

**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.**



SYLLABUS 2020 - 2023

M. SC. ZOOLOGY

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.	Endow with in-depth knowledge, analyze and apply the understanding of their discipline for the betterment of self and society.
2.	Synthesize ideas from various disciplines, enhance the interdisciplinary knowledge and extend it for research.
3.	Gain confidence and skills to communicate orally/ verbally in research platforms and state a clear research finding.
4.	Develop problem solving and computational skills and gain confidence to appear for the competitive examinations.
5.	Enhance knowledge regarding research by accumulating practical knowledge in specific areas of research.
6.	Achieve idealistic goals and enrich the values to tackle the societal challenges.

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, PO - 6
2.	Acquire theoretical basis and practical skills in the use of basic tools, technologies and methods common to different disciplines of life sciences.	PO - 2, PO - 3, PO - 6
3.	Develop skill to operate instruments applying the knowledge of Physics & Chemistry and handle biological data efficiently such as to collect, record, analyse and interpret the hypothesis.	PO - 2, PO - 3
4.	Enhance knowledge regarding research by accumulating practical knowledge in specific areas of research.	PO - 1, PO - 5
5.	Prepare for competitive exams at National level and exhibit their potential in teaching and lecture.	PO - 4, PO - 6

PG COURSE PATTERN (2020 - 2023) (UGC/ TANSICHE/ MTU)

Sem.	Code	Title of the Course	Hours	Credit
I	20PZO1C01	Biological Chemistry	6	5
	20PZO1C02	Cell and Molecular Biology	6	5
	20PZO1C03	Genetics	6	5
	20PZO1P01	Biological Chemistry, Cell and Molecular Biology and Genetics - Lab	6	4
	20PZO1E1A/ 20PZO1E1B/ 20PZO1E1C	Functional Morphology of Invertebrates and Chordates / Parasitology / Medical Entomology	6	4
		Total	30	23
II	20PZO2C04	Developmental Biology	6	5
	20PZO2C05	Environmental Biology	6	5
	20PZO2P02	Developmental Biology, Environmental Biology and Medical Lab Technology - Lab	6	5
	20PZO2E2A/ 20PZO2E2B/ 20PZO2E2C	Medical Lab Technology / Nanobiology / General Endocrinology	6	4
	20PZO2GE1	IDC - Human Physiology	4	3
	20PSE2S01	Soft Skills	2	1
		Total	30	23
III	20PZO3C06	Physiology	6	5
	20PZO3C07	Biotechnology	6	5
	20PZO3P03	Physiology and Biotechnology - Lab	6	5
	20PZO3E3A/ 20PZO3E3B/ 20PZO3E3C	Research Methodology / General and Applied Entomology / Industrial Zoology	6	4
	20PZO3GE2	IDC - Human Health Care	4	3
	20PSE3H02	Human Rights & Duties	2	1
	20PZO3IN1	Internship	-	2*
		Total	30	23+2*
IV	20PZO4C08	Immunology	6	5
	20PZO4C09	Applied Microbiology	6	5
	20PZO4P04	Immunology and Applied Microbiology - Lab	6	5
	20PZO4R01	Project	12	6
	20PZO4SM1	MOOC'S	-	1*
	20PZO4S01	Comprehensive Examination	-	2*
		Total	30	21+3*
		Total for All Semesters	120	90 + 5*

Internship for at least 10 days after II semester i.e. during the Semester Holidays - Extra Credits

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

THEORY:

Component	Marks	Marks
Internal Test I	40	Converted to 25
Internal Test II	40	
Seminar	10	
Term Paper	5	
Attendance	5	
Total	100	25

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

Practical: 40 Marks

PASSING MINIMUM

Semester Examination	
Theory	50% out of 75 Marks (i.e. 37.5 Marks)
Practical	50% out of 60 Marks (i.e. 30 Marks)

PROJECT WORK

The ratio of marks for Internal and External Examination is 50:50.

THE INTERNAL COMPONENTS OF PROJECT

Components	Marks
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
Total	50

External Valuation of Project Work

Components	Marks
Project	25
External Viva Voce	25
Total	50

Internship Component can be decided by the respective Dept.

INTERNAL QUESTION PATTERN

(Maximum Marks - 40)

Part - A

10 Questions × 1Mark = 10 Marks

Part - B

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

Part - C

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of three)

EXTERNAL QUESTION PATTERN

(Maximum Marks - 75)

Part - A

10 Questions × 1Mark = 10 Marks

(Two Questions from each Unit)

Part - B

5 Questions × 5 Marks = 25 Marks

(Internal Choice and one set of Question from each Unit)

Part - C

5 Questions × 8 Marks = 40 Marks

(Open Choice Five Questions out of Seven

Atleast One Question from each Unit)

BIOLOGICAL CHEMISTRY

Semester: I

Hours: 6

Code : 20PZO1C01

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the energy source, chemical bonds and understand the importance of acid base balance.	PSO - 1, PSO - 5	K, C, An
CO - 2	Describe the structure, classification and functions of Biomolecules.	PSO - 1, PSO - 5	K, An
CO - 3	Illustrate the metabolic pathways of Biomolecules.	PSO - 2, PSO - 5	K, S, C
CO - 4	Attain practical knowledge on Biotechnical instruments.	PSO - 2, PSO - 3, PSO - 5	K, An, A
CO - 5	Apply their knowledge and practical skills independently in research activity.	PSO - 2, PSO - 3, PSO - 4	A, S, E

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

Semester: I		BIOLOGICAL CHEMISTRY										Hours: 6
Code : 20PZO1C01												Credits: 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	4	4	3	4	4	3	4	4	3	3	4	3.64
CO - 2	4	3	4	4	3	3	4	3	3	2	3	3.27
CO - 3	4	4	3	3	4	3	4	4	3	3	4	3.55
CO - 4	4	3	2	3	4	3	4	5	3	3	3	3.36
CO - 5	4	3	4	4	4	3	3	4	4	4	4	3.73
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Chemical Foundations of Biology: Structure of atoms, molecules and chemical bonds. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.), High-energy phosphate compounds: introduction, phosphate group transfers. Water - physical properties. pH scale, pH measurements, pH maintenance. Buffer - buffer capacity, action of biological buffers. pK, Titration curves of strong and weak acid base combinations, Acid-base balance. Electrolytic dissociation into cations and anions - Henderson Hasselbach's equation. **(18 Hours)**

UNIT II

Chemistry and Metabolism of Carbohydrate and Lipid: Composition, structure, Classification and functions of Carbohydrates and lipid. Metabolism of carbohydrate - glycogenesis, glycogenolysis, glycolysis, Krebs cycle, HMP pathway, gluconeogenesis, and glyoxylate pathway. Metabolism of lipid β - oxidation of fatty acids (Palmitic acid), ketosis, biosynthesis of fatty acid (Palmitic acid), triglycerides and cholesterol. **(18 Hours)**

UNIT III

Chemistry and Metabolism of Protein: Amino acids: Composition, Structure, classification, essential amino acids, glycogenic and ketogenic amino acids. Levels of structure in protein architecture (structural organization - primary (peptide bond), secondary (α and β), tertiary (myoglobin) and quaternary (haemoglobin structure). Metabolism of amino acids - Amino acid break down pathways, Transamination of amino acids, the ping pong bi bi mechanism of transamination, the urea cycle, the degradation pathways of individual amino acids. **(18 Hours)**

UNIT IV

Enzymes and Metabolism of Nucleic acid: Enzymes: Types of Enzymes, mechanism of enzyme action, enzyme kinetics, enzyme inhibitors, coenzymes. Metabolism of nucleic acids - Metabolic routes and pathways of nucleotides - purine synthesis, Utilization of dietary nucleotides, purine degradation, Synthesis of pyrimidines, degradation of pyrimidines. **(18 Hours)**

UNIT V

Bioinstrumentation: Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy. Molecular structure determination using X-ray diffraction, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods. Principles and working mechanism of Electrophoresis and Ultracentrifugation (Velocity and buoyant). **(18 Hours)**

BOOKS FOR REFERENCE:

1. Nitin Jain, Jain, J.L. & Sunjay Jain (2014). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
2. Satyanarayana, U. & Chakrapani, U. (2013). Biochemistry (4th ed.). Elsevier, India.
3. Vasudevan, D. M., Sree Kumari, S. & Kannan Vaidyanathan (2013). Text Book of Biochemistry for Medical Students (7th ed.). Jaypee Brothers Medical Publishers Pvt. Limited, New Delhi.
4. Chatterjee, M.N. & Rana Shinde (2012). Text Book of Medical Biochemistry (8th ed.). Jaypee Brothers Medical Publishers Pvt. Limited, New Delhi.
5. Jeremy M. Berg, John L. Tymoczko & Lubert Stryer (2006). Biochemistry (6th ed.). Freeman & Co. Publishers, San Francisco.
6. Ambika Shanmugam (2012). Fundamentals of Biochemistry for Medical Students (7th ed.). Published by Wolters Kluwer, India.
7. Rodney F Boyer., (2009). Modern Experimental Biochemistry (3rd ed.). Published by Darling Kindersley (India), Pvt., Ltd, South Asia.
8. David.L.Nelson and Michael.M.Cox (2008). Lehninger's Principles of Biochemistry (4th ed.). W.H. Freeman and CO., New York.
9. Veerakumari L., (2006). Bio Instrumentation. MJP Publishers, Chennai.
10. Lehninger, A. L., Nelson, D. K., and Cox, M. M. (1993). Principles of Biochemistry. CBS Publishers and distributors, New Delhi.
11. Stryer, L. (1988). Biochemistry. W. H. Freeman and Company, New York.

CELL AND MOLECULAR BIOLOGY

Semester: I

Hours: 6

Code : 20PZO1C02

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Provide firm intellectual and basic knowledge on the structure and functions of biomembranes and relate the mechanisms of cell to cell signaling.	PSO - 1	K, S
CO - 2	Compare different types of transporters and its functions and explain the cell cycle and its regulation.	PSO - 1, PSO - 2	K, An, Ap
CO - 3	Restate and interpret the processes and significance of proteins synthesis and regulation of gene at the transcriptional and post transcriptional modification.	PSO - 1, PSO - 3, PSO - 5	K, C, An, S
CO - 4	Illustrate the structural organization of gene and control of gene expression.	PSO - 1, PSO - 5	K, An, C
CO - 5	Comprehend transcriptional regulation in prokaryotes and eukaryotes, gene silencing and genetic imprinting mechanisms.	PSO - 1, PSO - 3, PSO - 5	K, C, An

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

Semester: I		CELL AND MOLECULAR BIOLOGY										Hours: 6
Code : 20PZO1C02												Credits: 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	4	2	3	3	4	3	5	4	3	3	4	3.45
CO - 2	4	3	2	3	4	3	5	5	3	2	3	3.36
CO - 3	4	3	3	4	4	2	4	4	3	3	4	3.45
CO - 4	4	4	3	4	3	3	4	5	3	3	4	3.64
CO - 5	3	3	2	4	3	2	4	3	3	3	4	3.09
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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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 secretory 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.
2. Ajoy Paul, (2007). Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd. Kolkata.
3. Kapoor, V.C. (2001). Practice of Animal Taxonomy (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd New Delhi.
4. Lodish, H. & Berk, A. (2016). Molecular Cell Biology (8th ed.). W.H. Freeman and Company Limited Publication, New York.
5. Gupta, P.K. (2014). Cell and Molecular Biology (4th ed.). Rastogi Publication, New Delhi.
6. Geoffrey M. Cooper & Robert E. Hausman (2013). The cell: A Molecular Approach (6th ed.). Sinauer Associates Publication, Massachusetts, USA.
7. 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.

GENETICS

Semester: I

Hours: 6

Code : 20PZO1C03

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explicate the principles of genetics with respect to inheritance.	PSO - 1, PSO - 2	K, C, Ap
CO - 2	Illustrate the mechanism of linkage and crossing over.	PSO - 1, PSO - 5	K, Ap, E
CO - 3	Interpret the various extra chromosomal inheritances.	PSO - 2	K, Ap
CO - 4	Discuss the importance of sex linked genes.	PSO - 3	K, C
CO - 5	Analyze the need for genetic counseling.	PSO - 4	An, Ap

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

Semester: I		GENETICS										Hours: 6
Code : 20PZO1C03												Credits: 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	4	3	3	4	4	3	5	4	3	3	3	3.55
CO - 2	4	3	3	4	4	3	5	4	3	3	3	3.55
CO - 3	4	3	3	4	3	2	4	3	4	3	4	3.36
CO - 4	4	3	3	4	3	3	4	4	3	3	4	3.45
CO - 5	4	3	2	4	3	4	4	3	3	4	4	3.45
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:

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

Mendelian Principles and Genic Interaction: Inheritance of one gene and two gene (Monohybrid and Dihybrid) - back cross and test cross, Mendelian laws, Concept of genes: Complementary genes, Supplementary genes, Epistasis, Duplicate genes, Lethal genes. Extensions of Mendelian principles - Theory of inheritance, Complete, incomplete and codominance. Pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, Polygenic Inheritance Multiple alleles: Rh factor in man. **(18 Hours)**

UNIT II

Linkage and Crossing Over: Linkage - kinds, theories of linkage, linkage groups. Crossing Over - mechanism, theories of crossing over, significance of crossing over. Gene mapping methods: Linkage maps, mapping with molecular markers, cytological evidence (Stern's experiment and tetrad analysis). Chromosome map: two point and three point cross - problems to be solved in construction of chromosome map. Sex determination - primary and secondary non disjunction in Drosophila. Syndromes in man: Stiff -person syndrome, multiple endocrine neoplasia syndromes, Blue man syndrome, Irritable male syndrome. **(18 Hours)**

UNIT III

Extra chromosomal inheritance, Microbial genetics: Methods of genetic transfer - Bacterial transformation, conjugation and transduction. Mutation: Chromosomal mutation - changes in structure and number, aneuploidy and euploidy, Gene mutation - mutagens. DNA repair mechanisms. **(18 Hours)**

UNIT IV

Human Genetics: Autosomes and Allosomes - Human karyotype and ideogram. Simple mendelian traits in men. Twins - types, development and application. Inborn errors of metabolism. Sex - Linked genes and their inheritance, X - linked genes, holandric genes. Pedigree analysis and Human genome project. **(18 Hours)**

UNIT V

Population Genetics: Hardy Weinberg equilibrium - calculation of gene frequency - factors affecting gene frequency - selection, Structural and numerical alternation of chromosomes - mutation, genetic drift and migration. Inbreeding and out breeding and heterosis. Eugenics, eugenics and euphenics. Genetic prognosis - genetic counseling. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Verma P.S. and Agarwal, V.K. (2009). Genetics. Reviseded. S. Chand & Co. New Delhi.
2. Peter Snustad, D. and Micheal J. Simmons (2010). Principles of Genetics (2nd ed.). USA: John Wiley and Sons.
3. Chatterjee, S. (2009) Genetics. APH publishing Corporation, New Delhi.
4. Singh, B.D. (2008). Fundamentals of genetics (4th ed.). Kalyani Publishers, Ludhiana.
5. Gardner, Simmons, Snustad (2006). Principles of Genetics (8th ed.). John Wiley & Sons, USA.
6. Ahluwalia, K.B. (2009). Genetics (2nd ed.). New Age International. New Delhi.

BIOLOGICAL CHEMISTRY, CELL AND MOLECULAR BIOLOGY AND GENETICS - LAB

Semester: I

Hours: 6

Code : 20PZO1P01

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Demonstrate the working principles and applications of biochemical instruments.	PSO - 1, PSO - 2, PSO - 3	K, Ap, E
CO - 2	Impart comprehensive knowledge on the methodology for qualitative analysis of biomolecules.	PSO - 2, PSO - 3	K, C
CO - 3	Learn the skills pertaining to cell biology, genetics and biochemistry through experimental analysis.	PSO - 2, PSO - 3	K, An, S
CO - 4	Analyze the variations in cell types and significance of various cells.	PSO - 2, PSO - 4	K, An, E
CO - 5	Provide a deeper meaning and conceptual frame work to heredity.	PSO - 2	C, Ap

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

Semester: I		BIOLOGICAL CHEMISTRY, CELL AND MOLECULAR BIOLOGY AND GENETICS - LAB										Hours: 6
Code : 20PZO1P01												Credits: 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	4	4	4	4	4	3	4	4	4	4	3	3.81
CO - 2	4	3	3	4	4	3	4	4	4	3	4	3.64
CO - 3	4	3	4	4	3	2	4	3	4	4	4	3.55
CO - 4	4	4	3	4	3	3	4	3	3	4	4	3.55
CO - 5	4	3	3	4	3	4	4	4	3	3	4	3.55
Overall Mean Score for COs											3.62	

Result: The Score for this Course is 3.62 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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Biological chemistry:

1. Determination of pH of different samples using pH meter.
2. Preparation of buffers: Acetate, Phosphate and Tris buffers.
3. Quantitative estimation of carbohydrate in liver / muscle.
4. Quantitative estimation of protein in liver / muscle.
5. Estimation of protease activity on substrates.
6. Determination of saponification value of fats.
7. Estimation of iodine value in edible oils.
8. Estimation of ascorbic acid by titrimetric method.
9. Separation of lipids by TLC - Demo.
10. Determination of salivary amylase activity in relation to temperature.
11. Chromatographic separation of amino acids.
12. Instruments:

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

Cell and Molecular Biology:

1. Preparation of squamous epithelial cells.
2. Preparation of human blood smears.
3. Preparation of cockroach haemolymph smears.
4. Observation of striated muscle fibre from the coxal muscle of cockroach.
5. Observation of adipocytes from the fat body of cockroach.
6. Mitotic cell division in onion root tip.
7. Meiotic cell division in grasshopper testis.
8. Giant chromosome in Chironomous larva.
9. Barr-body identification.
10. Extraction and isolation of DNA from animal tissue.
11. Spotters - Observation of different types of tissues and cell organelles,

Gel electrophoresis, PCR, t - RNA, Lac Operon.

Genetics:

1. Preparation and maintenance of culture of Drosophila and observation of mutant forms.
2. Study of human syndromes in local areas.
3. Mendelian traits and pedigree analysis in man.
4. Dermatoglyphic data (finger print) of the class population.
5. Hardy - Weinberg law - Calculation of ABO, MN blood grouping and PTC tasters.
6. Study of random genetic drift in small populations (using beads).

FUNCTIONAL MORPHOLOGY OF INVERTEBRATES AND CHORDATES

Semester: I

Hours: 6

Code : 20PZO1E1A

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Identify and categorize levels of structural organization of invertebrates.	PSO - 1, PSO - 5	K, Ap
CO - 2	Classify and identify the relationships among invertebrates and chordates.	PSO - 2, PSO - 5	Ap, C
CO - 3	Acquire an in-depth knowledge on functional anatomy of invertebrates.	PSO - 1, PSO - 4	K, C
CO - 4	Compare the functional anatomy of various systems of vertebrates.	PSO - 1, PSO - 4	An, C
CO - 5	Develop holistic appreciation on the relationships in animals.	PSO - 1, PSO - 2, PSO - 5	Ap, E

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

Semester: I		FUNCTIONAL MORPHOLOGY OF INVERTEBRATES AND CHORDATES										Hours: 6
Code : 20PZO1E1A												Credits: 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	4	4	3	4	3	2	5	4	2	3	4	3.55
CO - 2	4	3	3	4	4	2	5	4	2	3	4	3.45
CO - 3	4	3	3	4	3	2	4	3	2	3	4	3.18
CO - 4	4	3	3	4	3	3	4	4	2	3	4	3.36
CO - 5	4	3	2	4	3	4	4	3	2	4	4	3.45
Overall Mean Score												3.40

Result: The Score for this Course is 3.11 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Principles of Taxonomy and Classification: Binomial, Trinomial nomenclature. Symmetry and its significance in animal organization. Coelom -Acoelomate, Pseudocoelomate, Coelomate groups (Schizocoel, Enterocoel, Mesenchyme) - Significance. Metamerism, Pseudometamerism, Cyclo metamerism, Corm theory, Embryological theory - Significance. Classification: Grouping of invertebrates into phyla, distinctive characters of phyla with one example each. Classification and salient features of prochordates and chordates upto classes with one example each. **(18 Hours)**

UNIT II

Functional Anatomy of Invertebrates: Locomotion - Annelids, Molluscs and Echinoderms. Nutrition - Filter feeding in Polychaetes, Molluscs and Prochordates. Respiration - Gills, book lungs, trachea in Arthropods and Molluscs. Circulation - Circulation in Arthropods and Molluscs. Excretion - Different types of excretory organs in invertebrates and their structure and function. **(18 Hours)**

UNIT III

Functional Anatomy of Invertebrates: Nervous System in Coelenterates, Annelids, Arthropods and Molluscs. Chemical Co-ordination - Endocrine glands in Crustaceans and Insects, Pheromones and Allelochemicals. Sexual and Asexual reproduction in invertebrates. Larval forms and their phylogenic significance. **(18 Hours)**

UNIT IV

Functional Anatomy of Vertebrates: Integumentary System ,Exoskeletal structures and their modifications. Digestive System- Alimentary canal and associated glands. Respiratory System- Gill respiration in cyclostomes and fishes, Pulmonary respiration in tetrapods (Pisces, Aves and Mammals). Comparative anatomy of chordates- axial and appendicular skeleton, heart and aortic arches and urinogenital system. **(18 Hours)**

UNIT V

Neurosensory : Nervous System - Brain, spinal cord, cranial nerves, spinal nerves and visceral nerves. Autonomic nervous systems - Sympathetic and Parasympathetic. Sense organs in vertebrates - Photoreceptors and Mechanoreceptors - their structure and functions. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Kapoor, V.C. (2001). Practice of Animal Taxonomy (5th ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Vasantika kashyap (1997). Life of Invertebrates. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Jordan, E.L. & Verma, P.S. (2001). Invertebrate Zoology. S. Chand and Company Ltd., New Delhi.
4. Jordan, E.L. and Verma, P.S. (2014). Chordate Zoology. S. Chand and Company Ltd., New Delhi.
5. Barrington, E.J.W. (1979). Invertebrate structure and functions (2nd ed.). ELBS and Nelson, London.
6. Romer, A.S. (1979). Hyman's Comparative Vertebrate Anatomy (3rd ed.) The University of Chicago Press, London.
7. Young, J.Z. (1950). Life of Vertebrates, Clarendon Press, Oxford, London.
8. Jollie, M. (1962). Chordate morphology, Reinholt publishing corporation, New York.

PARASITOLOGY

Semester: I

Hours: 6

Code : 20PZO1E1B

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend different kinds of parasites, sources, mode of transmission of parasitic infection and Parasitic adaptation.	PSO - 1, PSO - 2, PSO - 5	K, C
CO - 2	Enlist the disease causing protozoan parasites.	PSO - 2, PSO - 5	K, An, E
CO - 3	Describe the morphology and life cycle of helminth Parasites.	PSO - 5	K, C, S
CO - 4	Elucidate parasitic Vectors and their life cycle.	PSO - 1, PSO - 5	K, C, An
CO - 5	Analyse and examine the blood, stool, urine, sputum and biopsy material for parasites.	PSO - 2, PSO - 3, PSO - 5	K, Ap, An, S, E

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

Semester: I		PARASITOLOGY										Hours: 6
Code : 20PZO1E1B												Credits: 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	4	2	4	3	3	4	5	3	2	3	4	3.36
CO - 2	4	2	4	3	3	4	5	3	2	3	4	3.36
CO - 3	4	2	4	3	3	4	4	3	2	3	4	3.27
CO - 4	4	2	4	3	3	4	4	3	2	3	4	3.27
CO - 5	4	3	4	3	4	4	4	3	2	4	4	3.55
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Over View of Parasitism: Parasitism - Definitions, Hyperparasitism. Types of Host - regular hosts, irregular hosts, intermediate hosts. Parasites - Endoparasite, Ectoparasite, Obligate parasites, Facultative parasites, Accidental or Incidental parasite, Oioxenous, Stenoxenous and Euryxenous Parasite, Sources of parasitic infection, mode of transmission, parasitic adaptation. (18 Hours)

UNIT II

Protozoan Parasites: Classification of protozoan parasites, Morphology, Pathogenesis, Clinical features, Diagnosis, Treatment and prophylaxis of protozoan parasites - Entamoeba, Giardia, Trypanosoma, Leishmania, Plasmodium vivax, Balantidium. (18 Hours)

UNIT III

Helminth Parasites: Classification of helminth parasites, Morphology, pathogenesis, Clinical features, Diagnosis , Treatment and prophylaxis of helminth parasites - Schistosoma haematobium, Taenia saginata, Trichuris trichiura, Ancylostoma duodenale, Enterobius vermicularis, Wuchereria bancrofti and Dracunculus medinensis. (18 Hours)

UNIT IV

Insect Vectors: Brief account of various insect vectors and their life cycle (Mosquitoes - Anopheles, Aedes and Culex; vectors of Leishmania, Trypanosoma, Blood fluke). (18 Hours)

UNIT V

Diagnostic Methods in Parasitology: Collection and preservation of specimens for parasitological examination, transport of specimens. Microscopical examination of blood, stool, urine, sputum and biopsy material for parasites. General rules for microscopical examination. Examination of blood parasites - Thick and thin smears for malarial and filarial parasites. (18 Hours)

BOOKS FOR REFERENCE:

1. Jayaram Paniker, C.K. (2017). Textbook of Medical Parasitology (8th Ed.). Jaypee Brothers, Medical Publishers (P) LTD, New Delhi.
2. Chatterjee, K.D. (2009). Parasitology. (13th Ed.). Chatterjee Medical Publishers, Calcutta.
3. Rajesh Karyakarte and Ajit Damle (2008). Medical Parasitology (2nd Ed.). Books and Allied (P) Ltd, Kolkata.
4. Ichhpujani R.L. and Rajesh Bhatia (2002). Medical Parasitology. Jaypee Printers, New Delhi.
5. Patvaik, B.D. (2001). Parasitic Insects. Dominant Publishers and Distributors, Delhi.
6. Subah, C.P. (2001). Textbook of Medical Parasitology. All India publishers and Distributors, Chennai.
7. Kochhar S.K. (2004). A Text Book of Parasitology. Dominant Publishers and Distributors, New Delhi.
8. Veer Singh Rathore and Yogesh Singh Sengar (2005). Diagnosis parasitology. Pointer Publishers, Jaipur.
9. PrakashMalhotra (2008). Applied Parasitology. Adhyayan Publishers and Distributors, New Delhi.

MEDICAL ENTOMOLOGY

Semester: I

Hours: 6

Code : 20PZO1E1C

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on fundamentals of entomology.	PSO - 1, PSO - 4	K, C, Ap
CO - 2	Understand the general characters, life cycle and epidemiology of arthropod vectors.	PSO - 1, PSO - 3	K, An, E
CO - 3	Analyse the vector - host - pathogen relationships in arthropod-borne diseases.	PSO - 2, PSO - 4	An, S, E
CO - 4	Design appropriate vector control measures.	PSO - 1, PSO - 3, PSO - 5	K, C, Ap, An
CO - 5	Apply the knowledge of entomology in forensic science.	PSO - 1, PSO - 4, PSO - 5	K, An, Ap, E

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

Semester: I		MEDICAL ENTOMOLOGY										Hours: 6
Code : 20PZO1E1C												Credits: 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	4	2	3	4	3	4	4	3	2	3	4	3.27
CO - 2	4	2	3	4	3	4	4	3	2	3	4	3.27
CO - 3	4	2	3	4	3	4	4	3	2	3	4	3.27
CO - 4	4	2	3	4	3	4	4	3	2	3	4	3.27
CO - 5	4	3	3	4	3	4	4	3	2	3	4	3.36
Overall Mean Score											3.29	

Result: The Score for this Course is 3.29 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Overview of Entomology: Fundamentals and scope of medical entomology, Classification of Class Insecta with special emphasis to medically important Arthropods. Insect Morphology: Exoskeleton, head, thorax and abdomen. Insect Development: Growth, Development and Metamorphosis. Significance of insects to human importance. **(18 Hours)**

UNIT II

Human Parasitic Insects: Life cycle and epidemiology of lice, fleas, mosquitoes, house fly, tsetse fly, sandfly, eye fly and bedbugs. **(18 Hours)**

UNIT III

Insect borne Diseases of Man: Common vector insects and their identification: Hard and soft tick, trombiculid mite, itch mite. Mechanism of transmission of Typhus, yellow fever, dengue fever, encephalites, plague, leishmaniasis, sleeping sickness, malaria, filaria, onchocerciasis. **(18 Hours)**

UNIT IV

Venoms, allergens and Vector Management: Insect venoms, Blister and urticaria -inducing insects. Allergy caused by household pests - Cockroaches, crickets, ants, wasps, cloth moths, silver fish, carpet beetles, furniture beetles and booklice. Vector Control and management: Insecticides - uses and consequences, Use of biocontrol agents and biopesticides - bacillus and predatory fishes. Immunity to human parasites, defense mechanisms, Insect allergenicity.

(18 Hours)

UNIT V

Forensic Entomology: Forensic entomology of human and wildlife, Arthropods of forensic importance, Insect succession on corpse and its relationship to determining time of death. National programmes related to vector borne diseases -malaria - N.M.E.P., N.M.C.P - filarial - N.F.C.P. - N.F.E.P. Health education programme on dengue. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Patton, W.S. and Cragg, F.W. (1981). A Text Book of Medical Entomology. International Books and Periodicals Supply Service, New Delhi.
2. Walter Scott Patton and Francis William Cragg, (2008). A textbook of Medical Entomology. Kessinger Publishing Pvt. Ltd., Montana, USA.
3. Bruce F. Eldridge and John D. Edman, (2004). Medical Entomology - A textbook of public health and veterinary probes caused by Arthropods. Kluwer Academic Publishers, Netherlands.
4. Lance A. Durden, (2002). Medical and Veterinary Entomology (3rd ed.). Academic Press, Cambridge.
5. Rathinaswamy, T.K. (1986). Medical Entomology. S.Viswanathan and Co., Madras.
6. Service, M.W. (2004). Medical Entomology for Students (3rd ed.). Cambridge University Press, United Kingdom.
7. Fenemore, P.G. and Alkaprakash, (1992). Applied Entomology. Wiley Eastern Ltd., Delhi.
8. Alford, (1999). A textbook of Agricultural Entomology. Blackwell Science Ltd., Oxford, Malden.
9. Srivastava, A. (1993). Textbook of Applied Entomology. Vol. I & II (2nd ed.) Kalyani Publisher, Ludhiana.
10. Imms, (1977). A General Text Book of Entomology. 2 Vols. Asia Publishing House. University of London, New York.
11. Pedigo, (1989). Entomology and Pest Management. Prentice Hall, New Delhi.
12. Dhaliwal and Arora, (1994). Trends in Agricultural Insect Pest Management. Commonwealth Publ., New Delhi.

DEVELOPMENTAL BIOLOGY

Semester: II

Hours: 6

Code : 20PZO2C04

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the basic stages of developmental biology, process of gametogenesis and fertilization.	PSO - 1, PSO - 2,	K, C
CO - 2	Analyse the events of early developmental stages.	PSO-1, PSO - 2	An, C
CO - 3	Apply the knowledge of developmental biology in laboratory condition.	PSO - 1, PSO-2, PSO-3	An, Ap
CO - 4	Evaluate the reproductive cycle in human.	PSO - 1, PSO-2, PSO-4	K, E
CO - 5	Apply the skills of developmental biology for the betterment of human race.	PSO-2, PSO-4, PSO - 5	An, Ap

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

Semester: II		DEVELOPMENTAL BIOLOGY										Hours: 6
Code : 20PZO2C04												Credits: 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	4	3	4	4	3	4	4	3	2	3	5	3.45
CO - 2	4	3	3	4	3	4	4	3	2	2	4	3.27
CO - 3	4	3	3	4	3	4	4	4	2	3	4	3.45
CO - 4	4	3	3	4	3	4	4	3	2	2	4	3.27
CO - 5	4	3	3	4	3	4	4	4	2	3	4	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 = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Gametogenesis and Fertilization: Scope of Developmental Biology, theories - germ plasm theory, recapitulation theory, organizer theory, mosaic theory, gradient theory and regulative theory. Origin of primordial germ cells in Invertebrates and Chordates. Fertilization - sperm attraction, acrosome reaction, fusion of egg and sperm, theories of egg activation, types of fertilization, factors affecting fertilization. **(20 Hours)**

UNIT II

Early Developmental Stages: Cleavage - patterns, types, physiology and factors affecting cleavage. Morphogenetic movements, fate map of frog, chick and human. Study of development in frog and chick. Role of genes and chemical changes during gastrulation. Organogenesis - Development of heart, eye and brain in human. **(20 Hours)**

UNIT III

Interaction, development and Differentiation: Nucleo - cytoplasmic interaction, nuclear transplantation, gradients, embryonic induction, regeneration. Metamorphosis in insects and amphibians. Molecular basis of differentiation, immunological studies of embryonic differentiation. **(18 Hours)**

UNIT IV

Human Development: Structure of Male and female reproductive organs, menstrual cycle, PMT, gestation period, hormonal control of ovulation, pregnancy, parturition and lactation. Abnormal pregnancy - multiple pregnancy, missed abortion, ectopic pregnancy, abortion and still birth. Teratogenesis and congenital defects - heart diseases, sickle cell diseases, neural tube defects, orofacial clefts, limb defects, abdominal wall defects, spina bifida, marfan syndrome, amniotic bands syndrome and osteogenesis imperfecta. **(16 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. **(16 Hours)**

BOOKS FOR REFERENCE:

1. Gilbert, B. F. (2006). *Developmental Biology* (8th Ed.). Sinaur Associates Inc Publishers, Sunderland, Massachusetts, USA.
2. Mohan P. Arora. (2002). *Embryology*. Himalaya Publication House, Mumbai.
3. Verma. P. S. and Agarwal V. K. (2003). *Chordate Embryology*, S. Chand and Company Ltd, New Delhi.
4. Werner A. Muller. (2005). *Developmental biology*. Springer (India) Private Ltd, New Delhi.
5. Leon W. Browder., Carol A. Erickson and William R. Jeffery S. (1991). *Developmental Biology* (3rd Ed.). Saunders College Publishing, Florida.
6. Balinsky, B. J. (2012). *An Introduction to Embryology* (5th Ed.). Cengage Learning India.
7. Subramanian, T. (2005). *Developmental biology*, Narosa publishing house, New Delhi.
8. Carlson, Bruce, M., (2009). *Human Embryology and Developmental Biology*. Elsevier, Philadelphia.

ENVIRONMENTAL BIOLOGY

Semester: II

Hours: 6

Code : 20PZO2C05

Credits: 5

COURSE OUT COMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Discuss the concepts of ecosystem, and understand how flora and fauna are adapted to the habitat.	PSO - 1, PSO - 2	K, E
CO - 2	Discuss the concepts of community ecology and population ecology.	PSO - 1, PSO - 5	K, C
CO - 3	Identify and compare renewable and non-renewable energy resources, their conservation and better management.	PSO - 2, PSO - 5	C, Ap
CO - 4	Assess the current research practice and methodologies in the field of disaster management.	PSO - 3	K, Ap, An
CO - 5	Analyse the causes and consequences of pollution and address the pollution Problems.	PSO - 4, PSO - 5	K, Ap

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

Semester: II		ENVIRONMENTAL BIOLOGY										Hours: 6
Code : 20PZO2C05												Credits: 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	4	3	4	4	3	3	4	3	2	3	5	3.45
CO - 2	4	3	3	4	3	4	4	3	2	2	4	3.27
CO - 3	4	3	3	4	3	3	4	4	2	3	4	3.36
CO - 4	4	3	3	4	3	4	4	3	2	2	4	3.27
CO - 5	4	3	3	4	3	4	4	4	2	3	4	3.45
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

The Environment, Habitat and Ecosystem: Review on physical environment;,biotic environment,biotic and abiotic interactions. Climatic factors (climate, precipitation, temperature, light, oxygen, carbon dioxide and pH). Biogeochemical cycles: water cycle, carbon cycle, nitrogen cycle, sulphur cycle and phosphorous cycle. Habitat ecology: freshwater, marine, estuarine, mangrove, coral, reef and terrestrial. Ecosystem: Concepts of ecosystem - structure and functions. Energy flow - single channel energy model, Y - shaped energy flow models. Primary production, secondary production, measurement of primary and secondary productivity. **(18 Hours)**

UNIT II

Population, community and Pollution: Population ecology - structure and regulation, growth form, population fluctuations, population regulation. Life table - diagrammatic and conventional life tables, Life history strategies. Community: Concept, basic terms, community structure, composition and stratification. Ecological niche, Ecotone and Edge effect, Ecotype. Ecological succession: types, general process, Concept of climax. Pollution: sources, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, nuclear hazards. Species interactions (symbiosis, commensalism, parasitism and competition). **(18 Hours)**

UNIT III

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 /management strategy (Project tiger, Biosphere reserves). Natural resource ecology: Concept and classification of resource, mineral resource, land resource, forest resource, water resource, energy resource (conventional and non-conventional). **(18 Hours)**

UNIT IV

Disaster management: Definition, factors and Significance, Difference between Hazard and Disaster. Natural disasters - Earthquakes, Volcanic Eruption, Landslides, Snow Avalanches, Floods and Flash Floods, Cyclones, Tsunami and Droughts. Man Made Disasters - Fires and Forest Fires. Nuclear, Biological and Chemical disasters, Road accident. **(18 Hours)**

UNIT V

Applied Ecology: Waste management: solid, liquid and gaseous wastes. e-wastes. Remote sensing: Techniques involved - aerial photograph, satellite images - thermal, infrared, radar images, ecological applications - resource exploration, pollution monitoring, environmental impact assessment, eco restoration, predicting natural hazards. Space travel: life support system in space vehicle, Exobiology - space ecosystem. Urbanization: problems due to urbanization. Occupational health hazards, rain water harvesting. Pollution control board - Central and State government NGO, International environmental policy, Earth summit and world summit. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Eugene P. Odum, Murray Barrick, Gary W. Barret. (2005). Fundamentals of Ecology (5th Ed.). Brooks/Cole Publishers, UK.
2. Begon and Mortimer (1992). Population Ecology. UBS Publishers, Delhi.
3. Kormondy, Edward, J. (1994). Concept of Ecology. Prentice Hall of India Pvt. Ltd., Delhi.
4. Sharma, P.D. (1999). Ecology and Environment. Rastogi Publications, Meerut.
5. Dash, M.L. (1996). Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
6. Trivedi, P.C. and Sharma, K.C. (2003). Biodiversity Conservation. Avishekar Publishers, Jaipur.
7. Trivedi, R.N. (1993). Textbook of Environmental Sciences. Anmol Publications Pvt. Ltd., New Delhi.
8. Shukla, S.K. and Srivastava, P.R. (1992). Water Pollution and Toxicology. Common - Wealth Publishers. New Delhi.
9. Subramanian, M.A. (2004). Toxicology: Principles and methods. MJP Publishers, Chennai.
10. Verma, P.S. and Agarwal V. K. (1986). Principles of Ecology. S. Chand & Co. Pvt. Ltd., New Delhi.

**DEVELOPMENTAL BIOLOGY, ENVIRONMENTAL BIOLOGY AND MEDICAL LAB
TECHNOLOGY - LAB**

Semester: II

Hours: 6

Code : 20PZO2P02

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire skill in mounting chick blastoderm and observe the stages of chick embryo.	PSO-1, PSO-2, PSO - 4	K, An
CO - 2	Apply skill in identifying the developmental stages of frog.	PSO - 1, PSO - 4	K, Ap
CO - 3	Analyze and report the quality of water.	PSO-1, PSO-3, PSO-5	An, S
CO - 4	Estimate primary and secondary productivity.	PSO - 2 , PSO - 4	K, An, Ap
CO - 5	Investigate the clinical samples in medical laboratory technology.	PSO - 1, PSO - 3	K, An, Ap,

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

Semester: II		DEVELOPMENTAL BIOLOGY, ENVIRONMENTAL BIOLOGY AND MEDICAL LAB TECHNOLOGY - LAB										Hours: 6
Code : 20PZO2P02												Credits: 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	4	3	4	3	4	3	4	3	3	3	4	3.45
CO - 2	3	3	3	4	4	3	4	5	3	3	4	3.36
CO - 3	4	5	3	2	4	3	4	5	3	3	4	3.63
CO - 4	3	5	3	4	4	4	4	5	3	3	4	3.81
CO - 5	3	4	3	4	3	3	4	5	3	3	4	3.54
Overall Mean Score											3.56	

Result: The Score for this Course is 3.11 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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Developmental biology:

1. Study of mosquito life cycle.
2. Mounting of chick blastoderm.
3. Microscopic examination of frog spermatozoa and ova.
4. Study of life cycle of frog up to froglet stage.
5. Regeneration in earthworm and tadpole.
6. Role of thyroxine on the metamorphosis of tadpole.

7. Spotters:

- a. T.S of testis and ovary of frog and mammal.
- b. Observation of cleavage, blastula, gastrula of frog - slides.
- c. Observation of 24, 48, 72 and 96 hour's chick embryo.
- d. Observation of sperm and egg of mammal.
- e. Observation of any two congenital abnormalities - chart.
- f. Early stages of development in chick - cleavage, blastula and gastrula.
- g. Late stage of development in chick embryo - Organogenesis.

Environmental biology:

1. Estimation of BOD, pH, COD of given water Samples.
2. Assessment of air pollution and CO₂ level at various sites.
3. Estimation of primary productivity of aquatic macrophytes - light and dark bottle method.
4. Estimation of primary productivity of terrestrial plants - harvest method.
5. Estimation of secondary productivity - Biomass production in grasshopper.
6. Collection and mounting of phyto and zoo planktons.
7. Phytoremediation with plants for dye industry effluents.
8. Estimation of LC50 value using fish/mosquito larva model.

Medical Lab Technology:

1. Determination of Bleeding time, clotting time.
2. Estimation of Haemoglobin concentration.
3. Estimation of Erythrocyte Sedimentation Rate.
4. Estimation of Packed Cell Volume.
5. Differential count.
6. Total count: Leucocytes and Erythrocytes
7. Blood grouping.
8. Estimation of Blood sugar, cholesterol, urea and creatinine
9. Urine Analysis: Urine sugar, albumin, bile salt and bile pigment.
10. Microscopic examination of crystals and cast.
11. Pregnancy test.
12. Visit to various clinics and hospitals.

MEDICAL LAB TECHNOLOGY

Semester: II

Hours: 6

Code : 20PZO2E2A

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the medical devices and biomedical instruments.	PSO - 1, PSO - 5	K, Ap, An
CO - 2	Develop lab skills to handle clinical samples and become entrepreneur.	PSO - 1, PSO - 5	K, An, Ap
CO - 3	Explicate the clinical chemistry.	PSO-1,PSO-3, PSO - 5	K, S, An
CO - 4	Analyse and report the sample urine, stool and sputum.	PSO - 1, PSO - 5	K, An
CO - 5	Analyse and understand the Causative organisms, mode of transmission, clinical symptoms and laboratory diagnosis of bacterial and viral diseases.	PSO - 1, PSO - 3, PSO - 5	K, An, S

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

Semester: II		MEDICAL LAB TECHNOLOGY										Hours: 6
Code : 20PZO2E2A												Credits: 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	4	4	4	4	4	4	3	3	3	5	5	3.90
CO - 2	3	4	3	3	3	3	3	3	3	5	4	3.36
CO - 3	4	3	3	3	4	3	3	3	3	5	5	3.54
CO - 4	3	3	3	3	4	3	3	3	3	5	4	3.36
CO - 5	4	3	3	3	3	3	3	3	3	5	4	3.36
Overall Mean Score											3.50	

Result: The Score for this Course is 3.50 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Biomedical Devices and Biomedical Instruments: Laboratory safety measures. Medical devices: Light Microscope and phase contrast microscope, Sphygmomanometer, Thermometer, Haemometer, Hemocytometer, Urinometer, Electrocardiography (ECG), Electroencephalography (EEG), Electromyography (EMG), Light Amplification by Stimulated Emission of Electromagnetic Radiation (LASER) in Medicine. **(18 Hours)**

UNIT II

Haematological Test: Routine Haematological test - Bleeding Time (BT), Clotting Time (CT), Haemoglobin Concentration (Hb), Erythrocyte Sedimentation Rate (ESR), Haematocrit (PCV), Cell Study: Counting of Cells - Differential count (DC) and Total Count (TC), Cell indices - Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC). Blood grouping and Rh typing. **(21 Hours)**

UNIT III

Clinical Biochemistry: Clinical Biochemistry -Enzymes-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. **(15 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). **(21 Hours)**

UNIT V

Bacterial and Viral Diseases: Laboratory diagnosis, Causative organisms, mode of transmission and clinical symptoms of Bacterial diseases - Tuberculosis, Leprosy, Typhoid, Syphilis and Tetanus and Viral diseases - COVID-19, Chikungunya, HIV, Jaundice and Dengue fever. **(15 Hours)**

BOOKS FOR REFERENCE:

1. Isidro Aquilar and Herminia Galbes, (1999). Encyclopedia of Health and Education for the family. Education and Health Library, Published under the title of Encyclopedia familiarria, Amor Y sexo.
2. Kanai L., Mukherjee, (2005). Volume 1, A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Kanai L., Mukherjee, (2005). Volume 2, A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Kanai L., Mukherjee, (2008). Volume 3, A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Philip Evans., (1993). The family Medical books for reference Book the essential Guide to Health and Medicine. Published by Little Brown under the Black cat imprint, London.
6. Neeraja Sankaran., (2001). Volume 4, Microbes and People. Publication by Coe Library stacks.
7. Gabriel Virella, (1987). Microbiology and Infectious Diseases. B. I. Waverly Pvt. Ltd.

NANOBIOLOGY

Semester: II

Hours: 6

Code : 20PZO2E2B

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop a broad fundamental knowledge on nanoparticles.	PSO - 1	K, C
CO - 2	Apply the knowledge in synthesis and Characterization of Nanoparticles.	PSO-3, PSO-4, PSO-5	K, S, Ap, E
CO - 3	Comprehend on Biosensors and bio signaling.	PSO-2, PSO-4, PSO-5	K, Ap, An
CO - 4	Demonstrate Nanotechnology in Biomedical Applications.	PSO-4, PSO-5	K, Ap, An
CO - 5	Apply Nanotechnology in Pollution Control.	PSO-2, PSO-3, PSO-5	K, Ap, An, S

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

Semester: II		NANOBIOLOGY										Hours: 6
Code : 20PZO2E2B												Credits: 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	4	3	3	4	3	2	4	4	3	3	4	3.09
CO - 2	4	4	3	3	3	3	3	5	3	2	5	3.45
CO - 3	3	4	3	4	3	3	4	4	3	4	4	3.54
CO - 4	4	4	3	2	3	2	4	5	2	3	5	3.36
CO - 5	3	2	3	3	3	3	4	5	3	4	5	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 = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction to Nanoscience and Basic Concepts: Interaction of surface molecules and its chemical and physical properties, Nanoprocessess 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. **(18 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.

(18 Hours)

UNIT III

Biosensors: Classes of biosensors - methods of biological signalling-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. **(18 Hours)**

UNIT IV

Biomedical Applications of Nanoparticles: Drug carriers - liposomes, nanoshells, micelles, dendrimers and hydrogels, fictionalization of nanomaterials and targeted drug delivery, imaging technique, quantum dots and magnetic nanoparticles, Implants: orthopaedic and vascular. **(18 Hours)**

UNIT V

Application of Nanotechnology in Pollution Abatement: Photocatalyst oxidation (TiO_2 based nanoparticles), reduction (iron based nanoparticle), absorption (nanoclay), encapsulation (dendrimers), nanofiltration (nanosieve membranes), nanosensors, CO_2 capture, adsorption of toxic gases. **(18 Hours)**

BOOKS FOR REFERENCE:

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

GENERAL ENDOCRINOLOGY

Semester: II

Hours: 6

Code : 20PZO2E2C

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the neurohormones and neurosecretions.	PSO - 1	K, S
CO - 2	Elucidate the cytology, chemistry, biosynthesis of thyroid and parathyroid glands.	PSO - 5	K, An, S
CO - 3	Explicate the histology, cytology of hormones and their functions.	PSO - 1, PSO - 3	K, An, S
CO - 4	Elucidate the endocrinology of ovary and testis.	PSO - 2, PSO - 5	K, An, Ap
CO - 5	Learn endocrinology in invertebrates.	PSO-1, PSO-3, PSO-5	K, An

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

Semester: II		GENERAL ENDOCRINOLOGY										Hours: 6
Code : 20PZO2E2C												Credits: 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	4	3	3	3	3	3	4	4	3	3	4	3.36
CO - 2	3	4	3	4	3	3	4	3	3	2	4	3.27
CO - 3	4	4	3	4	3	3	4	3	3	2	4	3.36
CO - 4	3	3	3	4	3	3	4	3	3	2	4	3.18
CO - 5	4	4	3	3	3	2	4	3	3	2	4	3.18
Overall Mean Score											3.27	

Result: The Score for this Course is 3.27 (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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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 of other arthropods, Hormonal control of development and moulting, Hormones of invertebrates and their applications as pesticides in recent developments. **(18 Hours)**

BOOKS FOR REFERENCE:

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

HUMAN PHYSIOLOGY

Semester: II

Hours: 4

Code : 20PZO2GE1

Credits: 3

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Impart knowledge on nutrition, structure and functions of digestive system and its associated disorders.	PSO - 1, PSO - 4	K, C
CO - 2	Explain the structure of heart, blood grouping and its related diseases.	PSO - 1, PSO - 3	K, C, Ap, An
CO - 3	Analyze the transport of respiratory gases and its issues.	PSO - 1, PSO - 3	K, An, Ap
CO - 4	Attain knowledge on mechanism of neuromuscular physiology.	PSO - 1, PSO - 5	K, Ap, An
CO - 5	Analyse regulation of urine formation and various assisted reproductive technologies.	PSO - 1	K, Ap, E

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

Semester: II		HUMAN PHYSIOLOGY										Hours: 4
Code : 20PZO2GE1												Credits: 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	3	4	2	4	4	3	3	3	5	3.45
CO - 2	3	4	3	4	3	4	3	4	3	2	5	3.45
CO - 3	4	3	3	3	3	3	4	3	3	3	5	3.36
CO - 4	4	4	3	4	2	2	4	4	2	3	5	3.36
CO - 5	4	3	3	5	3	3	4	4	3	3	5	3.63
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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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.

(12 Hours)

UNIT 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).

(12 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.

(12 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.

(12 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.

(12 Hours)

BOOKS FOR REFERENCE:

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

SOFT SKILLS

Semester: II

Hours: 2

Code : 20PSE2S01

Credit: 1

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop their social, interpersonal, cognitive, ethical, professional, reading and communication skills	PSO-1	K
CO - 2	Increase their self-esteem and confidence.	PSO-2,4	Ap
CO - 3	Achieve their short and long term goals.	PSO-3	Sy
CO - 4	Prepare and formulate their resumes wisely.	PSO-4	Ap
CO - 5	Face the mock group discussions and interviews with a challenge and choose their right career.	PSO-5	Ap

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

Semester: II		SOFT SKILLS										Hours: 2
Code : 20PSE2S01												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	
CO1	4	4	4	4	4	5	4	4	4	4	5	4.18
CO2	4	4	4	4	4	5	4	4	4	4	5	4.18
CO3	4	4	4	4	4	5	4	4	4	4	5	4.18
CO4	4	4	4	4	4	5	4	4	4	4	5	4.18
CO5	4	4	4	4	4	5	4	4	4	4	5	4.18
Overall Mean Score												4.18

Result: The Score for this Course is **4.18** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I: SOFT SKILLS

Introduction - Soft skills - Importance of soft skills - Selling your soft skills - Attributes regarded as soft skills - Soft skills - Social - Soft skills - Thinking - Soft skills - Negotiating - Exhibiting your soft skills - Identifying your soft skills - Improving your soft skills - will formal training enhance your soft skills - Soft Skills training - Train yourself - Top 60 soft skills - Practicing soft skills - Measuring attitude. **(6 Hours)**

UNIT II: CAREER PLANNING

Benefits of career planning - Guidelines for choosing a career - Myths about choosing a career - Tips for successful career planning - Developing career goals - Final thoughts on career planning - Things one should know while starting career and during his/her career. **(6 Hours)**

UNIT III: ART OF LISTENING AND SPEAKING

Two ears, one mouth - Active listening - Kinds of Listening, Common - poor listening habits - Advantages of listening - Listening Tips. Special features of Communication - Process - Channels of Communication - Net Work - Barriers - Tips for effective communication and Powerful presentation - Art of public speaking - Public Speaking tips - Over coming fear of public speaking. **(6 Hours)**

UNIT IV: ART OF READING AND WRITING

Good readers - Benefits - Types - Tips - The SQ3R Technique - Different stages of reading - Rates of Reading - Determining a student's reading rate - Increasing reading rate - Problems with reading - Effective reader - Importance of writing - Creative writing - Writing tips - Drawbacks of written communication. **(6 Hours)**

UNIT V: PREPARING CV / RESUME

Meaning - Difference among Bio-data, CV and Resume - The terms - The purpose of CV writing - Types of resumes - Interesting facts about resume - CV writing tips - CV/Resume preparation - the dos - CV/Resume preparation - the don'ts - Resume check up - Design of a CV - Entry level resume - The content of the resume - Electronic resume tips - References - Power words - Common resume blunders - Key skills that can be mentioned in the resume - Cover letters - Cover letter tips. **(6 Hours)**

COURSE BOOK:

- ❖ Dr. K. Alex, Soft Skills, Chand & Company Pvt. Ltd., New Delhi.

BOOKS REFERENCE:

1. Dr. T. Jeya Sudha & Mr. M.R. Wajida Begum : Soft Skills/Communication Skills, New Century Book House (P) Ltd., Chennai.
2. S. Hariharen, N. Sundararajan & S.P. Shanmuga Priya : Soft Skills, MJP Publishers, Chennai.

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)**THEORY:**

COMPONENT	MARKS
Internal test I	40
Internal test II	40
Seminar	10
Term Paper	5
Attendance	5
Total	100

CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)**Passing Minimum: 50% out of 100****INTERNAL QUESTION PATTERN****(Maximum Marks-40)****Part - A**

10 Questions × 1Mark = 10 Marks

Part - B

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

Part - C

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of Three)

PHYSIOLOGY

Semester: III

Code : 20PZO3C06

Hours: 6

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Apply the knowledge to lead a healthy life.	PSO - 1, PSO - 5	K, An
CO - 2	Understand the terminology, concepts, and relationships in circulatory and excretory system.	PSO - 1, PSO - 4, PSO - 5	C, An
CO - 3	Recognize the mechanism of muscular contraction, propagation of nerve impulse.	PSO - 1, PSO - 4, PSO - 5	K, S, C
CO - 4	Evaluate the functions of endocrine glands.	PSO - 1, PSO - 5	An, Ap
CO - 5	Analyze the relationship between environment and physiological adaptations.	PSO -1, PSO -2, PSO -3, PSO -5	K, S, E

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

Semester: III		PHYSIOLOGY										Hours: 6
Code : 20PZO3C06												Credits: 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	4	3	4	3	3	4	4	2	2	3	4	3.27
CO - 2	4	4	4	3	2	3	4	4	2	4	4	3.45
CO - 3	4	3	4	3	3	3	4	3	2	4	4	3.36
CO - 4	4	2	4	3	2	4	4	2	2	3	4	3.09
CO - 5	4	2	4	3	4	4	4	2	2	3	4	3.27
Overall Mean Score											3.29	

Result: The Score for this Course is **3.29** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Digestion and respiration: An overview of human digestive tract, digestive function - assimilation and absorption, unique food and feeding mechanisms in animals, neuroendocrine regulation of gastro-intestinal movement and secretion, the concept of balanced diet, obesity, starvation and stimulation of hunger and thirst. An overview of human respiratory system, respiratory quotient, respiratory pigments, transport of respiratory gases in blood, respiratory acidosis and alkalosis and the concept of alkali- reserve and regulation of blood pH, respiratory disorders: hypoxia and oxygen therapy, dyspnea, high altitude respiration. **(18 Hours)**

UNIT II

Circulation and excretion: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis, cardiodynamics, haemodynamics, pacemaker system and conducting fibers, neural, humoral and pharmacological regulation of cardiac amplitude and frequency, anatomy of human heart, myogenic heart, ECG - its principle and significance, cardiac cycle, blood pressure. Nitrogenous wastes and waste elimination in different habitat, functional anatomy of human kidney and its renal units, physiology of urine formation, micturition, regulation of water balance, electrolyte balance, renal malfunctions and hemodialysis. **(18 Hours)**

UNIT III

Neuromuscular system: Structure and types of neurons, electrical signals and signal transmission, membrane channels, resting and action potentials, propagation of nerve impulses, synapses and types, synaptic knobs and synaptic potentials. Neurotransmitters: Physiological role of acetylcholine, amino acids, GABA receptors, catecholamines, nitric oxide and neuropeptides. Neurotransmitter receptors: Ionotropic receptors (nicotinic receptors of acetylcholine), metabotropic receptors like G-protein coupled receptors (D1 and D2 of dopamine and muscarinic receptors of acetylcholine). General properties of sensory receptors, pressure receptors, phonoreceptor, photoreceptor. Types, properties and functions of the muscle tissues, molecular organization of sarcomere, mechanism of contraction, physiological adaptations of muscles for jumping, swimming and flight, disorders of muscular system - Myasthenia gravis, fibromyalgia, muscular dystrophy, atrophy and hypertrophy. **(18 Hours)**

UNIT IV

Endocrine glands:Endocrine systems in vertebrates - Structure and functions of pituitary, thyroid, parathyroid, pancreas, adrenal, testis, ovary and pineal gland. Mechanism of hormonal action, endocrine disorders, hormone therapy and hormonal control on metabolism, endocrine mechanism of invertebrates - Insects and crustaceans. **(18 Hours)**

UNIT V

Stress physiology: Osmoregulation in aquatic and terrestrial environments, Kidney functions and diversity, Extra-renal osmoregulatory organs, Patterns of nitrogen excretion. Thermoregulation - Heat balance in animals, Adaptations to temperature extremes, torpor, Aestivation and hibernation, Counter current heat exchangers. Adaptations to Stress- basic concept of environmental stress, acclimation, acclimatization, avoidance and tolerance, stress and hormones. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Richard W. Hill, Gordon A. Wyse and Margaret Anderson (2012). Animal Physiology, 3rd edition, Sinauer Associates Inc. ISBN-13: 978-0878935598.
2. Christopher D. Moyes, Patricia Schulte (2014). Principles of Animal Physiology, Pearson.
3. Rastogi S. C. (2008). Essentials of Animal Physiology, 4th edition, New Age International Publishers.
4. Pat Willmer, Graham Stone, Ian Johnston, (2004). Environmental Physiology of Animals, Wiley Blackwell Publishing.
5. Pocock G, Richards GD and Daly MDB (1999). Human Physiology, Oxford University Press, London.
6. Widmaier E, Raff H and Strang K (2013). Vander's Human Physiology: The Mechanisms of Body Function, Thirteenth edn, Mc Graw Hill Education, New York.
7. McFarland, D. (1999). Animal Behaviour (3rd edition) Pitman Publishing Limited, London, UK.
8. Manning, A. and Dawkins, M. S. (2012). An Introduction to Animal Behaviour (6th edition) Cambridge, University Press, UK.

9. Eckert and Randal (2005). *Animal Physiology: Mechanisms and Adaptations*, Second edition. CBS publishers and Distributors Pvt. Ltd., New Delhi.
10. Knut Schmidt-Nielsen (2002). *Animal Physiology: Adaptation and Environment*, Fifth edition, Cambridge University Press, Newyork.
11. Alcock, J. (2005). *Animal Behaviour* (8th edition) Sinauer Associate Inc., USA.
12. Sherman, P. W. and Alcock, J. (2013). *Exploring Animal Behaviour* (6th edition) Sinauer Associate Inc., Massachusetts, USA.
13. Dunlap, J. C.; Loros, J.J. and DeCoursey, P. J. (2009). *Chronobiology Biological Timekeeping* (1st edition) Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
14. Kumar, V. (2002). *Biological Rhythms*: Narosa Publishing House, Delhi/ Springer - Verlag, Germany.

BIOTECHNOLOGY

Semester: III
Code : 20PZO3C07

Hours: 6
Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Apply the integral application of knowledge and techniques of biotechnology.	PSO - 2, PSO - 3	Ap, An, K
CO - 2	Comprehend the applications of transgenic animals.	PSO - 3, PSO - 5	C, An
CO - 3	Highlight the industrial biotechnology.	PSO - 3, PSO - 5	C, An, Ap
CO - 4	Obtain benefits from biotechnology for human welfare.	PSO - 2, PSO - 4	K, Ap, S
CO - 5	Explicate the bioethics, biosafety and IPR.	PSO - 3, PSO - 5	An, K, C

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

Semester: III		BIOTECHNOLOGY										Hours: 6
Code : 20PZO3C07												Credits: 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	5	3	5	5	4	4	3	5	4.27
CO - 2	5	3	4	5	4	4	5	5	4	4	4	4.27
CO - 3	5	3	4	5	4	5	5	4	5	3	5	4.18
CO - 4	5	4	3	3	3	4	5	4	5	3	4	3.90
CO - 5	5	3	4	4	5	5	5	5	3	3	5	4.27
Overall Mean Score											4.18	

Result: The Score for this Course is **4.18** (Very 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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction to Biotechnology: History and scope, traditional vs modern biotechnology, Biotechnology - A multidisciplinary growth tree, tools used in genetic engineering, gene cloning vectors - Plasmid, bacteriophage vectors, shuttle vectors, expression vectors, cosmids and phagemids. Stem cell culture technique, virus culture in different cell line and culture of vaccine. Bio sensors, biodegradation and bioremediation - Soil and ground water. Biofuels, biomass and future biotechnology. **(18 Hours)**

UNIT II

Animal Biotechnology: Animal tissue culture techniques, Transgenic animals - transgenic mice, transgenic rabbit, transgenic cattle, transgenic goat, transgenic sheep, transgenic pigs, transgenic fishes and transgenic drosophila. Applications of transgenic animals and their uses - Methods of gene transfer - Retroviral method and microinjection method and transfection method. **(18 Hours)**

UNIT III

Industrial biotechnology: Fermentors - Continuous stirred tank bioreactors and conventional bioreactors. Fermentation technology, downstream processing, enzyme technology, biotransformation, microbial production of alcohol, microbial production of antibiotics - Penicillin, aromatic antibiotics - Chloramphenicol and nucleoside antibiotics, microbial production of vitamin B₁₂ and riboflavin and microbial production of alcoholic beverage - Beer and wine. Strain improvement for industrially important secondary metabolites. **(18 Hours)**

UNIT IV

Biotechnology for human welfare: DNA in disease diagnosis and medical forensics - methods of DNA assay, nucleic acid hybridization, DNA probes and DNA chip - Microarray of gene probes. DNA in the diagnosis of infectious diseases - Tuberculosis and malaria. DNA in the diagnosis of genetic diseases - Cystic fibrosis, sickle cell anaemia and Alzheimer's disease. Therapeutic agents for human diseases - Insulin, tissue plasminogen activator and interferons.

(18 Hours)

UNIT V

Bioethics, biosafety and IPR: Ethical conflicts in biological sciences, bioethics in health care, artificial reproductive technologies, ethics in transplantation and stem cell research, animal rights and welfare. Biosafety - Primary containment for biohazards, recommended biosafety levels for specific microorganisms and biosafety guidelines for industrial operations with GMO. Intellectual property rights (IPR) and patenting biological material - Different forms of IPR. General concept, basics, rules and regulations of patenting, Indian patent Act 1970 and current Indian patent law. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Dubey R.C., (2001). A Text book of Biotechnology. S. Chand and company Ltd., New Delhi.
2. Gupta P.K., (2003). Elements of Biotechnology, Rastogi Publications.
3. SathiyarayananU., (2005). Biotechnology. Books and Allied Pvt. Ltd., Kolkata, India.
4. KumaresanV., (2005). Biotechnology. Saras Publication, Nagercoil.
5. Singh B.D., (2006). Biotechnology. Kalyani Publishers, New Delhi.
6. Ignacimuthu, (1997). Plant Biotechnology. Tata MC Graw Hill Publication Company Ltd., New Delhi.
7. Rajmohan (2006). Bio Safety and Bio ethics 01 Edition. Isha Books.
8. M.K.Satheesh (2008). Bioethics and Biosafety. IK International publishing house.
9. Goel and Parashar (2013). IPR, Biosafety and Bioethics, IE Paperbook, Pearson.

PHYSIOLOGY AND BIOTECHNOLOGY - LAB

Semester: III

Code : 20PZO3P03

Hours: 6

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Demonstrate the effect of temperature on physiological activities, salt gain and salt loss in fish.	PSO - 2, PSO - 3	Ap, K
CO - 2	Estimate the oxygen consumption in fish and prepare the haemin crystals and ureate crystals.	PSO - 3, PSO - 5	C, An
CO - 3	Develop skill in the working principles of gel electrophoresis.	PSO - 3, PSO - 5	C, K, Ap
CO - 4	Analyse the extraction, isolation and purification of DNA.	PSO - 2, PSO - 4	K, Ap, S
CO - 5	Isolate the nitrogen fixing symbiotic bacteria from root nodule.	PSO - 3, PSO - 5	An, Ap, C

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

Semester: III		PHYSIOLOGY AND BIOTECHNOLOGY - LAB										Hours: 6
Code : 20PZO3P03												Credits: 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	4	3	4	3	4	3	3	4	3.72
CO - 2	4	3	4	3	3	4	4	5	3	4	4	3.72
CO - 3	3	3	4	4	4	3	4	4	3	3	4	3.54
CO - 4	4	3	3	4	4	4	4	4	4	3	4	3.72
CO - 5	4	4	4	3	3	4	4	5	4	3	3	3.72
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 = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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PHYSIOLOGY:

1. Experiment on salt gain in fish.
2. Experiment on salt loss in fish.
3. Preparation of haemin crystals.
4. Oxygen consumption in fish.
5. Oxygen consumption in fish in relation to temperature.
6. Opercular movements in fish in relation to temperature.
7. Study of ureate crystals in malphigian tubules.
8. To study the effect of exercise on cardiovascular and respiratory systems.

BIOTECHNOLOGY:

1. Isolation of DNA from animal cell.
2. Isolation of DNA from plant cell.
3. Separation of protein using Polyacrylamide Gel Electrophoresis (PAGE).
4. Thin layer Chromatography (TLC).
5. Isolation of nitrogen fixing symbiotic bacteria from root nodule.
6. Enzymatic disaggregation of cells from a tissue (Spleen).

RESEARCH METHODOLOGY

Semester: III
Code : 20PZO3E3A

Hours: 6
Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the various aspects of research methods, experimental design, technical and scientific writing.	PSO - 2, PSO - 4, PSO - 5	K, C, An, Ap
CO - 2	Describe the working principles and applications of various instruments used in research laboratories and apply in research.	PSO -1, PSO -2, PSO -3, PSO -4, PSO - 5	K, An, Ap
CO - 3	Restate the principal concepts about biostatistics and execute sampling, collection and presentation of data effectively.	PSO - 3, PSO - 4, PSO - 5	K, S, C, An, Ap
CO - 4	Solve problems using basic probability theory, analyze data by appropriately fitting suitable statistical methods to research studies.	PSO - 3, PSO - 4, PSO - 5	K, An, Ap
CO - 5	Choose and apply appropriate statistical methods for analyzing one or two variables, interpret statistical results effectively.	PSO - 3, PSO - 4, PSO - 5	K, An, S, E, Ap

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

Semester: III		RESEARCH METHODOLOGY										Hours: 6
Code : 20PZO3E3A												Credits: 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	4	3	4	5	4	4	1	1	4	5	4	3.55
CO - 2	3	4	4	4	5	4	4	5	5	5	5	4.36
CO - 3	2	3	5	4	3	3	1	3	5	4	5	3.45
CO - 4	2	3	5	4	3	3	1	3	5	4	5	3.45
CO - 5	2	3	5	4	3	3	1	3	5	4	5	3.45
Overall Mean Score											3.65	

Result: The Score for this Course is **3.65** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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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, sequence system, alphabet - number system and journal abbreviations. Technical writing: Writing a research report - synopsis, research paper, review article, poster preparation, oral presentations. 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, web of science, etc. **(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), Thin Layer Chromatography (TLC) 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, percentiles and quartiles, 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 - H_0 and H_1 , hypothesis testing, significance level, degrees of freedom, statistical errors - Type I and II, paired and unpaired tests, one tailed and two tailed tests, parametric and nonparametric tests. Chi Square test - properties, calculating expected values, goodness of fit and contingency tables. Comparing means of two samples - Student's t test. Comparing more than two samples - Analysis of variance (ANOVA). Statistical packages - Excel, SPSS and R. tool. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Anderson N Durston., (1970). Thesis and Assignment Writing. Polle Wiley Eastern Limited.
2. Kothari C.R., (2004). Research Methodology. 2nd edition, New Age International Publishers, New Delhi.
3. Parsons C.J. George Allen., (1973). Thesis and Project work Guide to Research and Writing. Unwin Ltd, London.
4. Veerakumari, L. (2006). Bioinstrumentation. Chennai: MJP Publishers.
5. Gurumani. N. (2006). Research Methodology for Biological Sciences. Chennai: MJP Publishers.
6. Robert L. Dryer & Gene F. Lata (1989). Experimental Biochemistry. New York: Oxford University Press.
7. Ana, S.V.S. (2002). Biotechniques. Meerut: Rastogi Publications.
8. Keith Wilson & John Walker (2000). Principles and Techniques of Practical Biochemistry (5th ed.). United Kingdom: Cambridge University Press.
9. Marimuthu, R. (2008). Microscopy and Microtechnique. Chennai: MJP Publishers.
10. Gurumani N., (2005). An Introduction to Biostatistics, MJP Publishers, Chennai.
11. Khan, I. & Khanum, A. (2014). Fundamentals of Biostatistics (3rd ed.): Hyderabad. Ukaaz Publications.
12. Zar, J.H. (1984). Biostatistical Analysis (2nd ed.). London: Prentice-Hall International Inc.
13. Bailey, N.T.J. (1997). Statistical methods in Biology (3rd ed.). New York: Cam. University Press.
14. Sokal, R. & James, F. (1973). Introduction to Biostatistics. Tokyo, Japan: W.H. Freeman and Company Ltd.
15. Daniel, W.W. (1987). Biostatistics: A foundations for Analysis in the Health Sciences. New York: John Wiley & Sons.
16. Gupta, S.P. (1998). Statistical Methods. New Delhi: S. Chand and Company Ltd.
17. Banerjee, P.K. (2005). Introduction to Biostatistics. New Delhi: S. Chand and Company Ltd.

GENERAL AND APPLIED ENTOMOLOGY

Semester: III

Code : 20PZO3E3B

Hours: 6

Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Describe the diversity of insects.	PSO - 1, PSO - 5	K, C, An
CO - 2	Elucidate the biology, life cycle and controlling measures of the insects.	PSO - 1, PSO - 5	K, An
CO - 3	Illustrate the agricultural and medical entomology.	PSO - 2, PSO - 5	K, S, C
CO - 4	Comprehend the types and their economic importance.	PSO - 2, PSO - 3, PSO - 5	K, An, Ap
CO - 5	Manage the insect pests in the ecosystem.	PSO - 2, PSO - 3, PSO - 4	Ap, S, E

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

Semester: III		GENERAL AND APPLIED ENTOMOLOGY										Hours: 6
Code : 20PZO3E3B												Credits: 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	4	3	3	4	4	3	4	4	3	3	4	3.54
CO - 2	4	3	4	4	3	3	3	3	3	2	3	3.18
CO - 3	4	4	3	3	4	3	3	4	3	3	4	3.45
CO - 4	4	3	2	3	4	3	5	4	3	3	3	3.36
CO - 5	4	3	4	4	4	3	3	4	4	4	4	3.72
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction to Entomology: Scope and branches of entomology, classification of class Insecta upto order level. Salient features with two examples of the following insect orders - Coleoptera, Lepidoptera, Odonata, Orthoptera, Hemiptera, Isoptera, Hymenoptera, Diptera, Dermapetera, Neuroptera, Thysanoptera and Trichoptera. Methods of insect collection and preservation.

(18 Hours)

UNIT II

Morphology of insects: Head - pre and post antennal appendages, antennae, mandibles, superlinguae, maxillae and labium. Thorax - Structure of thorax - prothorax, pterothorax and thoracic muscles. Thoracic Legs - Structure and mechanism of legs. Wings - Structure of wings, wing movement and insect flight. Abdomen - Structure of abdominal segments and musculature. Physiology of insects: Digestive system - Structure and modification of gut, digestive enzymes and physiology of digestion. Respiratory system - Structure of trachea, spiracles, air sacs and aquatic respiration. Circulatory System - Organs of circulation, haemolymph, haemocytes and their functions. Excretory System - Excretory organs and water regulation.

(18 Hours)

UNIT III

Agricultural and medical entomology: Pest of agricultural and industrial importance, biology, life cycle and economic importance, nature of damage and control measures of major pests of paddy, sugarcane, coconut, cotton and mango. Insects in relation to public health, biology, mode of transmission of diseases and control measures of housefly, human head louse and mosquito.

(18 Hours)

UNIT IV

Beneficial insects: Insects as service to man - useful products, useful body, galls, pollinators, destroyers of insect pests, serve as food for animals and man, role in soil fertility, act as scavengers, destroyers of weeds, aesthetic and entertainment value, use in medicine, pollution indicators, arrow poisons, cold light, insects in forensic science and utility of insect pheromones and hormones. Insects of industrial importance - Biology and rearing of honey bees, silk worm and lac insect.

(18 Hours)

UNIT V

Pest Management: Cultural, mechanical, biological and chemical methods - Classification of pesticides, LC_{50} , LD_{50} values, first aid and precautions in handling pesticides and pesticide spraying appliances. Insect pest management - Ecological basis and agents of biological control - Parasites, parasitoids, predators, Autocidal control - Sterile male technique, chemo sterilants, methods of sterilisation, pheromonal control, insect repellents, insect anti feed ants. Insect attractants - Definition, applications, advantages and disadvantages. Microbial control of crop pests (White flies and Grasshoppers) by employing bacteria, virus and fungi and integrated pest management (IPM). **(18 Hours)**

BOOKS FOR REFERENCE:

1. David, B.V. and Ananthakrishnan, T.N. (2004). General and Applied Entomology. 2nd Ed., Tata McGraw Hill, New Delhi.
2. Ignacimuthu, S. S and Jayaraj S, (2003). Biological Control of Insect Pests. Phoenix Publ, New Delhi, 39.
3. David, B.V. (2003). Elements of Economic Zoology. Popular Book Depot, Chennai.
4. Nalinasundari, M.S. and Santhi, R. (2006). Entomology. MJP Publishers Chennai,
5. Awasthi, V.B. (2002). Introduction to General and Applied Entomology. Scientific Publishers, Jodhpur.
6. Norris, R.F., Caswell-chen, E.P. and Kogan, M. (2002). Concepts in Integrated Pest management Prentice Hall, New Delhi.
7. Racheigl and Racheigl. (1998). Biological and Biotechnological Control of Insect Pests. CRC Press.
8. Srivastava, K. P., (1988). A textbook of Applied Entomology Vol.I. 2nd ed. Kalyani Publishers, New Delhi.

INDUSTRIAL ZOOLOGY

Semester: III
Code : 20PZO3E3C

Hours: 6
Credits: 4

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Comprehend the poultry industry based on the past and present emphasis of future growth.	PSO - 1, PSO - 3	K, C, Ap
CO - 2	Acquire knowledge on vermitechnology to become an entrepreneur.	PSO - 2, PSO - 3	K, Ap, An
CO - 3	Elucidate the principles of sustainable beekeeping and enduring practice.	PSO -1,PSO -2, PSO - 3	K, S, An
CO - 4	Generate skilled man power to impart training in extension management and transfer of technology.	PSO - 1, PSO - 2, PSO - 4	C, An, Ap
CO - 5	Identify and manage the ecological impacts to soil, water, vegetation, and wildlife resulting from recreation and tourism development.	PSO - 2, PSO - 3, PSO - 4	An, C, S, E

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

Semester: III		INDUSTRIAL ZOOLOGY										Hours: 6
Code : 20PZO3E3C												Credits: 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	4	4	4	3	3	4	4	4	5	3	2	3.64
CO - 2	5	5	4	3	4	4	4	5	5	4	2	4.09
CO - 3	5	4	4	3	4	4	4	5	5	3	2	3.90
CO - 4	4	4	4	3	4	4	4	4	5	3	2	3.72
CO - 5	4	4	4	3	4	4	4	4	5	4	3	3.90
Overall Mean Score												3.85

Result: The Score for this Course is **3.85** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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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 broiler, 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. **(18 Hours)**

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 earthworms in food and medicine - Ayurvedic and unani. Recycling of food wastes in vermitechnology. **(18 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 beekeeping, advantages of extensive beekeeping and Newton's bee hive extraction of honey. Bee products- honey, bees 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. **(18 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. **(18 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 - estrous cycle, artificial insemination of milch cows and parturition. Clean milk production and economic importance of dairy farming. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Ensminger. M. E., (2015). Poultry Science. 3rd Edition. International Book Distribution Co., Lucknow, India.
2. Bell D. Donald and Weaver D. William Jr., (2007). Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.
3. Singh, R. A., (2011). Poultry Production. 3rd Edition. Kalyani Publishers, New Delhi.
4. Jull A. Morley, (2007). Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi.
5. Shukla, G.S. and Upadhyaya, V.B. (1999-2000). Economic Zoology (Rastogi Publishers).
6. Sathe, T.V. (2004). Vermiculture and Organic Farming. Daya publishers.

7. Abrol, D. P. (2010). *A Comprehensive guide to Bees and Beekeeping*. Scientific Publisher, New Delhi.
8. Withhead, S. B. (2010). *Honey bees and their management* Axis books Publisher, Jodhpur.
9. Nagaraja, N. and Rajagopal, D. (2013.) *Honey bees: Diseases, Parasites, Pests, Predator and their management*. M.J.P Publisher, Chennai.
10. Narasimhanna, M. N. (1988). *Manual of Silkworm Egg Production*; CSB, Bangalore.
11. Sengupta, K. (1989). *A Guide for Bivoltine Sericulture*. CSR & TI, Mysore.
12. Mowforth, M., & Munt, I. (2009). *Tourism and sustainability (3rd Edition)*. London, UK: Routledge.
13. Newsome, D., Moore, S.A., & Dowling, R.K (2002). *Natural area tourism*. Bristol, UK: Channel View. (Publications.
14. Weaver, D. (2008). *Ecotourism (2nd Edition)*. Hoboken, NJ: JS Wiley. Staff: Dr Julian Clifton

HUMAN HEALTH CARE

Semester: III

Code : 20PZO3GE2

Hours: 4

Credits: 3

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge on human health care.	PSO - 2, PSO - 3	A, K
CO - 2	Obtain balanced exposition of healthy life style.	PSO - 3, PSO - 5	C, An
CO - 3	Comprehend the maternal and child health care.	PSO -1, PSO - 3, PSO - 5	C, An
CO - 4	Explicate the menstrual cycle, PMS and AIDS.	PSO - 2, PSO - 4	An, Ap, S
CO - 5	Analyse the warning signals and treatment Of mental illness.	PSO - 3, PSO - 5	An, K, C

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

Semester: III		HUMAN HEALTH CARE										Hours: 4
Code : 20PZO3GE2												Credits: 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	4	3	5	5	4	3	3	5	4.09
CO - 2	5	3	4	3	3	4	4	4	4	4	4	4.00
CO - 3	5	3	4	4	3	5	5	4	3	3	4	3.90
CO - 4	5	4	3	3	4	4	4	4	4	3	4	3.81
CO - 5	5	3	4	4	3	5	4	4	3	3	4	3.81
Overall Mean Score											3.92	

Result: The Score for this Course is **3.92** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Physical fitness: Measures of physical fitness, benefits of physical exercise, measurement of blood pressure, reading of arterial pulse rate, bleeding time, clotting time, haemoglobin concentration. Body Mass Index, balanced diet, diet and control measures of obesity, hypertension, diabetic and peptic ulcer. Vitamins - sources, functions and deficiency diseases. **(12 hours)**

UNIT II

Hygiene and Vaccination: Personal hygiene - Care of skin, hair, teeth, eyes and feet, Universal immunization programme - Vaccination chart for children in India, National immunization schedule, active immunization recommended under special circumstances, successful breast feeding and birth control measures. Menstrual cycle - Premenopause, post menopause causes and common symptoms of menopause. **(12 hours)**

UNIT III

Maternal Child Healthcare (MCH): Antenatal care - objectives and antenatal visits. Prenatal care: Prenatal advice - Diet, hygiene, exercise, drugs, child care, specific health education and mental preparation. Intranatal care, postnatal care and neonatal care. **(12 hours)**

UNIT IV

Sexually transmitted diseases: Gonorrhoea, Pelvic Inflammatory Diseases (PID), Genital Warts and Human Papillomavirus (HPV), Genital Herpes, Syphilis, and Acquired Immuno Deficiency Syndrome (AIDS). **(12 hours)**

UNIT V

Mental health: Mental health problem statements, characters of strong mental health, warning signals of poor mental health, types of mental illness - Depression, alcoholism, drug addiction, senile dementia, schizophrenia, treatment - Desensitization, paedophilia and Electro Convulsive Therapy(ECT). **(12 hours)**

BOOKS FOR REFERENCE:

1. Kanai L., Mukherjee, volume 1 (2005). Volume 2 (2005), Volume 3 (2008). Medical Laboratory Technology. A Procedure Manual for Medical Laboratory Technology. Routine diagnostic test.
2. Philip Evans., (1993). The family Medical Reference Book the essential Guide to Health and Medicine. Published by Little Brown under the Black cat imprint, London.
3. Isidro Aquilar and Herminia Galbes., (1999). Encyclopedia of Health and Education for the family. Education and Health Library, Published under the title of Encyclopedia familiarria, Amor Y sexo.

HUMAN RIGHTS AND DUTIES

Semester: III

Hours: 2

Code : 20PSE3H02

Credit: 1

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Discuss the Meaning and Definitions of Human Rights and Historical Evolution of Human Rights.	PSO - 5	K, A, E
CO - 2	Explain the Human Rights Education and Constitutional Provision for protection of Human Rights in India.	PSO - 5	K, A, E
CO - 3	Assess the Human Rights Activities in India	PSO - 5	K, A, E
CO - 4	Analyse the Welfare Acts of Women in India.	PSO - 5	K, A, E
CO - 5	Evaluate the need of Welfare Acts for the protection of Human Rights in India.	PSO - 5	K, A, E

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

Semester: III		HUMAN RIGHTS AND DUTIES										Hours: 2
Code : 20PSE3H02												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	5	5	5	5	3	2	3	3	2	5	3.90
CO-2	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-3	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-4	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-5	5	5	5	5	5	3	2	3	3	2	5	3.90
Overall Mean Score											3.90	

Result: The score for this course is **3.90** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction - Meaning and Definitions of Human Rights - Historical Evolution of Human Rights - Universal Declaration of Human Rights 1948-Human Rights Day.

(6 Hours)

UNIT II

Human Rights Education - Constitutional Provision for protection of Human Rights in India - Fundamental Rights and Directive principles of State Policy - Fundamental Duties - Protection of Human Rights Act of 1993.

(6 Hours)

UNIT III

Human Rights Activities in India - National Human Rights Commission - State Human Rights Commission - Structure - functions - Human Rights courts - Role of NGOs - Amnesty - People's Watch.

(6 Hours)

UNIT IV

The Child Marriage Restraint Act, 1929 - Amended in 1978 - The Special Marriage Act, 1954 - The Hindu Marriage Act, 1955 - The Hindu Adoption and Maintenance Act, 1956 - The Hindu Succession Act, 1956 - The Hindu Minority and Guardianship Act, 1956 - Suppression of Immoral Traffic in Women and Girls Act, 1956 - Devadasis Abolition Act, 1958 - The Hindu Widow Remarriage Act, 1959 - The Dowry Prohibition Act, 1961 - The Maternity Benefit Act, 1961.

(6 Hours)

UNIT V

The Medical Termination of Pregnancy Act, 1971 - Criminal Law (Amendment) Act, 1983 - The Family Courts Act, 1984. Indecent Representation of Women Prohibition Act, 1986 - Dissolution of Muslim Marriage Act, 1939 and Muslim Women's (Protection of Rights in Divorce) Act, 1986 - Prohibition of Sati Act and Sati Prevention Act, 1987 - Abolition of Female Infanticide - Self Respect Marriage Act - Hindu Women's Property Act - The Tamil Nadu Prohibition of Harassment of Women Act, 1998 - (Protection of Children from Sexual Offences) POCSO Act 2012.

(6 Hours)

COURSE BOOK:

- Human Rights and Duties - Dr. P. Floras Mary & Dr. V. Santhi, Pandiyanadu Cultural Foundation, 3/26, Nellaiyappa Puram, 1st Street, Thirunagar, Madurai, 2021.
- Website: pandiyanadu.in.

BOOKS FOR REFERENCE

1. Justice Iyer, Dr. Ambedkar and The Dalit Future, B.R. Publishing Co, New Delhi. 1990
2. Bajwa, G.S, Human Rights in India, Anmol Publications Pvt. Ltd., New Delhi, 1995.
3. Paramasivam Sivagami, Human Rights - A Study, Sriram Computer Printer & offset, Salem, Tamilnadu, 1998.
4. Rajendar Mangari The Protection Of Human Rights Act and Relating Laws, Book Agency, Hyderabad - 1., 1999.
5. Jayapalan, N, Women and Human Rights, Atlantic Publishers and Distributors, New Delhi. , 2001.

IMMUNOLOGY

Semester: IV

Code : 20PZO4C08

Hours: 6

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Compare and contrast innate and adaptive immunity and describe cell types and organs present in the immune response.	PSO - 1, PSO -2, PSO - 4, PSO - 5	K, C, An
CO - 2	Design a model of immunoglobulins and apply basic techniques for identifying antigenantibody interactions.	PSO - 1, PSO -3, PSO - 4, PSO - 5	K, An, Ap
CO - 3	Assimilate deep ideas on MHC antigens, exemplify the adverse effect of immune system and analyse the key events of immunity at molecular level.	PSO - 1, PSO - 5	K, S, C, An
CO - 4	Explain the stages of transplantation responses and describe the immunological response against tumor.	PSO -1, PSO-2, PSO - 3, PSO -4, PSO - 5	K, An, Ap
CO - 5	Communicate the mechanisms of protection against infectious diseases.	PSO - 2, PSO -3, PSO - 5	K, An, S, E

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

Semester: IV		IMMUNOLOGY										Hours: 6
Code : 20PZO4C08												Credits: 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	4	3	4	4	3	4	3	4	3	4	4	3.64
CO - 2	4	4	4	4	3	4	4	4	3	4	5	3.64
CO - 3	4	3	3	4	2	4	4	4	3	4	5	3.64
CO - 4	4	3	4	3	3	4	4	4	2	4	4	3.55
CO - 5	4	2	2	4	4	4	2	4	2	3	5	3.46
Overall Mean Score												3.57

Result: The Score for this Course is **3.57** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Overview of immunity: Innate and adaptive immunity. Primary and secondary lymphoid organs and cells of the immune system. Immune response: Humoral and cell mediated immune response - Primary and secondary immune response, importance of B cells in humoral immune response (antibody formation), immunological memory and haematopoiesis. Activation and differentiation of T cell, B cell and T and B cell receptors, antigen processing and presentation - role of antigen presenting cells - cytosolic pathway and endocytic pathway. **(18 Hours)**

UNIT II

Immunochemistry and Immunotechnology: Epitopes, allergens, haptens, adjuvants, thymus dependent and independent antigens. Antibodies - structure, classes and functions. Antigen-antibody reaction: Properties of Ag - Ab reaction - Strength, affinity, avidity and cross reactivity, precipitation - precipitation reaction in fluids and precipitin curve, 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, Flow cytometry and monoclonal antibodies - Hybridoma technology. **(18 Hours)**

UNIT III

Molecular Immunology: MHC antigens, HLA system, clinical significance and MHC restriction phenomenon. Hypersensitivity reactions - Type I, II, III and IV. Immune effector mechanisms: Cytokines - Properties, classes, functions and cytokine related diseases. Complement system - Classical, alternate pathways and biological 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. **(18 Hours)**

UNIT V

Immunity to infection: Epidemiology, immune response and immune evasion to - Viral - HIV, bacterial - tuberculosis, protozoan - malaria, helminth - filarial and fungal - candidiasis infection. Immune deficiency diseases: Primary immune deficiencies - Defects in lymphoid lineage and myeloid lineage, Secondary immune deficiencies - AIDS and SCID. Autoimmune diseases: Factors behind auto immune diseases - characteristics, causes, classification, localized - Diabetes mellitus and Addison's disease, systemic - systemic lupus erythematosus and rheumatoid arthritis. **(18 Hours)**

BOOKS FOR REFERENCE:

1. Goldsby, R.A., Kindt, T.J. and Osborne, B.A. (2007). Kuby's Immunology (6th ed.). New York: W.H. Freeman and Company.
2. Delves, P., Martin, S., Burton, D., Roitt I.M. (2006). Roitt's Essential Immunology (11th ed.). Oxford: Wiley-Blackwell Scientific Publication.
3. Ashim, K., Chakravarthy (2007). Immunology and Immunotechnology (2th ed.). Delhi: Saurabh Printers Pvt. Ltd.
4. Dasgupta, A. (1992). Modern Immunology (2th ed.). New Delhi: Jaypee Brothers Medical Publications Pvt. Ltd.
5. Gupta, S.K. (1991). Immunology perspectives in Reproduction and Infection. New Delhi: Oxford and IBH publication Co. Pvt. Ltd.
6. Hannigan, B.M., Moore, C.B.T. and Quinn, D.G. (2010). Immunology (2th ed.). India: Viva Book Pvt. Ltd.
7. Rao, C.V. (2008). Immunology (4th ed.). Chennai: Narosa Publishing House.
8. Murphy, K., Travers, P. and Walport, M. Garland (2008). Janeway's Immunobiology (7th ed.). New York: Science Publishers.
9. Arun Ingale, (2010). Basic Immunology. New Central Book Agency (P) Ltd., London.
10. Slites D.P., Stoho J.D., Fundeaberq H.M and Wells J.V., (1994). Basic and Clinical Immunology. Medical Publication, USA.
11. Helen Chapel, Mansel Haeney, (1984). Essentials of Clinical Immunology. English Language Book Society/Blackwell scientific Publications, London.
12. Hildemann W.H., (1984). Essentials of Immunology. Elsevier science Publishing Co., Inc, New York.
13. Rajasekara Pandian M. and Senthil Kumar B., (2007). Immunology and Immunotechnology. Panima Publishing Corporation, Bangalore, New Delhi.

APPLIED MICROBIOLOGY

Semester: IV

Code : 20PZO4C09

Hours: 6

Credits: 5

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, development and structural organization of microorganisms.	PSO - 1, PSO - 5	K, C, An
CO - 2	Demonstrate key practical skills in working with microbes for study and used in the laboratories.	PSO - 1, PSO - 5	K, An, C
CO - 3	Analyse the food processing, production and preservation.	PSO - 2, PSO - 3, PSO - 5	K, S, C
CO - 4	Focus on the basic principles of industrial and medical microbiology.	PSO - 2,PSO -3, PSO - 4	K, An, Ap,S
CO - 5	Explicate the practical consequences of microorganisms.	PSO - 1,PSO -2, PSO - 4	K, An, S, E

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

Semester: IV		APPLIED MICROBIOLOGY										Hours: 6
Code : 20PZO4C09												Credits: 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	4	4	4	2	4	2	4	3	3.54
CO - 2	4	3	2	2	4	4	2	5	4	4	2	3.27
CO - 3	5	2	2	3	3	4	2	4	4	3	3	3.18
CO - 4	5	3	2	2	4	4	3	3	3	4	3	3.27
CO - 5	4	4	2	2	4	4	4	4	3	3	3	3.36
Overall Mean Score												3.32

Result: The Score for this Course is **3.32** (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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction: History, scope and developments in microbiology. Classification of microorganisms - Haeckel's three kingdom concepts, Whittaker's five kingdom concepts and classification of bacteria according to Bergey's manual of bacteriology. Staining Methods - Simple, Gram, acid-fast, spore, capsular and flagellar. General features of virus, Actinomycetes and fungi. Bacterial anatomy - Ultra structure, flagella, fimbriae, pili, cell wall, plasma membrane, ribosome, plasmid and magnetosomes. Physico chemical conditions required for bacterial growth, growth curve and generation time. **(18 Hours)**

UNIT II

Basic microbiology: Sterilization: Types - dry heat, moist heat, filtration, pasteurization and radiation. Mode of action and applications - Disinfectants. Antimicrobial chemotherapy -Drug resistance mechanism, spread of drug resistance, drug resistance encounter and antimicrobial drug susceptibility tests. Culture techniques - Types and preparation of media, Pure culture techniques, enumeration of bacteria. Nutritional types and nutritional requirements of bacteria. **(18 Hours)**

UNIT III

Food microbiology: Microorganisms in food materials -Bacteria, mold, and yeasts. Factors influencing microbial growth in food - Nutrient content, pH, temperature, humidity. Principles of food preservation - Temperature, dehydration, osmotic pressure, chemicals, radiation. Contamination, spoilage and preservation of cereals, vegetables, fruits, seafood's, meat, milk and poultry products. Food borne infections and intoxications of Bacillus, Clostridium, Salmonella and Staphylococcus. Fermented foods -Bread, cheese and vinegar. Dairy products - Oriental fermented foods - Fermented beverages (beer and wine). Food produced by microbes -SCP (Spirulina and Chlorella). Food controlling agencies and its regulations (AGMARK, BIS and FDA). **(18 Hours)**

UNIT IV

Industrial and Medical Microbiology: Bioreactors - Types of bioreactors. Desirable characters of industrially important microorganisms. Basic processes in industrial microbiology: Production of commercial products - wine, vinegar, penicillin, vitamin B12, glutamic acid and amylases. Medical microbiology: Viral diseases - Influenza and hepatitis B, bacterial diseases - Meningitis and streptococcal pneumonia, Fungal diseases - Mycotoxicosis and aspergillosis, Food and waterborne diseases - Cholera and typhoid. **(18 Hours)**

UNIT V

Environmental microbiology: Microbial bioremediation: Requirements of microbial growth in bioremediation process - Bioaugmentation, bioremediation of petroleum, heavy metals, pesticides, plastics and pollutants in air, water and soil. Production of bioethanol and biodiesel. Biofertilizer and biopesticides. Waste as a resource - Microbes in composting, potable water and sewage treatment.

(18 Hours)

BOOKS FOR REFERENCE:

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

IMMUNOLOGY AND APPLIED MICROBIOLOGY - LAB

Semester: IV

Hours: 6

Code : 20PZO4P04

Credits: 5

COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Demonstrate practical knowledge to isolate and identify immune organs and cells.	PSO - 1,PSO -2, PSO - 3,PSO -5	K, Ap
CO - 2	Explain the principles and perform interpret serological tests.	PSO - 2,PSO -3, PSO - 4,PSO -5	K, An, Ap
CO -3	Acquire technical and instrumentation knowledge in the field of immunology and microbiology.	PSO - 2,PSO -3, PSO - 4, PSO - 5	K, S, C
CO -4	Comprehend the practical consequences of immune system and microorganisms with the environment.	PSO - 2,PSO -3, PSO - 4, PSO - 5	K, An, Ap, S
CO -5	Obtain hands-on training on various aspects of immunological and microbial techniques.	PSO - 1,PSO -2, PSO - 3,PSO -4	K, An, S, E

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

Semester: IV		IMMUNOLOGY AND APPLIED MICROBIOLOGY - LAB										Hours: 6
Code : 20PZO4P04												Credits: 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	4	5	3	2	5	3	2	5	5	4	3	3.72
CO - 2	4	5	3	2	5	3	2	5	5	4	3	3.72
CO - 3	5	4	3	2	5	3	2	4	4	3	2	3.36
CO - 4	4	4	3	2	5	4	2	4	4	4	2	3.45
CO - 5	4	4	2	2	5	4	2	4	5	3	2	3.36
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 = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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IMMUNOLOGY:

1. Display of Lymphoid organs of 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- Intravenous, intraperitoneal and subcutaneous routes
5. Methods of blood collection (from vein) and serum preparation.
6. Isolation of lymphocytes from peripheral blood.
7. Identification and enumeration of human T lymphocytes using E - Rosette technique.
8. Isolation of lymphocytes from solid lymphoid organ.
9. Demonstration of Radial Immuno diffusion.
10. Demonstration of Double Immuno diffusion.
11. Demonstration of Haemagglutination.
12. 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.

Counting of viable (CFU/ml) by serial dilution and pour plate culture.
4. Staining methods - Simple, Negative 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.
 - Hydrolysis of Starch (Amylase).
8. Test for antibiotic sensitivity methods - Kirby-Bauer method.
9. Microbiological examination of water portability by MPN method.
10. Microbial flora from milk - population study.

PROJECT

Semester: IV
Code : 20PZO4R01
COURSE OUTCOMES:

Hours: 12
Credits: 6

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire basic skills and understand basic concept of Research methodology.	PSO - 1, PSO - 2, PSO - 5	K, An
CO - 2	Choose to specialize in a particular field in Life science	PSO - 2, PSO - 3,	K, An, Ap
CO - 3	Select an appropriate research design, and implement a research project.	PSO - 3, PSO - 4,	K, Ap
CO - 4	Choose the methods, materials, scientific tools and techniques relevant to the solution of the problem	PSO - 3, PSO - 4,	K, An, Ap, S
CO - 5	Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.	PSO - 2, PSO - 3, PSO - 4	K, An, S, E

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

Semester: IV		PROJECT										Hours: 12
Code : 20PZO4R01												Credits: 6
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Individual Project