.46** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

General Introduction to Endocrinology: Historical background, Scope of endocrinology, organization of endocrine system in Vertebrates and Invertebrates, concept of neurosecretion. Endocrinology in Vertebrates. Pituitary gland - anatomy and histology, adeno hypophysis - cytology and histology of hormones and their functions. Par intermedia - integrated function of dermal chromatophores in colour change. Neuro hypophysis - biological actions of neuro hypophysial hormone. **(18 Hours)**

UNIT II

Thyroid Gland: History and cytology, chemistry and biosynthesis of thyroxin, control of thyroid secretion, para thyroid - anatomy, histology, chemistry and functions of para thyroid hormones. **(18 Hours)**

UNIT III

Adrenal Cortex and Inter Renal Glands: Histology and cytology of hormones and their functions, control of secretions, adrenal medulla - histology and cytology, bio synthesis and physiology of medullary hormones, Pancreas - Histology and morphology control and function of hormones. Endocrinology of gastro intestinal hormones, endocrinal disorders.

(18 Hours)

UNIT IV

Endocrinology of Ovary and Testis: Endocrinology of ovary, histopathology-ovarian hormones and their functions, pituitary control over ovarian functions, Endocrinology of testis - Histopathology of testis, hormones of testis and functions pituitary control of testis. **(18 Hours)**

UNIT V

Endocrinology in Invertebrates: Endocrine mechanism in lower groups - Coelenterata, turbellaria, Annelida and Mollusca. Endocrine mechanism with special reference to Crustacean, insects and other Arthropods, hormonal control of development and moulting, hormones of Invertebrates and their applications as pesticides in recent developments. **(18 Hours)**

COURSE BOOKS:

1. Gorbern Benn, Aubrey Gorbman, A text book of Comparative Endocrinology, Howard publications, Newyork, 1996.
2. Robert William, Text book of Endocrinology, 4th edition, W.B. Saunder company, London, 1996.

UNIT	BOOK	CHAPTERS
I	2	1,3,4
II	1	2,5
III	1	2,6,10
IV	2	6,8,11
V	2	10,14,16

BOOKS FOR REFERENCES:

1. Howard A. Bern, A text book of Comparative Endocrinology. Gorbman Aubrey Gorbman, New York, California, 1966.
2. Robert H. William W.B. Text book of endocrinology. 4th edition, Saundar company, Philadelphia, London, Toronto, 1968.
3. Turner, C.D. General Endocrinology, Pub- Saunders Toppan, 1971.
4. Nussey, S.S., and Whitehead, S.A. Enocrinology: An Integrated Approach, Oxford: BIOS Scientific Publishers, 2001.
5. Hadley, M.E., and Levine J.E, Endocrinology. 6th edition, Pearson Prentice-Hall, New Jersey, 2007.

MEDICAL LABORATORY TECHNIQUES

Semester: III **Hours: 6**

Code : 23PZO3SE3 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the techniques of medical laboratory and its safety measures.	PSO - 1	K1
CO - 2	Understand the clinical reports and interpret the clinical significances.	PSO - 3	K2
CO - 3	Construct the lab requirements and diagnostic methods for clinical laboratories.	PSO - 2	K3
CO - 4	Connect the diverse knowledge on lab technology and health care	PSO - 5	K4
CO - 5	Develop training skills to attain employment in hospitals and Laboratories.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				MEDICAL LABORATORY TECHNIQUES							Hours: 6
Code : 23PZO3SE3											Credit: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	5	4	4	3	3	4	5	4	3	4	3	3.82
CO - 2	2	3	4	5	3	3	2	4	5	3	3	3.36
CO - 3	3	4	5	4	3	4	3	5	4	4	3	3.82
CO - 4	2	3	3	3	5	3	2	3	3	3	5	3.18
CO - 5	3	5	3	2	2	5	3	3	2	5	2	3.18
Overall Mean Score												3.47

Result: The score for this course is **3.47** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Laboratory Safety measures: Safety precautions against infection. Major causes of laboratory hazards - toxic chemicals and biohazards waste, biosafety level, good laboratory practices. Universal precautions for laboratories - maintenance and promoters of health. Specimen collection and processing of blood, urine, sputum and stool. **(18 Hours)**

UNIT II

Haematology: Composition of blood and their function, lab procedure to collect blood, types of anemia, mechanism of blood coagulation, bleeding time, clotting time, determination of hemoglobin, erythrocyte sedimentations rate, packed cell volume, total count of RBC and WBC, differential count WBC, blood grouping and typing, platelet count, reticulocytes count, absolute eosinophil count. Bleeding disorder of man - hemolytic disease of newborn. **(18 Hours)**

UNIT III

Clinical Biochemistry: Enzyme Linked Immunosorbent Assay (ELISA), western blot, Venereal Disease Research Laboratory Test (VDRL), rheumatoid arthritis, immunologic test for pregnancy, blood glucose, blood urea, blood uric acid, blood creatinine and blood cholesterol. Semen Analysis- sperm viability, motility, sperm count and morphological changes in sperm. **(18 Hours)**

UNIT IV

Analysis of Urine, Stool and Sputum: Analysis of urine - physical properties of urine - colour, volume, specific gravity, odour and pH, Chemical composition of urine - urine sugar, albumin, bile salts and bile pigments, microscopic examination of organized and unorganized sediments. Analysis of stool- macroscopic examination - colour, form consistency and odour. Microscopic examination of ova and cyst. Analysis of sputum- macroscopic examination - colour and consistency of sputum, microscopic and biochemical examination of sputum - Gram stain and Acid-Fast Bacilli (AFB). **(18 Hours)**

UNIT V

Biomedical Instruments: Medical devices -principle, mechanism and significance of light microscope and phase contrast microscope, thermometer, heamometer, hemocytometer, urinometer, computer tomography (CT scan), magnetic resonance imaging, lowcytometry, PET, Electrocardiogram (ECG), ultrasonography, electroencephalography (EEG), treadmill test. **(18 Hours)**

COURSE BOOKS:

1. Kanai L., Mukherjee, Medical Laboratory Technology. A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test. Volume: 1, 2005.
2. Kanai L., Mukherjee, Medical Laboratory Technology. A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test. Volume: II, 2005.
3. Ochei, J. Kolhatkar, A., Medical Laboratory Science, Tata Mc Graw Hill Publishing company limited, New Delhi,2000.

UNIT	BOOK	CHAPTERS
I	1	1, 2, 3
II	1	8, 9, 10, 11, 12
III	2	25
IV	2	23, 24, 27, 28, 33
V	1 3	4 2, 3

BOOKS FOR REFERENCES:

1. Philip Evans., The family Medical Reference Book the essential Guide to Health and Medicine. Published by Little Brown under the Black cat imprint, London. 1993.
2. Isidro Aquilar and Herminia Galbes., Encyclopedia of Health and Education for the family. Education and Health Library, Published under the title of Encyclopedia familiarrida, Amor Y sexo. 1999.

INTERNSHIP

Semester: III

Code : 23PZO3IN1 **Credit: 2**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall and summarize the basic scientific concepts involved in concerned industry.	PSO-1	K1
CO - 2	Understand the principles and methodologies employed during the Internship.	PSO - 3	K2
CO - 3	Apply the subject knowledge and skills to conduct experiments, collection of data to be an entrepreneur.	PSO- 5	K3
CO - 4	Analyze the steps involved in the training process.	PSO- 4	K4
CO - 5	Critically assess the effectiveness of experimental techniques.	PSO - 2	K5

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III				**INTERNSHIP**							**Hours:-**
Code : 23PZO3IN1											**Credit:2**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	4	3	3	3	5	4	3	3	3	3.54
CO - 2	4	3	4	5	3	3	4	4	5	3	3	3.72
CO - 3	4	2	3	3	5	2	4	3	3	2	5	3.27
CO - 4	3	5	3	3	3	5	3	3	3	5	3	3.54
CO - 5	3	3	5	2	3	3	3	5	2	3	3	3.18
Overall Mean Score												**3.45**

Result: The Score for this Course is **3.45** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

PG INTERNSHIP - GUIDELINES

I. **Duration of Internship-** Each student shall undergo 10 days (50 Hours) of training during the Second semester vacation.

II. **Place of Internship-** The Internship shall be undertaken in Institutions/Organizations with whom the Department has signed a Memorandum of Understanding (MoU), or in any other Institution approved by the Department.

III. **Internship Report**-Each student must submit two copies of the Internship Report in not less than 20 typed pages (A4 format). An Attendance Certificate issued by the training institution/organization must be appended to the report.

IV. **Submission Rules & Extensions-** Failure to submit the report within the stipulated period, an extension may be granted by the Head of the Department and the supervisor.

V. **Evaluation of Internship Report-** The Internship report will be assessed by the committee comprising of the Head of the Department and Supervisor.

IMMUNOLOGY

Semester: IV **Hours: 6**

Code : 23PZO4C07 **Credit: 6**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the basic concepts of Immunology, components of immune system and immunity against various diseases.	PSO - 1	K1
CO - 2	Discuss the effector components of immune system, immune response and immune evasion against pathogens and cancer.	PSO - 5	K2
CO - 3	Apply the immunological concepts and techniques for the preparation of therapeutics and promote the welfare of mankind.	PSO - 3	K3
CO - 4	Analyze various immunological techniques for diagnosis and treatment of immunological disorders.	PSO - 4	K4
CO - 5	Design immunization schedule for a better wellbeing.	PSO - 2	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**IMMUNOLOGY**							**Hours: 6**
Code : 23PZO4C07											**Credit: 6**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	3	3	3	3	5	3	3	3	3	3.36
CO - 2	3	4	4	4	5	4	3	4	4	4	5	4.00
CO - 3	3	4	3	5	4	4	3	3	5	4	4	3.82
CO - 4	3	5	4	3	4	5	3	4	3	5	4	3.91
CO - 5	3	3	5	4	3	3	3	5	4	3	3	3.55
Overall Mean Score												**3.73**

Result: The score for this course is **3.73** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Introduction to Immunology: An overview- scope of immunology, recognition of self and non-self as a basic functional feature of immune system, Concepts of external and internal defense systems, External (first line / innate) defense system - components, distribution, salient functions, Internal (second line / acquired) immune system, cellular and humoral immune response - salient functions, primary and secondary immune responses. Immune tissues / organs- types, anatomical location, structure, antigens - definition, characteristic features and classification, antigenicity versus immunogenicity, adjuvants - definition, types and applications, haptens. **(18 Hours)**

UNIT II

Major effector components of cellular immune system: Lymphoid lineage - Lymphocytes - types, clones, sub-populations, distribution and Myeloid lineage. B and T cell receptors, B and T cell epitopes, toll-like receptors. Antigen processing and presentation - role of antigen presenting cells, T cell and B cell maturation, activation and differentiation - cytosolic pathway and endocytic pathway, MHC molecules and their immunologic significance.

(18 Hours)

UNIT III

Major effector components of humoral immune system: Antibodies - structural and functional characteristics of various antibody classes. Monoclonal antibodies - definition, hybridoma technology and applications. Antibody engineering and its applications. Antigen-Antibody interactions - properties, precipitation - radial immunodiffusion and double immunodiffusion, Immunoelectrophoresis - counter and rocket electrophoresis. Agglutination - direct, indirect, active, passive and haemagglutination. Immunofluorescence technique, Radio Immuno Assay, ELISA, Western Blotting. Complement system - components, three major activation pathways and immune functions. Cytokines - definition and salient functional features, Interleukins - definition, types (lymphokines and monokines) and functions, Interferons - types and functions. **(18 Hours)**

UNIT IV

Clinical Immunology: Theory of surveillance, tumors of the immune system, tumor antigens, immune response to tumors, tumor evasion of the immune system and cancer immunotherapy. Transplantation immunology - Immunological basis of graft rejection, clinical manifestation of graft rejection, tissue typing, immune suppressive therapy during transplantation, clinical transplantations and immune tolerance. Vaccines - methods of vaccine preparation, types of vaccines used in human and immunization schedule. Erythroblastosis foetalis. **(18 Hours)**

UNIT V

Diseases and immune responses: Hypersensitivity - definition, types I to IV and immune manifestations. Auto-immune diseases - types (any two examples each) and major immune responses, Immunodeficiency diseases - types including SCID and consequences. Viral (HIV), bacterial (tuberculosis) and parasitic (malaria) diseases - etiology, host immune responses and evasion by pathogens. **(18 Hours)**

COURSE BOOKS:

1. Kuby J, Immunology, 6th edition, W. H. Freeman and Co., New York., 2006.
2. Male D.J., Brostoff, D. B, Roth and Roitt, I., Immunology (7th edition), Mosby/ Elsevier, Philadelphia, 2006.

UNIT	BOOK	CHAPTERS
I	1	1, 2, 3, 4
II	2	5, 8
III	1	4, 6, 7
IV	1	17, 19, 21
V	1	15, 16, 18

BOOKS FOR REFERENCE:

1. Abbas A. K. and Lichtman, A. H., Cellular and Molecular Immunology, (6th edition), W.B. Saunders, Philadelphia, 2007.
2. Weir D. M., Stewart, J., Immunology, Churchill Livingstone, London, 1997.
3. Janeway, C. A. and Travers P., Immunology, Garland Publ. Inc., London, 1997.
4. Peakman, M and Vergani D., Basic and Clinical Immunology, Churchill Livingstone, London, 1997.
2. Parham P., The Immune System (Third edition), Garland Science, USA, 2009.
3. Weissman I., Hood, L., Wood, W., Essential Concepts in Immunology, the Benjamin/Cummings, California, 1978.
4. Hood, L, Weissman, I, Wood, W., Wilson, J, Immunology (Second edition), the Benjamin/Cummings, California, 1984.
5. Coica, R and Sunshine, G. Immunology A Short Course (Sixth edition), John Wiley & Sons, USA, 2009.
6. Doan, T. Melvold, R. Viselli, S. *et al*., Immunology (Second edition), Lippincott Williams & Wilkins, Maryland, 2013.
7. Owen, J. A. Punt, J. Stanford, S. Kuby A., Immunology (7th edition), Macmillan, England, 2013.

ECOLOGY AND EVOLUTION

Semester: IV **Hours: 6**
Code : 23PZO4C08 **Credit: 5**
COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain key ecological concepts such as ecosystem, community, population and biodiversity and describe the process of change in all forms of life over generations.	PSO - 1	K1
CO - 2	Comprehend ecological principles to distinguish and estimate disturbances in the environment and understand the role of isolation and speciation in the formation of new species.	PSO - 3	K2
CO - 3	Apply ecological ideas to address real-world environmental issues such as habitat destruction, pollution and resource management and apply the principles of natural selection to specific examples of evolution.	PSO - 5	K3
CO - 4	Connect ecological principles to real world problems in collaboration with professionals from other fields and assess the different types of evidence supporting the theory of evolution, including fossil records, molecular biology and comparative anatomy.	PSO - 4	K4
CO - 5	Evaluate existing environmental policies and regulations considering their impact on environment and evaluate how natural selection, genetic drift, and other evolutionary mechanisms contribute to the diversity of life on Earth.	PSO - 2	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**ECOLOGY AND EVOLUTION**							**Hours: 6**
Code : 23PZO4C08											**Credit: 5**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	2	4	3	4	2	5	4	3	2	4	3.45
CO - 2	4	4	3	5	3	4	4	3	5	4	3	3.82
CO - 3	3	3	4	4	5	3	3	4	4	3	5	3.73
CO - 4	3	5	4	2	3	5	3	4	2	5	3	3.55
CO - 5	4	3	5	4	4	3	4	5	4	3	4	3.91
Overall Mean Score												**3.69**

Result: The score for this course is **3.69** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

UNIT I

Concept of ecosystem, population and community ecology: Abiotic factors and its ecological role - soil, light, temperature, water. Types and faunal adaptations in freshwater (lotic and lentic), marine, estuarine, cave, forest and desert habitat. Population ecology- structure and regulation, growth form. Community ecology - structure, composition and stratification, ecological niche, ecotone and edge effect. **(18 Hours)**

UNIT II

Biodiversity and conservation biology: Biodiversity - definition, characterization, levels, types and values. Mega diversity countries, diversity hotspot, IUCN categories of threatened species, biodiversity and sustainable development, gene banks, cryopreservation and DNA bar coding. Conservation biology - principles of conservation, major approaches to management, Indian case studies on conservation (project tiger, biosphere reserves), In situ and Ex situ conservation. Natural resource ecology- concept and classification of resources, mineral resource, land resource, forest resource, water resource, energy resource (conventional and non- conventional). Disaster management - definition, factors and significance, difference between hazard and disaster. Natural disasters and Manmade disasters. Biodiversity indices - Shannon Weiner and Simpson indices.

(18 Hours)

UNIT III

Pollution: Types, causes, effects (with examples) and management of land, water, air, thermal and pesticide pollution. Pollution monitoring, environmental impact assessment, eco restoration, pollution control board - central and state government, NGO, international environmental policy, earth summit and world summit. **(18 Hours)**

UNIT IV

Evidences of Evolution: Evidences of evolution - morphological and anatomical, embryological, physiological and biochemical and paleontological evidences. Theories of organic evolution - Darwinism - principles and criticism, supplementary theories of Darwin, Lamarckism- principles and criticism. Neo Darwinism - experimental support, Neo Lamarckism- experimental evidences, Natural selection. Hardy-Weinberg equilibrium - gene pool, frequency, factors affecting Hardy-Weinberg equilibrium and non-random breeding-reproductive isolating mechanisms. **(18 Hours)**

UNIT V

Evolution of Higher forms and Animal distribution: Evolutionary innovations and the origin of higher taxa - Evolution of *Homo sapiens*. Impact of DNA bar coding in modern evolutionary studies. Isolation - mechanism and types of isolation. Speciation- mechanism and patterns of speciation. Mimicry and colouration. Adaptive radiation, Fossils - fossil formation, types of fossils, dating of fossils, incompleteness of fossil record, Indian fossils, living fossils and geological time scale. **(18 Hours)**

COURSE BOOKS:

1. Eugene P. Odum, Murray Barrick, Gary W. Barret, Fundamentals of Ecology (5th ed.). Brooks/Cole Publishers, UK, 2005.
2. Kormondy, Edward, J, Concept of Ecology. Prentice Hall of India Pvt. Ltd., Delhi, 1994.
3. Saha T.K. Ecology and Environmental Biology, Arunabha Sen, (P), Ltd., Kolkatta, 2017.
4. Arora M.P, Organic Evolution, Himalaya Publishing house, Bombay, 1991.

UNIT	BOOK	CHAPTERS
I	1	2, 6, 7, 8, 9, 10
	2	1, 10, 11, 12, 14, 15
II	1	9
III	3	20, 21, 22, 23, 24, 25
IV	4	4, 5, 6, 8
V	4	09, 11, 12, 22, 27

BOOKS FOR REFERENCE:

1. Sharma, P.D, Ecology and Environment. Rastogi Publications, Meerut. (Unit I, II, III), 1999.
2. Begon and Mortimer, Population Ecology. UBS Publishers, Delhi. (Unit I, II, III), 1992.
3. Dash, M.L, Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd., New Delhi. (Unit I, II, III), 1996.
4. Trivedi, P.C. and Sharma, K.C, Biodiversity Conservation. Avishekar Publishers, Jaipur. (Unit I, II, III), 2003.
5. Trivedi, R.N, Textbook of Environmental Sciences. Anmol Publications Pvt. Ltd., New Delhi. (Unit I, II, III), 1993.
6. Shukla, S.K. and Srivastava, P.R, Water Pollution and Toxicology. Common - Wealth Publishers. New Delhi. (Unit I, II, III), 1992.
7. Subramanian, M.A, Toxicology: Principles and methods. MJP Publishers, Chennai. (Unit I, II, III), 2004.
8. Verma, P.S. and Agarwal V. K, Principles of Ecology. S. Chand and Co. Pvt. Ltd., New Delhi. (Unit I, II, III), 1996.
9. Bell, G, The basics of selection. New York, Chapman and Hall. (Unit IV), 1996.
10. Roger Lewin, Human evolution. An illustrated introduction. Wiley - Blackwell Publication, Oxford. (Unit V), 2004.
11. Kamshilor, M.M, Evolution of the Biosphere. MIR Publishers, Moscow. (Unit IV, V), 1974.
12. Edwin H Colbert, Evolution of the Vertebrates. V.R. Damodaran for Wiley Eastern Limited, Delhi. (Unit IV, V), 1990.
13. Sanjib Chattopadhyay, Evolution, Adaptation and Ethology, Books and Allied (P) Ltd., Kolkata. (Unit IV, V), 2012.
14. Mani M.S, Ecology and Evolution. Sathish Book Enterprise, Agra. (Unit IV, V), 1983.
15. Williams, G.C, Natural Selection: Domains, Levels and Challenges. New York: Oxford Univ. Press. (Unit IV, V), 1992.

IMMUNOLOGY, MICROBIOLOGY AND ECOLOGY - LAB

Semester: IV **Hours: 5**

Code : 23PZO4P04 **Credit: 4**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Examine the various immune tissues and organs (primary and secondary) in mice/chick, identification of lymphocytes, methods of immunization, blood collection, sterilization, staining methods and microbiological examination of water portability.	PSO - 5	K1
CO - 2	Estimate BOD, COD, pH of water sample, primary productivity of aquatic macrophage and secondary productivity - biomass production in grasshopper.	PSO - 2	K2
CO - 3	Demonstrate radial and double immune diffusion, haemagglutination, immune electrophoresis and Mount of phyto and zoo planktons.	PSO - 3	K3
CO - 4	Analyse the motility, culture techniques and growth of microbes.	PSO - 1	K4
CO - 5	Assess air pollution and CO_2 level at various sites.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**IMMUNOLOGY, MICROBIOLOGY AND ECOLOGY - LAB**							**Hours: 5**
Code : 23PZO4P04											**Credit: 4**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	3	3	3	3	5	3	3	3	3	3	5	3.36
CO - 2	3	4	5	4	3	4	3	5	4	4	3	3.82
CO - 3	3	4	3	5	3	4	3	3	5	4	3	3.64
CO - 4	5	4	4	3	3	4	5	4	3	4	3	3.82
CO - 5	3	5	3	4	4	5	3	3	4	5	4	3.91
Overall Mean Score												**3.71**

Result: The score for this course is **3.71** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

IMMUNOLOGY

1. Identification of various immune tissues and organs in mice/chick
2. Histology of lymphoid organ.
   i) Primary lymphoid organs - Thymus, Bone Marrow.
   ii) Secondary lymphoid organs - Lymph nodes, Spleen.
3. Separation and preparation of cellular antigen (RBC and bacteria).
4. Methods of immunization in any mammal - Intravenous, intraperitoneal and subcutaneous routes
5. Method of blood collection (from vein) and serum preparation.
6. Isolation and Identification of lymphocytes from peripheral blood.
7. Isolation of lymphocytes from solid lymphoid organ.
8. Demonstration of Radial Immuno diffusion.
9. Demonstration of Double Immuno diffusion.
10. Demonstration of Haemagglutination.
11. Demonstration of Immuno Electrophoresis.

MICROBIOLOGY

1. Methods of sterilization.
2. Pure culture techniques - serial dilution, pour plate, spread plate and streak plate methods.
3. Preparation of culture media for microorganism.
4. Staining methods - Simple and Gram's staining.
5. Study of motility of microbes by Hanging drop method.
6. Preparation of Growth curve - Turbidity method - Spectrophotometer.
7. Biochemical Tests for identification of bacteria - IMVIC test.
8. Microbiological examination of water portability by MPN method.

ECOLOGY

1. Estimation of BOD, pH, COD of given water Samples.
2. Assessment of air pollution and CO_2 level at various sites.
3. Estimation of primary productivity of aquatic macrophytes - light and dark bottle method.
4. Estimation of secondary productivity - Biomass production in grasshopper.
5. Mounting of phyto and zoo planktons.

MICROBIOLOGY

Semester: IV **Hours: 5**
Code : 23PZO4E3A **Credit: 3**
COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the general characters, classification and structure of various microorganisms.	PSO - 1	K1
CO - 2	Explain the methods of culture, mechanism of reproduction, nutrition and life cycle of bacteria, fungi, algae, virus, bacteriophage and protozoa	PSO - 2	K2
CO - 3	Apply various culturing methods to isolate and identify microorganisms, and leverage their understanding of viral evolution for vaccine development and antiviral strategies.	PSO - 4	K3
CO - 4	Compare and contrast the culturing methods of microorganisms in the fields of bacteriology, mycology, virology and protozoology.	PSO - 5	K4
CO - 5	Evaluate the evolutionary histories of microorganisms and predict adaptive strategies across diverse environments	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**MICROBIOLOGY**							**Hours: 5**
Code : 23PZO4E3A											**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	3	4	4	3	5	3	4	3	4	3.73
CO - 2	4	3	5	2	4	3	4	5	2	3	4	3.55
CO - 3	4	5	3	3	4	5	4	3	3	5	4	3.91
CO - 4	4	2	4	3	5	2	4	4	3	2	5	3.45
CO - 5	4	2	4	5	4	2	4	4	5	2	4	3.64
Overall Mean Score												**3.66**

Result: The score for this course is **3.66** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Introduction to Microbiology: Brief history of Microbiology - germ theory of disease and scope. Contributions of Louis Pasteur, Robert Koch and Beijerinck. Classification of microbes - Whittaker's five kingdom concepts. Basic techniques in Microbiology - sterilization and disinfection - dry heat, moist heat, filtration, incineration, radiation and chemical. Nutritional types of microorganisms. Culture of microbes - culture medium, culture techniques - batch, fed-batch, continuous culture, serial dilutions, spread plate, pour plate and streak plate. Staining techniques - simple, Gram and Acid Fast. **(15 Hours)**

UNIT II

Bacteria: Classification, size, shape, arrangement, ultra-structure of bacterial cell - cell wall, cell membrane, flagella, pili and capsule. Bacterial reproduction and growth - phases of growth and growth curve, factors affecting growth, measurement of bacterial growth - cell mass and number. Bacterial diseases - *Streptococcus pneumoniae, Salmonella typhi* and *Vibrio cholera.* Bacteria used as biofertilizer - *Rhizobium, Bacillus thuringiensis* - isolation, identification, inoculum production and field application. **(15 Hours)**

UNIT III

Viruses: Basic concepts of virology, discovery, characteristics, structure, shape and classification of viruses. Differences between bacteria and virus, viroids, prions, Tabacco Mosaic Viruses, Adeno virus, Bacteriophage. Multiplication of Bacteriophages - life cycle of phages, transmission of viruses - plants, animals and man. Causes, symptoms, transmission and prevention of Covid 19, chikungunya, dengue fever. **(15 Hours)**

UNIT IV

Algae and Fungi: General characters and classification of fungi (Fritsh method), ultrastructure of cell and cell wall composition, nutrition and reproduction in fungi, heterothallism, heterokaryosis and para sexuality. Economic importance of fungi. Algae - general characteristics, classification, organisation of thallus, cell structure, pigmentation and reproduction, Economic importance of algae. Structure, reproduction and life cycle of Chlamydomonas. **(15 Hours)**

UNIT V

Recent advances in Microbiology: Industrial fermenters, commercial production of microorganisms -single-cell protein, bioconversions - biomining, bioleaching, bio-gas and bio-diesel. Methods of purification of portable water, microorganisms in agricultural waste water treatment, Production of commercial products - antibiotics - Penicillin, amino acid - glutamic acid, enzyme - amylase, Vitamin - Vitamin B12. Bioremediation and phytoremediation. Role of microbes in soil fertility and nitrogen fixation. Fermented food products - Yoghurt (milk), sauerkraut (vegetables). Microbial spoilage of meat, milk and canned food, food infection (amoebiasis), food poisoning (botulism), factors influencing microbial growth in food. **(15 Hours)**

COURSE BOOKS:

1. Dubey R.C., Maheshwari D.K., A Text Book of Microbiology Revised Edition S. Chand and Company, New Delhi, 2013.
2. Michael J, Pelczar Jr, E.C.S. Chan, and Noel R. Kreig, Microbiology, Fifth Edition, McGraw Hill (India) Private Limited, New Delhi, 1958.
3. Balkrishna M. Sandikar, Fundamental Microbiology, Ruba Sen Books Allied (p) Ltd. Kolkata, 2021.

UNIT	BOOKS	CHAPTERS
I	1, 2, 3	Book 1- 1, 2, 3, 4 Book 2-1, 2, 3 Book 3- 1, 2, 7, 8, 9, 11, 12
II	1, 2, 3	Book 1- 2, 4 Book 2-5, 6, 7, 8 Book 3- 2, 3, 4, 6, 13
III	1, 2, 3	Book 1-2, 4 Book 2-17,18 Book 3-4, 13, 14, 15, 16
IV	1, 2, 3	Book 1-15, 17 Book 2-21, 37, 38 Book 3-5, 15, 16
V	1, 2, 3	Book 1-2, 18, 24 Book 2-19 Book 3-15,

BOOKS FOR REFERENCE:

1. Prescott L.M, Harley J.P and Klein D.A, Microbiology (10th edition) McGraw Hill, New York, 2003.
2. Pelczar Jr, M.J. Chan, E.C.S and Krei N.R, Microbiology McGraw Hill, New York 1993.
3. Michael Madigan, John Martinko, David Stahl and David Clark, Brock Biology of Microorganisms (Thirteenth edition) Pearson International edition, 1997.
4. Holt, J S., Kreig N R., Sneath P. H. A and Williams ST Bergey's, Manual of Determinative Bacteriology (9th edition) Williams and Wilkins, Baltimore, 1994.
5. Jefrey C Pommerville, Alcamo's Fundamentals of Microbiology (Seventh edition) - Jones and Bartlett Publishers, 2004.
6. Gerard J. Tortora Berdell R. Funke, Christine L. Case, Microbiology an Introduction, Pearson International edition (12th edition), 2001.
7. Albert G. Moat, John W. Foster and Michael P. Spector, Microbial Physiology, (4th edition), John Wiley and Sons, INC., Publication, 1995.
8. Ananthanarayan and Paniker's, Text book of Microbiology Universities Press (9th edition), Hyderabad, 1978.
9. Hans G Schlegel, General Microbiology. Low Price 7th edition, Cambridge University Press, 2003.
10. Meenakumari S, Microbiology Physiology. 1st edition, MJP Publishers, A unit of Tamil Nadu Book House, Chennai, 2006.

NANOBIOLOGY

Semester: IV **Hours: 5**

Code : 23PZO4E3B **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Define the basic principles of nanobiology.	PSO - 1	K1
CO - 2	Identify the nanoparticle-based drug delivery.	PSO - 4	K2
CO - 3	Demonstrate the use of nanomaterials in specific biological applications.	PSO - 2	K3
CO - 4	Evaluate the potential risks and benefits of nano biological applications	PSO - 5	K4
CO - 5	Develop and characterize Nanoparticles.	PSO - 3	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**NANOBIOLOGY**							**Hours: 5**
Code : 23PZO4E3B											**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	3	4	3	2	3	5	4	3	3	2	3.36
CO - 2	3	5	3	3	4	5	3	3	3	5	4	3.73
CO - 3	3	3	5	3	2	3	3	5	3	3	2	3.18
CO - 4	4	3	3	2	5	3	4	3	2	3	5	3.36
CO - 5	3	4	3	5	3	4	3	3	5	4	3	3.64
Overall Mean Score												**3.45**

Result: The score for this course is **3.45** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Introduction to nanoscience and basic concepts: Interaction of surface molecules and its chemical and physical properties, nano processes in nature - lotus effect, colour patterns in butterflies, adhesive pads in lizards. Different types of nanoparticles - metallic nanoparticles - gold / silver, titanium based, non- metallic nanoparticles - carbon and silicon based.

(15 Hours)

UNIT II

Synthesis and characterization of nanoparticles: Solid state, vapour state and solution based (green synthesis, mechanical ball milling, sol gel process, chemical vapor deposition). Characterization of nanoparticles - spectroscopic methods (UV- visible, FTIR, Raman spectroscopy, NMR), microscopic (AFM, Scanning and Transmission Electron Microscopy STEM), Structural (XRD), EDAX. **(15 Hours)**

UNIT III

Biosensors: Classes of biosensors, methods of biological signaling, methods of signal transduction, cantilever-based biosensors, carbon nanotube-based sensors, methods to prepare CNTs based sensors and biosensors, application of CNTs based electrochemical sensors and biosensors, biological and electrochemical fictionalization of carbon nanotubes. **(15 Hours)**

UNIT IV

Biomedical applications of Nanoparticles: Drug carriers - liposomes, nano shells, micelles, dendrimers and hydrogels, fictionalization of nanomaterials and targeted drug delivery, imaging technique, quantum dots and magnetic nanoparticles, Implants - orthopaedic and vascular.

(15 Hours)

UNIT V

Application of Nanotechnology in Pollution Abatement: Photocatalyst oxidation (TiO_2 based nanoparticles), reduction (iron-based nanoparticle), absorption (nano clay), encapsulation (dendrimers), nanofiltration (nano sieve membranes), nano sensors, CO_2 capture, adsorption of toxic gases.

(15 Hours)

COURSE BOOKS:

1. Breck *et al.,* Nanotechnology, Volume:2, CBS Publishers, Bengaluru, 2016.
2. Veenita Singh, Nanobiology, Agrotech press, New Delhi, 2014

UNIT	BOOK	CHAPTERS
I	2	Chapter: 1, 2, 3
II	2	Chapter: 3, 4
III	1 2	Section-I, III, V, VI Chapter: 5, 6
IV	2	Chapter: 6,7
V	1 2	Section-II, VIII, X Chapter: 7, 8

BOOKS FOR REFERENCE:

1. Janos. H. Fendler (Ed), Nanoparticles and Nanostructured Films: Preparation, Characterization and Applications. Wiley, VCH, 1998.
2. Williams, D. B. and Carte, C. B, Transmission Electron Microscopy - A text Book of Materials Science. Plenum Press, N. Y, 1996.
3. Challa Kumar, Nanomaterials for Medical Diagnosis and Therapy. Wiley, VCH, 2006.
4. Harvey Lodish, Arnold Berk, Molecular Cell Biology. W.H. Freeman& Co, New York, 2008.
5. Geoffrey, M. Cooper, Robert, E. Hausman, The Cell - A Molecular Approach. ASM Press, Washington, 2007.
6. Challa Kumar, (Ed), Biological and Pharmaceutical Nanomaterials. Wiley, VCH Verlag, Weinheim, 2006.
7. Challa, S.S.R. Kumar, Nanomaterials for Biosensors. Wiley, VCH, Verlag, Weinheim, 2007.
8. Challa, S.S.R. Kumar, Nano system Characterization Tools in the Life Science. Wiley- VCH, Verlag, Weinhei, 2006.
9. Arben Merkoci, Biosensing using Nanomaterials. Wiley Publication, New Jersey.
10. Challa Kumar (2010). Semiconductor Nanomaterials. Wiley-VCH, 2009.

INDUSTRIAL ZOOLOGY

Semester: IV **Hours: 5**

Code : 23PZO4E3C **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall basic principles of Zoology relevant to industrial applications.	PSO - 1	K1
CO - 2	Interpret the industrial significance of Zoology.	PSO - 5	K2
CO - 3	Manipulate animal models in industrial processes and manage to be successful entrepreneur.	PSO - 4	K3
CO - 4	Survey the need and effectiveness of industrial Zoology for societal implications.	PSO - 3	K4
CO - 5	Design their carrier by applying the skill in industrial Zoology.	PSO - 2	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**INDUSTRIAL ZOOLOGY**							**Hours: 5**
Code : 23PZO4E3C											**Credit: 3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	4	3	3	2	4	5	3	3	4	2	3.45
CO - 2	3	4	3	2	5	4	3	3	2	4	5	3.45
CO - 3	3	5	4	3	2	5	3	4	3	5	2	3.55
CO - 4	2	3	3	5	2	3	2	3	5	3	2	3.00
CO - 5	3	4	5	3	2	4	3	5	3	4	2	3.45
Overall Mean Score												**3.38**

Result: The score for this course is **3.38** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Poultry Farming: Past and present scenario of poultry industry in India, role of Government/private agencies in poultry development. Classification of chicken- layers and broilers, hybrids available and its merit and demerits. System of rearing- Range, semi- intensive, intensive rearing, advantages and disadvantages. Rearing of layers and broiler. Poultry industry- Breeder farm, hatcheries, commercial farms, feed mills and processing industry.

(15Hours)

UNIT II

Vermiculture: Endemic and exotic species of earthworms. Biology of *Eisenia foetida*. Influence of soil organisms in Vermitechnology, litter degradation, decomposition, vermicomposting materials and vermicomposting methods-small scale and large scale. Factors affecting vermicomposting-pH, moisture, temperature. Vermiculture unit - materials required and maintenance. Harvesting of vermicompost- quality, properties and advantages over chemical fertilizers. Packaging and marketing-cost benefit analysis. Vermiwash and its applications. Pests, parasites and pathogens affecting earthworms. Uses of earthworm in food and medicine-Ayurvedic and unani. Recycling of food wastes in Vermitechnology. **(15 Hours)**

UNIT III

Bee Keeping and Ancillary Industries: Species of honey bees in India, bee morphology, colony organization, polymorphism, caste system, division of labour, bee flora, foraging and honey flow periods. Life history of *Apis indica*. Methods of bee keeping, limitations on the development of bee keeping, advantages of extensive beekeeping and Newton's bee hive extraction of honey. Bee products- honey, bee wax, pollens, royal jelly, propolis and bee venom. Bee diseases, enemies and their control. Bee flora and planned pollination services. Routine management, seasonal management, migratory beekeeping, harvesting and marketing of bee products. Economics and extension of bee keeping. Important Institutions pertinent to Apiculture-National Bee Board, Bee Research and Training Institute. **(15 Hours)**

UNIT IV

Sericulture: Mulberry and non- mulberry sericulture. Distribution and types of races, selection of mulberry variety, establishment of mulberry garden, rearing house and rearing appliances. Biology of silkworm, silkworm rearing technology- early age and late age rearing, selection of silkworm breeds for rearing. Incubation- Definition, requirement of environmental conditions, incubation devices, identification of stages of development, black boxing and its importance. Diseases of silk worm, prevention and control. Employment generation in sericulture and role of women in sericulture. Sericulture organization in India, role of State Departments of Sericulture, Central Silk Board and NGOs in sericulture development.

(15 Hours)

UNIT V

Dairy Farming: Introduction, importance of livestock in the health and economy of rural and urban population, Breeds of cattle - Gir, Sindhi, Sahiwal, Jersey and Holstein. Fresian raising calf, Heifer management, care of pregnant cow and feeding of milch cows. Cattle feed formula and important fodder varieties. Housing, breeding- oestrous cycle, artificial insemination of milch cows and parturition. Clean milk production and economic importance of dairy farming. **(15 Hours)**

COURSE BOOKS:

1. Supriti sarkar *et al*., Introduction to Economic Zoology, New Central book agency (P) Ltd. London, 2016.
2. Tarut Kumar Banerjee *et al.,* Applied Zoology. New central Book agency (P) Ltd. New Delhi, 2017.

UNIT	BOOK	CHAPTERS
I	1 2	Book: 1- Chapter: 5 Book: 2- Chapter: 8
II	1 2	Book: 1-Chapter: 13 Book: 2-Chapter: 10
III	1 2	Book: 1-Chapter: 2 Book: 2-Chapter: 1, 3, 4
IV	1 2	Book: 1-Chapter: 3 Book: 2-Chapter: 2
V	1 2	Book: 1-Chapter: 9 Book: 2-Chapter: 9, 12, 13, 14

BOOKS FOR REFERENCE:

1. Ensmiger, M. E., Poultry Science.3rd edition. International Book Distribution Co., Lucknow, India, 2015.
2. Bell D. Donald and Weaver D. Willian Jr., Commercial Chicken Meat and Egg Production. 5th edition. Springer India Pvt, Ltd., Noida, 2007.
3. Singh, R.A., Poultry production. 3rd edition. Kalyani Publishers, New Delhi, 2011.
4. Jull A. Morley, Successful poultry management. 2nd edition. Biotech Boos, New Delhi, 2007.
5. Shukla, G.S and Upadhyaya, V.B, Economic Zoology (Rastogi Pubishers), 1999-2000.
6. Sathe, T.V, Vermiculture and Organic farming. Daya Publishers, 2004.
7. Abrol, D.P, A comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi, 2010.
8. Withhead, S.B, Honey bees and their management Axis books Publisher, Jodhpur, 2010.
9. Nagaraja, N. and Rajagopal, D, Honey bees: Diseases, parasites, pests, predator and their management. M.J.P Publisher, Chennai, 2013.
10. Narasimhanna, M.N, Manual of silkworm egg production, CSB, Bangalore, 1988.
11. Sengupta, K, A Guide for bivoltine sericulture. CSB and TI, Mysore, 1989.
12. Mowforth, M., and Munt, I, Tourism and sustainability 3rd edition. London, UK: Routledge, 2009.
13. Newsome, D., Moore, S.A., and Dowling, R.K., Natural Area Tourism, Bristol, UK: Channel View Publications, 2002.
14. Weaver, D, Ecotourism 2nd edition. Hoboken, NJ: JS Wiley. Staff: Dr. Julian Clifton, 2008.

PROJECT

Semester: IV **Hours: 6**

Code : 23PZO4R01 **Credit: 3**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Do literature survey in their respective field and identify a problem.	PSO - 3	K1
CO - 2	Understand the various methods involved in solving the problem.	PSO - 1	K2
CO - 3	Adopt suitable analytical techniques to complete the research.	PSO - 2	K3
CO - 4	Improve their presentation skills through reviews.	PSO - 4	K4
CO - 5	Compile their research findings.	PSO - 5	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV												**Hours:6**
Code : 23PZO4R01						**PROJECT**						**Credit:3**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	4	3	4	5	2	3	4	4	5	3	2	3.55
CO - 2	5	3	4	4	3	3	5	4	4	3	3	3.73
CO - 3	4	3	5	4	2	3	4	5	4	3	2	3.55
CO - 4	4	5	4	4	3	5	4	4	4	5	3	4.09
CO - 5	4	4	4	4	5	4	4	4	4	4	5	4.18
Overall Mean Score												**3.82**

Result: The Score for this Course is **3.82** (High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total No. of POs \& PSOs}}$	Mean Overall Score for COs= $\frac{\text{Total of Mean Scores}}{\text{Total No. of COs}}$

PG PROJECT WITH VIVA VOCE - GUIDELINES

I. **Title Selection**- Each student shall select a topic for her project in consultation with the Guide in the thrust areas of Life Sciences.

II. **Text Formatting**-The project report should contain a minimum of 40 pages in A4 format, 1.5 line spacing using Font Style Times New Roman and Font Size 12. Each student should submit two copies of the project report for evaluation.

III. **Submission of Project Report**- The final project Dissertation shall be submitted to the Controller of Examinations through the Guide and the Head of the Department on or before the stipulated time assigned by the Controller of Examinations.

IV. **Evaluation of Project Report –** If a student fails to submit the Project dissertation within the stipulated time assigned by the Controller of Examination, an extension may be granted by the Principal based on the return recommendations through the Guide and the Head of the Department.

V. **Viva Voce Examination –** Each student must prepare a PowerPoint presentation of 8 – 10 minutes of their summarised project work and present it before the Guide and the External Examiner for the Viva voce Examinations

TRAINING FOR COMPETITIVE EXAMINATIONS

Semester: IV **Hours: 2**

Code : 23PZO4SE4 **Credit: 1**

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Recall the fundamental principles, key theories and terminologies of the core concepts in Life sciences.	PSO - 1	K1
CO - 2	Interpret the relationship between various biological process in cellular, biochemical and physiological pathways within the context of Lifesciences.	PSO - 3	K2
CO - 3	Acquire competency in critical thinking and analytical reasoning to address the challenging questions in Life sciences.	PSO - 2	K3
CO - 4	Develop insightful understanding of competitive exams in the light of Life sciences	PSO - 5	K4
CO - 5	Evaluate the various experimental methodologies, research hypothesis, develop protocols to analyse and interpret results in different domains of life sciences.	PSO - 4	K5, K6

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV				**TRAINING FOR COMPETITIVE EXAMINATIONS**							**Hours: 2**
Code : 23PZO4SE4											**Credit: 1**
Course Outcomes	**Programme Outcomes (PO)**						**Programme Specific Outcomes (PSO)**					**Mean Score of CO's**
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	
CO - 1	5	4	4	4	4	4	5	4	4	4	4	4.18
CO - 2	4	3	4	5	4	3	4	4	5	3	4	3.91
CO - 3	4	3	5	3	4	3	4	5	3	3	4	3.73
CO - 4	2	4	3	4	5	4	2	3	4	4	5	3.64
CO - 5	4	5	3	3	4	5	4	3	3	5	4	3.91
Overall Mean Score												**3.87**

Result: The Score for this Course is **3.87**(High Relationship)

Note:

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

Values Scaling:

Mean Score of COs = Total of Values / Total No. of POs & PSOs	Mean Overall Score for COs= Total of Mean Scores / Total No. of COs

UNIT I

Composition, structure, function and metabolism of biomolecules i.e., carbohydrates, lipids, proteins, nucleic acids and vitamins, enzymes and enzyme kinetics.

Blood and circulation, cardiovascular system, respiratory system, nervous system, sense organs, digestive system, excretory system and endocrine system of humans. **(6 Hours)**

UNIT II

Structural and functional organization of cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast. cellular communication and signalling, cancer, apoptosis ageing and senescence

Mendelian principles, gene and genic interactions, linkage and crossing over, mutation, extra chromosomal inheritance, microbial genetics, quantitative genetics, population genetics and human genetics.

DNA replication and repair, RNA synthesis and processing, protein synthesis and processing, control of gene expression at transcription and translation level, gene mapping methods. **(6 Hours)**

UNIT III

Biotic and abiotic factors, habitat and niche, species interaction, population ecology, community ecology, ecosystem ecology, applied ecology, energy resources, disaster management, urbanisation and conservation biology.

Evidences of evolution, Darwinism, Lamarckism, Natural selection. Hardy-Weinberg equilibrium, mimicry and coloration. adaptive radiation, Paleontology and geological time scale, Evolution of man, horse and elephant. **(6 Hours)**

UNIT IV

Levels of structural organization, outline classification of plants, animals and microorganisms, basic concepts of development, gametogenesis, fertilization and early development, morphogenesis and organogenesis in animals.

Innate and adaptive immune system, immune response, immune cells and organs, activation and differentiation of immune cells, antigen processing and presentation, antigen, antibody and their interaction, MHC, cytokines, complement, hypersensitivity, autoimmunity, vaccines, transplantation and tumour immunology, immunity to infections. **(6 Hours)**

UNIT V

Tools and techniques of genetic engineering, r -DNA technology, microscopic techniques, Chromatography, Electrophoresis, Calorimetry, Spectrophotometer, Immuno techniques, Radio labelling techniques, Statistical methods, Histochemical techniques **(6 Hours)**

BOOKS FOR REFERENCE:

1. Berg, J. M., Tymoczko, J. L. and Stryer L., Biochemistry. 5th ed., W.H. Freeman and Co., New York, 2002
2. William S. Hoar, General and Comparative Physiology, Prentice Hall Publication, New Delhi, 1983.
3. De Robertis, E.D.P. (2011). Cell and Molecular Biology (8th ed.). New York:
4. Alberts B., Johnson. A., Lewis, J., Raff, M., Roberts, K. and Watter, P. (2008). Molecular Biology of the Cell (5th ed.). Garland Science Publication, New York.
5. Gardner, E.J., Michael J. Simmons, Peter Sunstad, D, Principles of Genetics. 8th edition, John Wiley and Sons, INC, 1990.
6. Eugene P. Odum, Murray Barrick, Gary W. Barret, Fundamentals of Ecology (5th ed.). Brooks/Cole Publishers, UK, 2005
7. Scott F. Gilbert, (2006), Developmental Biology, Eighth Edition, Sinauer Associates, inc., Publishers, USA.
8. Balinsky, B. I. (1981). Introduction to Embryology (5th Edition), CBS College Publishers, New York.
9. Gorbern Benn, Aubrey Gorbman, A text book of Comparative Endocrinology, Howard publications, Newyork, 1996.
10. Edwin H Colbert, Evolution of the Vertebrates. V.R. Damodaran for Wiley Eastern Limited, Delhi. (Unit IV, V), 1990.
11. Walker J.M. and Rapley R., Molecular Biology and Biotechnology, 4th edition, New Delhi: Panima Publications 2003.
12. Harpers Illustrated Biochemistry, Victor Rodwell, David A, Benzer, McGraw Hill education,30th edition,2014.
13. Kuby J, Immunology, 6th edition, W. H. Freeman and Co., New York., 2006.
14. Michael J, Pelczar Jr, E.C.S. Chan, and Noel R. Kreig, Microbiology, Fifth Edition, McGraw Hill (India) Private Limited, New Delhi, 1958.