

M.Sc. ZOOLOGY

SEM	Course Code	Course	Course Title	Ins. Hrs / Week	Cred it	Exam Hrs	Marks		Total
							CIA	ESE	
I	20PZO1CC1	Course – I	Biology of Invertebrates & Chordates	6	5	3	25	75	100
	20PZO1CC2	Course – II	Developmental Biology	6	5	3	25	75	100
	20PZO1CC3	Course – III	Environmental Biology, Evolution and Paleontology	6	4	3	25	75	100
	20PZO1CC4P	Course – IV	Biology of Invertebrates and Chordates, Developmental Biology, Environmental Biology, Evolution and Paleontology- Practical-I.	6	4	3	25	75	100
	20PZO1DE1	DSE– I#		6	4	3	25	75	100
		TOTAL		30	22				500
II	20PZO2CC5	Course – V	Genetics	6	5	3	25	75	100
	20PZO2CC6	Course – VI	Cell and Molecular Biology	6	5	3	25	75	100
	20PZO2CC7	Course – VII	Animal Physiology	6	4	3	25	75	100
	20PZO2CC8P	Course – VIII	Genetics, Cell and Molecular Biology and Animal Physiology- Practical-II.	6	4	3	25	75	100
	20PZO2DE2	DSE – II #		6	4	3	25	75	100
		TOTAL		30	22				500
III	20PZO3CC9	Course – IX	Biochemistry	6	5	3	25	75	100
	20PZO3CC10	Course – X	Immunology	6	5	3	25	75	100
	20PZO3CC11	Course – XI	Biostatistics and Bioinformatics	6	4	3	25	75	100
	20PZO3CC12P	Course – XII	Biochemistry, Immunology, Biostatistics and Bioinformatics- Practical-III.	6	4	3	25	75	100
	20PZO3DE3	DSE – III #		6	4	3	25	75	100
	20PZO3EC1	Extra Credit Course – I	Online Course (MOOC)	-	1*	-	-	-	-
		TOTAL		30	22				500
IV	20PZO4CC13	Course – XIII	General and Applied Entomology	6	5	3	25	75	100
	20PZO4CC14	Course – XIV	Microbiology	6	5	3	25	75	100
	20PZO4CC15P	Course – XV	General and Applied Entomology and Microbiology- Practical-IV	6	5	3	25	75	100
	20PZO4DE4	DSE- IV #		6	4	3	25	75	100
	20PZO4PW	Project		6	4	-	-	100	100
	20PCNOC	Online Course (Compulsory)		-	1	-	-	-	-
	20PZO4EC2	Extra Credit Course – II	Zoology for career examinations	-	5*	3	-	100	100*
		TOTAL		30	24				500
		GRAND TOTAL			90				2000

#Discipline Specific Elective

SEM	COURSE CODE	COURSE TITLE
I	20PZO1DE1A	Biophysics and Radiation Biology and Nanotechnology
II	20PZO2DE2B	Biotechnology
III	20PZO3DE3A	Animal Behavior and Biodiversity Conservation
IV	20PZO4DE4A/B	Research Methodology & Bioinstrumentation / Aquaculture and Farm Management

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PZO1CC1	Core – I	BIOLOGY OF INVERTEBRATES & CHORDATES	6	5	100	25	75

Course Outcomes:

1. Knowledge on animal organization, locomotion and nutrition in Invertebrates.
1. Knowledge and ability to compare respiration excretion and reproduction in Invertebrates.
2. Knowledge on larval life of Invertebrates and biology of organisms of minor phyla.
3. Ability to compare and differentiate integumentary system, digestive system and Circulatory system in Vertebrates.
4. Knowledge on respiratory system, excretory system reproductive system and structure of appendicular skeleton.

BIOLOGY OF INVERTEBRATES

UNIT I

18 hours

Animal organization: Symmetry, Coelom and Metamerism; origin and significance - Body wall pattern in Invertebrates - Locomotion in Arthropods and Molluscs - Nutrition in Polychaetes, # Molluscs and Echinoderms #

UNIT II

18 hours

Respiration in Annelids, Arthropods and Molluscs – Excretory organs in Invertebrates – Nervous system in Arthropods and #Echinoderms # – Reproduction in Invertebrates.

UNIT III

18 hours

Larval life of Invertebrates: Larval forms, their existence, adaptation and transformation – Minor Phyla: Classification –Detailed study of Mesozoa, Rotifera, Ectoprocta, # Phoronida # and Chaetognatha.

BIOLOGY OF CHORDATES

UNIT IV

18 hours

Integumentary system in Vertebrates – Dermal and Epidermal derivatives of Vertebrates - Digestive system in Vertebrates – # Stomach in Mammals # – Circulatory system in vertebrates – Heart in Vertebrates.

UNIT V

18 hours

Respiration in Fishes – Pulmonary Respiration in Tetrapods – Types of Kidneys - Reproductive system in Vertebrates – Appendicular Skeleton in Vertebrates: Pectoral and Pelvic girdles of Vertebrates – Limbs of Vertebrates: Fishes, # Birds# and mammals.

Text Books

1. Barnes, R.D. Invertebrate Zoology, IV Edition, Holt Saunders, 1982.
2. Barrington, E.J.W. Invertebrate Structure and Function, II Ed., ELBS and Nelson. 1979.
3. Hyman, G.H., The Invertebrates, Vols. I to VII, McGraw Hill Book Co. Inc. New York.
4. Kent. G.C. Comparative Anatomy of the Vertebrates, McGraw Hill Book Co., Inc., New York. 1976.
5. Malcolm Jollie, Chordate Morphology, Reinhold Publishing Corporation, New York. 1962.

Books for Reference:

1. Kotpal, R.L., Minor Phyla., Rastogi Publication, Meerut. 2nd Edition, 2002.
2. Vasantika Kashyap., Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi. 1997.
3. Waterman, A.J., Chordate Structure and Function, The Macmillan Company. 1971.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
I	20PZO1CC1		BIOLOGY OF INVERTEBRATES & CHORDATES			6		5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	-	✓	✓	✓	-	-	✓	✓
CO2	✓	✓	-	✓	✓	✓	-	-	✓	✓
CO3	✓	✓	-	✓	✓	✓	-	-	✓	✓
CO4	✓	✓	-	✓	✓	✓	✓	-	✓	✓
CO5	✓	✓	-	✓	✓	✓	✓	-	✓	✓
Number of Matches= 37, Relationship : High										

Prepared By:
SS

Checked by:
Dr. I. Joseph A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PZO1CC2	Core – II	DEVELOPMENTAL BIOLOGY	6	5	100	25	75

Course outcomes:

1. Understand the key concepts, including mechanisms by which differential gene activity controls development, mechanisms that determine cell fate, and mechanisms that ensure consistency and reliability of development
2. Understand the basic concepts of development and the role of genes in sex determination
3. Analyse and apply the concept of organizer and induction in the development of limb and metamorphosis
4. Understand and apply the concept of differentiation in gene knock out and abnormal differentiation
5. Apply the knowledge of understanding of basic concepts in stem cells and Assisted Reproductive Technologies (ART)

UNIT I : PHASES OF DEVELOPMENT

18 hours

Developmental patterns among Metazoans – Gametogenesis: Structure of Mammalian gametes. Fertilization: Biochemical events. # Cleavage (patterns & types) #Gastrulation: Germ layer formation. Organogenesis. Growth and differentiation. Genetic regulations of early embryonic development – Gradient theory – Morphogenetic gradients – cell fate and cell lineage.

UNIT II: EMBRYONIC INDUCTION AND ORGANISER

18 hours

Embryonic induction. Organizers - Spemann and Mangold experiments. Molecular biology of the Nieuwkoop center - Functions of organizer – Induction Regional specification types – Nuclear transplantation - Growth and Post embryonic development – Sex determination – Genomic equivalence and cytoplasmic determinants- Imprinting- Cell aggregation and differentiation in Dictyostelium. # Axes and pattern formation in Drosophila #

UNIT III: METAMORPHOSIS AND REGENERATION

18 hours

Influence of hormones on growth and metamorphosis of Insects and Amphibians – Formation of limb bud in Amphibia – Specification of limb fields – Induction of early limb bud – Eye lens induction-Cell death and the formation of digits and joints. Regenerative ability of various Invertebrates and Vertebrates – Mechanism of regeneration – Blastema formation – Wolffian regeneration - # Factors affecting regeneration #.

UNIT IV: DIFFERENTIATION AND AGING

18 hours

Teratogenesis: Teratogenic agents. Embryonic induction and differentiation. Embryonic induction in vertebrates: Types – exogenous and endogenous. Theories of organizer or inductor. Morphology - Chemical basis of neural induction. Differentiation - Characteristics and types of Differentiation. Aging and Senescence – Apoptosis. # Selective action of genes in differentiation #.

UNIT V: ADVANCED TECHNIQUES IN DEVELOPMENTAL BIOLOGY

18 hours

Cell differentiation and Stem cells - Applications of Stem cells – Control of transcription involving tissue specific transcription regulators – Assisted Reproductive Technology (ART) - Super ovulation, ICSI, GIFT- Artificial insemination – *In vitro* fertilization – Cloning - Human development – Placentation. # Birth control and its need #.

#.....# Self study

Text books:

1. Balinsky, B.L., An Introduction to Embryology, V Ed., Saunders Co., Philadelphia. 1981.
2. Strickberger, M.W., Evolution. Jones and Barlett Pub. Inc., London. 1996.

Books for Reference:

1. Gilbert, S.F. Developmental Biology, II Edn. Sinauer Associates Inc. Publishers Sanderland, Massachusetts, USA. 1995.
2. Berrill, N.J., Developmental Biology, Tata McGraw Hill, New Delhi. 1986.
3. Browder, L.N., Developmental Biology, Saunders Co., Philadelphia. 1980.
4. Saunders, A.W., Developmental Biology, Patterns, Principles and Problems. Macmillan Publishing Co., New York. 1982.
5. Stevan, B. and Oppenheimer., Introduction to Embryonic Development, Alley and Bern. 1980.
6. Sharma, B.K. and Kaur, H. Environmental Chemistry, Goel Pub. House, Meerut. 1997.
7. Tacconi, L., Biodiversity and Ecological Economics - Participation, Values and Resource Management. Earthscan Pub. Ltd., London. 2000.
8. Castri, F.D. and Younes, T., Biodiversity: Science and Development, CAB Int, Wallingford, U.K. 1996.

Web reference:

1. www.corning.com › worldwide › cls › documents › CLS-DL-CC-015
2. dev.biologists.org › content
3. www.reproductivefacts.org › documents › fact-sheets-and-info-booklets

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper				Hours		Credits	
I	20PZO1CC2		DEVELOPMENTAL BIOLOGY				6		5	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√		√	√	√		
CO2	√	√		√	√	√		√	√	
CO3	√		√	√	√	√			√	√
CO4	√	√	√		√	√	√	√	√	
CO5		√	√	√	√	√		√	√	√
Number of Matches= 37, Relationship : High										

Prepared By:

Dr. Mohamed Shamsudin

Checked by:

Dr. I. Joseph A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PZO1CC3	Core – III	ENVIRONMENTAL BIOLOGY, EVOLUTION AND PALEONTOLOGY	6	4	100	25	75

OUTCOMES

1. Understand the diversity of animals in various ecosystems and demographic analysis in their habitats.
2. Analyses the characteristics of different kinds of resources and anthropogenic activities responsible for degradation of natural resources.
3. Adopt measures to protect environment and maintain sustainability of natural resources.
4. Acquire knowledge on modern theories and principles related to evolution of animal populations.
5. Understand the geological time scale of animal evolution and related major events fossilization in various organisms; leading to fossilization.

UNIT I CONCEPTS IN ECOLOGY

18 hours

Ecosystem: Structure of ecosystem, Energy flow, Dynamics of ecosystem, Food chain, Food web, Tropic level and ecological pyramids. Biogeochemical Cycles: Nitrogen Cycle, Phosphorous Cycle, Sulfur Cycle, Carbon Cycle and Hydrologic Cycle – Nutrient Cycling in the Tropics.- Limiting and Regulatory Factors.

Population Ecology: Characteristics of a population; population growth curves; population regulation - concept of metapopulation. Community Ecology: Biological communities Community structure and regulation – # Ecological Succession#.

UNIT II NATURAL RESOURCES

18 hours

Forest and Water resource – Exploitation, decrease of forest cover, its impact on Urbanization, Impact of dams on forest exploitation of ground water – surface water and sustainable use.

Energy resources and Food resources – Renewable and Non renewable resources, energy sources, its impact on nature, mining and its environmental impacts.

Food resources, food material, #Agriculture and food production and its impacts of on environment, GIS, remote sensing and satellites - application.

UNIT III SOCIAL ISSUES & ENVIRONMENT

18 hours

Urban problems: Energy consumerism - waste products – rain water harvesting. Environmental ethics, issues – possible solutions. Global issues: Climate change – Global Warming - Global summits – Acid rain – Ozone depletion –Environmental protection Act –# Forest conservation Act# .Natural disasters – Floods, Drought, Earthquake, Cyclone and Landslide

UNIT IV EVOLUTION

18 hours

Direct and indirect evidences of evolution - Lamarckism - Darwinism – Germ Plasm theory – Mutation theory - Isolation and isolating mechanism – Speciation.Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller (1953); Evolution of prokaryotes and Eukaryotic cells. Phylogenetic tree – Evolutionary significance of animals.

UNIT V PALAEOLOGY

18 hours

Scope and development – Geological time scale -The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale - Fossils and fossilization; Collection of fossils – Dating of Rocks – Micropalaentology; Collection, sampling and storing – Vertebrate Palaentology - Mammalian Palaeontology; Development of viviparity and parental care – #Evolution of Horse#.

Text books

1. Odum, E.P. Fundamentals of Ecology, W.B. Saunder's Co. Philadelphia. 5th Edition,2010.
2. Sharma, P.D. Ecology and Environment VII edition, Rastogi Publication.2005.
3. Asthana D K, Environment: problems and solutions, S Chand and & Company, 2007

UNIT I :chapter ...I.. : section 17-76 & 177-282

UNIT II :chapter ...II.. : section 315-353

UNIT III :chapter ...II.. : section 430-450

UNIT IV :chapter ...III.. : section 70-92 & 151 - 166

UNIT V :chapter ...IV.. : section 244-256, 78-99 & 148 - 159

Books for Reference:

1. Clarke, G.L. Elements of Ecology. John Wiley & Sons, New York. 1954.
2. Kendeigh, S.C. Animal Ecology. Prentice Hall. 1961.
3. N.Arumugam. Concepts of ecology. Saras publication. 114/35G. A.R.P.Comp road .Periyevilar, Kottar(post). Nagargovil. 1983.
4. Odum, E.P. and Barrett, G.W. Fundamentals of Ecology. Thomson Brooks/ Cole (EWP)5th Ed. 2005.
5. Rastogi, V.B. and M.S. Jayaraj Animal Ecology and distribution of animals, Kedarnath Ramnath. 1989,
6. Southwick, C.H. Ecology and the quality of Environment. D.Vas Nostrand Co. 1976.
7. Verma, P.S. and V.K. Agarwal, Principles of Ecology. S. Chand & Co. New Delhi. 1996.

WEB REFERENCE:

1. <https://peda.net/kenya/css/subjects/biology/form-three/ecology2/concepts-of-ecology>
2. <http://www.yourarticlelibrary.com/environment/5-major-environmental-problems-discussed/31434>
3. <https://www.yourgenome.org/facts/what-is-evolution>
4. <https://www.nature.com/subjects/palaeontology>

Self-study #.....#

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
I	20PZO1CC3		ENVIRONMENTAL BIOLOGY, EVOLUTION AND PALEONTOLOGY			6		4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√		√	√	√	√	√	√	√	√
CO2	√		√	√	√	√	√		√	√
CO3		√	√	√	√	√			√	√
CO4	√	√	√	√	√	√			√	√
CO5		√	√	√	√	√	√	√		√
Number of Matches= 36, Relationship : High										

Prepared by:

1. Dr P.RAJASEKAR

Checked by:

1. Dr I.JOSEPH A. JERALD

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PZO1CC4	Core – IV	BIOLOGY OF INVERTEBRATES & CHORDATES, DEVELOPMENTAL BIOLOGY, ENVIRONMENTAL BIOLOGY, EVOLUTION & PALEONTOLOGY – PRACTICAL-I	6	4	100	25	75

Course Outcomes

1. Correlate the invertebrates based on their general characters.
2. Utilize the knowledge on mounting and dissection of Invertebrates.
3. Analyse and evaluate the knowledge of developmental biology through bull sperm smear preparation, Induced ovulation.
4. Understand, concept of water quality analysis , plankton studies.
5. Apply and analyse evidences of evolution.

BIOLOGY OF INVERTEBRATES & CHORDATES

a. TAXONOMY

30 Invertebrates – Identifying features upto Class level

Minor Phyla - Rotifera, Phoronida, Chaetognatha

20 Vertebrates – Identifying features upto Order level

b. MOUNTING

Scales of Teleost Fish (Ctenoid and Cycloid types), Feathers (structure), Soil Nematodes

c. SPOTTERS

Invertebrate Larval forms.

DEVELOPMENTAL BIOLOGY

Preparation of sperm suspension of bull and observation of spermatozoa.

Observation of live spermatozoa & study of motility rate of bull spermatozoa.

Chick blastoderm

Vaginal smear preparation of rat/mouse to study the stages of estrous cycle.

Induced ovulation in fish.

Group Project: Study of life cycle of silkworm (Egg, Larva, Pupa)

Spotters: Different developmental stage chick development

ENVIRONMENTAL BIOLOGY & RESOURCE MANAGEMENT

Faunal adaptations of different Marine Habitat – Sandy, Muddy and Rocky shore characteristics.

Analysis of water samples for Chlorides, Silicates, Calcium, Total hardness, Phosphates, Nitrates, and Water Quality Index.

Qualitative and Quantitative estimation of Plankton (Marine sample).

A study on Pond ecosystem and Forest ecosystem – Report submission mandatory.

Spotters : Secchi disk, Electrical conductivity Meter, Turbidity Meter

EVOLUTION AND PALAENTOLOGY

Fossil study - Nautiloid, Ammonoid and Belemnites.

Colouration and Mimicry

Evolutionary significance - Nimulus, Peripatus

Connecting Link – Archaeopteryx

Text books:

T.B -1 P.S.Verma , A Manual of Practical Zoology Invertebrates Fifteenth Edition

S.Chand& Company Ltd, 2003

T.B – 2 Manual of Zoology Chordata M. EkambaranathaAyyar, T.N. Anathakrishnan ,
S. Viswanathan (Printers &Publishers)Pvt. Ltd. 2008.

T.B.- 3 P.S.Verma ., V.K.Agarwal , Chordate Embryology Developmental Biology
S.Chand& Company Ltd, 2003

Books for Reference:

1. Kotpal, R.L., Minor Phyla., 2nd Edition , Rastogi Publication, Meerut., 2002.
2. VasantikaKashyap., Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi. 1997.
3. Ekambaranathalyer and S. Viswanathan, Manual of Zoology CHORDATA Vol. II (Printers & Publishers) Chennai. 1993.
4. Gilbert, F.S. Developmental Biology, 8th edition, Sinauer Associates, Inc. Publishers, Massachusetts 2006.
- 5 R.K.Trivedy&P.K.Goel , Environmental Publications, Karad, India 1984.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Paper				Hours	Credits			
I	20PZO1CC4	BIOLOGY OF INVERTEBRATES &CHORDATES, DEVELOPMENTAL BIOLOGY, ENVIRONMENTAL BIOLOGY, EVOLUTION & PALEONTOLOGY – PRACTICAL-I				6	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		√	√		√	√	√		√	
CO2	√		√	√	√	√		√	√	
CO3		√					√			√
CO4	√			√	√			√		
CO5		√	√	√	√			√	√	√
Number of Matches= 27, Relationship : Moderate										

Prepared By:

Dr.H.E. Syed Mohamed

Checked by:

Dr. I.Jopesh A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
I	20PZO1DE1A	DSE – I	BIOPHYSICS, RADIATION BIOLOGY AND NANOTECHNOLOGY	6	4	100	25	75

Course Outcomes

1. Understand and apply the Thermodynamic principles in biology and compare and apply the principle and applications of microscopy.
2. Gain through the application of various biological instruments by understanding their Biophysics principles.
3. Understand and manipulate the impact of Natural Radiations.
4. Judicial application of the knowledge on Radio isotopes in Energy Production.
5. To analyze the significance of nano-materials in biomedical science.

BIOPHYSICS

UNIT I

18 hours

Thermodynamic principles in biology – Concept of free energy – Energy rich bonds – Biological energy transducers – Oxidation, Reduction and Redox potential. Microscopy - Principles and applications of microscopy –Phase contrast, Confocal, Fluorescence and Electron microscopes - Scanning and Transmission Electron Microscopy. Cytofluorimetry. #Laser- Principle and applications#.

UNIT II

18 hours

Absorption and Emission principles - Principle and application of UV-visible, Spectrofluorometer, Flame photometer, Atomic Absorption and Emission spectrophotometers, Structure determination using X-ray diffraction, NMR and Mass spectrometer in Biology. Principles and Application of Chromatography: Thin layer, Column, Ion Exchange, Gel filtration, Gas Liquid, HPLC and Affinity. Principles and Application of Electrophoresis: Agarose, SDS - PAGE and #Iso-Electric Focusing#.

RADIATION BIOLOGY

UNIT III

18 hours

Natural Radiation - Man made radiations; Ionizing and non-ionizing radiation - Properties of Radiation – Radiation Units (Becquerel, RAD, Gray & Curie, Sievert). Measurement of Radiation – Geiger-Muller proportional counter- Skeletal Scintigraphy#Safety standards – safety measures#.

UNIT IV

18 hours

Biological effects of Radiation - Cellular level – Organ and system level – Genetic effects (aberrations) – Dosimetric study – Radiation Oncology, PET, Applications of Radio Isotopes in Agriculture, Industry and Food Preservation - Radioactive wastes - Sources and Management - #Nuclear Energy Programme in India#.

NANOTECHNOLOGY

UNIT V

18 hours

Fundamentals of Nanotechnology –Nanomaterials – Building blocks -Interaction and Topology – Microscopic environment of the Nanoworld. Metal and Semiconductor Nanomaterials, Quantum Dots, Wells, Fibers and Wires, Bucky balls and Carbon Nanotubes. Biomedical Nanotechnology – Diagnostics, Therapy and Applications; Nanotoxicology – Nano etymology – Sources of nanoparticles and their health effects; #Social and Ethical Implications#.

#.....# **Self study**

Text Books:

1. Narayanan, P. Essential of Biophysics. New Age International (P) Ltd., Publishers, New Delhi. 2000
2. Sha, V.C., Elements of Radiation Biology, Today's & Tomorrow's Printers & Publishers, New Delhi. 1985.

3. Siddhartha Shrivastava, Introductory Nanobiotechnology. New Central Book Agency (p) Ltd. Delhi. 2013.

UNIT I : Text Book 1 : Chapter 8: Pp 265-277; Chapter 10:Pp309-320
UNIT II :Text Book 1 : Chapter 6 & 7: Pp169 – 261; Pp277-305
UNIT III : Text Book 2 :Chapter 1to 5 : pp 1- 21
UNIT IV : Text Book 2 :Chapter 9 to 15 : pp 43-100
UNIT V : TextBook 3 : Chapter 1: pp 1-10; Chapter 11: 153-165;
 Chapter 14: pp 184-236;
 Chapter 15: pp 237-255

Books for Reference:

- Casey, E. J. Biophysics - Concepts and Mechanisms. East West Press Pvt. Ltd. New Delhi. 1962
- N. Gurumani, Research Methodology for biological Sciences. MJP Publishers, 2007.
- Daniel, M. Basic Biophysics for Biologist. Agro Botanical Publishers, Bihaner, India. 2005.
- Narayanan, P. Essentials of Biophysics. New Age International (P) Ltd. Publishers. 2007.
- Plummer, T.D. An introduction to Practical Biochemistry. Tata McGraw Hill Publishing Company Limited, New Delhi. 1978.
- Rodney, C. Biophysics An Introduction. John Wiley & Sons Ltd. 2004
- Skoog, A. D. and James, J. L. Principles of Instrumental Analysis. Saunders GoldenSunberst Series. 1992.
- Vasanthan, P. and Gautham, N. Biophysics. Narosa Publishing House, New Delhi. 2002.
- Sharma, B.K., Environmental Chemistry, Goel Publishing House, Meerut. 1990
- Sood, D.D., Reddy, A.V.R. and Ramamoorthy, N. Fundamentals of Radiochemistry, Indian Association of Nuclear Chemists and Allied Scientists, Radiochemistry Division, Mumbai. 2000.
- Arun, B. Arun, S., Bhongirwar, D.R., Food Preservation by Irradiation. Indian Association for Radiation Protection, BARC, Trombay, Mumbai. 2001.
- M. Eisenbud and T. Gesell, Environmental Radio activity from Natural, Industrial, and Military Sources. Academic Press. 1997.
- Shanmugam, S. Nanotechnology. MJP Pub. Chennai. 2010.
- Breck, M.M., Nanotechnology, Vol.1 & 2. CBS Pub. & Distributors Pvt. Ltd., New Delhi. 2016.

Web reference:

<https://nptel.ac.in/courses/103108100/>

www-pub.iaea.org > MTCD > Publications > PDF > TCS-42_webPDF

<https://en.wikipedia.org/wiki/Radiobiology>

<https://en.wikipedia.org/wiki/Nanotechnology>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
I	20PZO1DE1A		BIOPHYSICS, RADIATION BIOLOGY AND NANOTECHNOLOGY			6		4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√	√	√	√	√		√	
CO2	√	√	√	√	√	√		√	√	
CO3	√	√	√	√	√		√			√
CO4	√			√	√	√	√	√		√
CO5		√	√		√	√		√	√	√
Number of Matches= 37, Relationship : HIGH										

Prepared By:

Dr.H.E. Syed Mohamed

Checked by:

Dr. I.Jopesh A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
II	20PZO2CC5	Core – V	GENETICS	6	5	100	25	75

Course Outcomes

1. Acquire knowledge on the chromosome structure, chromatin organization and variation.
2. Understand the facts of Mendelian inheritance and gene regulation factors.
3. Understand the concepts of Gene and gene interactions, DNA transcription and translation process.
4. Explore the various kinds of mutations and genetic transfers in human.
5. Explain the diseases and disorders related to Genes and Metabolism; knows the applications of Genetics for human welfare.

UNIT I

18 hours

Principles of segregation and independent assortment- Deviation from Mendel's findings-Incomplete dominance and co-dominance, lethal genes. Pleiotropism-The chromosome theory of inheritance. Chromatin- structure, heterochromatin and euchromatin, C value paradox, repetitive DNA, satellite DNA, overlapping genes, split genes, pseudo genes. #Genetic structure analysis of eukaryotic genomes#.

UNIT II

18 hours

Gene interactions and types, multiple alleles, recombination and its molecular mechanism, linkage, crossing over, chromosome mapping, LOD score for linkage testing. # Hardy – Weinberg equilibrium# Extra chromosomal inheritance - Inheritance of Mitochondrial and chloroplast genes, maternal inheritance - Mitochondrial and chloroplast genome organization

Sex determination: Chromosome theory of sex determination, gynandromorphism. Hormonal Influence on sex determination and Environmental influence - Hermaphroditism.

UNIT III

18 hours

Gene regulation in prokaryotes: Lac operon, Catabolite repression, Attenuation and tryptophan operon, Lytic and lysogeny regulation in lambda phage - Gene regulation in eukaryotes: Short term regulation and Long term regulation. Effect of temperature and light on gene expression.

Microbial genetics: Bacterial chromosome and # Plasmids# - Methods of gene transfer; transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating - fine structure of gene - Transposons.

UNIT IV

18 hours

Mutation; classification, DNA damage and repair, role in genetic analysis and evolution. types, causes and detection, Mutation detecting systems AME's test – fluctuation test, SCE (sister chromatic exchange). Mutant type's lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutation, insertional mutagenesis. Chromosomal mutation- # Numerical changes in chromosomes # and structural changes in chromosomes.

UNIT V

18 hours

Inborn errors of metabolism: Phenylketonuria, Alkaptonuria, Albinism, Lesch-Nyhan syndrome, ADA deficiency, Galactosemia, G6PD deficiency, TaySach's disease, and Gaucher's disease. Human karyotype: preparation and analysis - # chromosomal syndromes in man#. Detecting genetic diseases – Genetic counselling - prenatal diagnosis, pedigree analysis, Genetic diseases - Treating genetic diseases - Altering genetic traits Human Genome Project – Features, methods and future prospects.

Text Books:

- 1.M.W. Strickberger, Genetics, Third Edition, Prentice-Hall of India Private Limited, 2004.
2. P.S. Verma and V.K. Agarwal, Genetics, Ninth Revised edition, S.Chand& Company Ltd. Publishers, 2009.
3. Alice Marcus, Genetics, MJP Publication, 1st Edition 2009

UNIT I: chapter ...II.. : section 62-94 & 103 - 108

UNIT II: chapter ...I.. : section 179-185 & 330-343

UNIT III :chapter ...I: section 344-375

UNIT IV :chapter ...II.. : section 457 & 476

UNIT V :chapter ...III : section 185 - 199

Books for Reference:

1. Benjamin Levin. Genes VIII, Oxford University Press, New York. 2005.
2. Daniel L. Hartl. Genetics, III Ed., Jones Bartlett Publishers. Boston. 1996.
3. David Friefelder. Microbial Genetics, Narosa Publishing House, New Delhi. 1998.
4. Elaine Johansen Mange and Arthur P. Mange., Basic Human Genetics, Sinour Associates, Inc., Sunderland, Massachusetts. 1994.
5. Jenkins, J. B. Human Genetics, The Benjamin Cummings Publishing Co. 1983.
6. John D. Hawkins. Gene Structure and Expression, III Ed., Cambridge University Press. 1996.
7. Robert H. Tamarin. Principles of Genetics, WCB Publishers. 1996.

Self-study#.....#

WEB REFERENCE:

- 1.<https://www.khanacademy.org/science/biology/dna-as-the-genetic-material/structure-of-dna/a/nucleic-acids?modal=1>
- 2.https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1005-9_690
- 3.https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1005-9_690

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
II	20PZO2CC5		GENETICS			6		5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√		√	√	√	√	√	√	√	√
CO2	√		√	√	√	√	√		√	√
CO3		√	√	√	√	√			√	√
CO4	√	√	√			√			√	√
CO5		√	√	√	√	√	√	√		√
Number of Matches= 38, Relationship : HIGH										

Prepared by:

1. Dr P.RAJASEKAR

Checked by:

1.Dr I.JOSEPH A. JERALD

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
II	20PZO2CC6	Core – VI	CELL AND MOLECULAR BIOLOGY	6	5	100	25	75

Course Outcomes

1. Understand the basic Structural organization of Prokaryotic, Eukaryotic and Intracellular organelles-- K₁ and K₂
2. Analyse the most important methods by which cells communicate and how cells send signals with interpret the signals they receive and Cellular communication- K₅
3. Apply the knowledge, skill, and awareness to topics like DNA replication, damage, mutation and repair mechanisms —K₃.
4. Integrate the knowledge of Transcription in Prokaryotes and Eukaryotes and Regulation of Protein Synthesis and RNA processing. K₄ and K₅
5. Understand the Cell cycle and Analyse the role of mammalian cells, Advanced knowledge of the underlying Oncogenes and Understanding of the cancer cells- K₅ and K₄

UNIT I

15 hours

Structure and functions of Plasma membrane, Mitochondria, Golgi bodies, Lysosomes, Ribosome, Endoplasmic Reticulum- # Membrane models # (Fluid mosaic and Unit membrane) -Mechanism of protein sorting and Regulation of intracellular transport- Electrical properties of membranes.

UNIT II

15 hours

Cell signaling hormones and their receptors- Cell surface receptors– signaling through G-protein coupled receptors– Signal transduction pathways: MAP kinase pathway – Tyrosine kinase - #Signaling from plasma membrane to nucleus#. Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, neurotransmission and its regulation.

UNIT III

15 hours

Structure and functions of Nucleus, Nuclear envelope, Nuclear pore complex and Nucleolus- DNA replication: Semi conservative and rolling circle replication, genes, enzymology of replication, replication origin and replication fork, fidelity of replication - #DNA damage, mutation and repair mechanisms#, homologous and site-specific recombination- structure of chromatin and chromosomes.

UNIT IV

15 hours

Regulation of transcription in Prokaryotes and Eukaryotes. Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping- Regulation of Protein Synthesis: initiation, elongation and termination, RNA processing, splicing, polyadenylation, introns, exons, and #RNA transport#.

UNIT V

15 hours

Cell cycle: Mitosis and Meiosis – Cell division control in mammalian cells – Oncogenes - Types – Characteristics of cancer cells – Control & prevention -#Tumor suppressor genes# - Tumor viruses - Role of Apoptosis in Cancer - Molecular diagnosis, prevention, early detection and treatment of cancer, Therapeutic interventions of uncontrolled cell growth.

#..... # Self study

Text Book:

- 1). De Robertis, E.D.P., and De Robertis, E.M.F., Cell and Molecular Biology, VIII Ed., 2014, Lippincott Williams & Wilkins, A Wolters Kluwer India Pvt., Ltd.
- 2). Verma, P.S. and Agarwal, V.K., Cytology, 3rd Edition, 2009. Chand & Co., Ltd. Delhi.

- 3). Ajoy Paul 2009. Text Book of Cell and Molecular Biology. II Edition, Books and Allied (P)Ltd.

UNIT I : TB 2-Chapter 2: 32-217
UNIT II : TB 2-Chapter 3: 242-292 TB2-Chapter 4: 1-63
UNIT III : TB 2 Chapter 5:173-290
UNIT IV : TB 1: Pg:104-128 TB3: Pg: 479-518
UNIT V : TB2: Chapter 6: 521-529

Books for Reference:

- 1) Geoffrey, M. Cooper and Robert E. Hausman., The Cell – A Molecular Approach. 5th Edition. Asm Press, Sinauer, Washington D.C. USA. 2007.
- 2) Alberts *et al.*, Molecular Biology of the Cell. 4th Edition, Garland Science, A Member of the Taylor and Francis group, New York, USA. 2002.
- 3.) Cooper, G. M. “The Cell – A Molecular Biological Approaches”. ASM Press, Washington, 2013.
- 4.) David Freifelder. “Molecular Biology” Narosa Publishing House, 2000.
- 6.) Gupta PK, Cell and Molecular Biology. Rastogi Publications, Meerut, 2013.

Web Reference:

1. [https://en.wikipedia.org/wiki/Cell_\(biology\)](https://en.wikipedia.org/wiki/Cell_(biology))
2. <https://www.ncbi.nlm.nih.gov/books/NBK9940/>
3. <http://marjoriebrandlab.com/sitebuildercontent/sitebuilderfiles/hfspworkshop.pdf>
4. http://genome.tugraz.at/MolecularBiology/WS11_Chapter_12.pdf
5. https://en.wikipedia.org/wiki/Cell_cycle

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
II	20PZO2CC6		CELL AND MOLECULAR BIOLOGY			6		5		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√	√		√	√	√		√	
CO2	√		√	√	√	√		√	√	
CO3	√	√	√		√		√		√	√
CO4	√	√	√		√		√	√		√
CO5		√	√		√	√		√		√
Number of Matches= 37, Relationship : HIGH										

Prepared by:
Dr. PK

Edited By
Dr. IJ

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
II	20PZO2CC7	Core – VII	ANIMAL PHYSIOLOGY	6	4	100	25	75

Course Outcomes

1. Know the importance of nutrients and digestion in animal well being.
2. Understand , and evaluate the physiology of circulation and cardiovascular system in animals.
3. Integrate knowledge on physiology of effectors , neural conduction and receptors
4. Discuss homeostatic mechanisms, osmoregulation and excretion.
5. Understand and analyse the biology of endocrine glands and human reproductive physiology.

UNIT I Nutrition, Digestion, Respiration

18 hours

Nutritive types in animal kingdom, Role of vitamins and minerals in nutrition – Deficiency diseases – Caloric value of foods – BMR. Digestion and absorption of proteins, carbohydrates and lipids – Role of enzymes in digestion. Comparison of respiration in different vertebrate; anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Digestive glands

UNIT II Blood , Cardiovascular system

18 hours

Blood and circulation - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Cardiovascular System: Anatomy of heart , myogenic heart, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Respiratory organs and pigments

UNIT III Nervous, Muscle, Receptor

18 hours

Nervous system - Neurons, Nerve Impulse genesis conduction and transmission across synaptic junction, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system. Types of muscles – Ultra structure of skeletal muscle – Mechanism of muscle contraction. Receptor: Chemoreception - Chemical senses, taste and smell Mechanoreception - Pressure receptor , Gravity receptor – Phonoreception, Physiology of hearing Photoreception – Photochemistry of vision.

#Neural control of muscle tone and posture#

UNIT IV Homeostatic, Osmoregulation, Excretion

18 hours

Homeostatic mechanisms: Thermoregulation in Poikilotherms & Homeotherms - Tolerance to high temperature, cold and freezing - Acclimatization and acclimation – Physiology of hibernation and aestivation - Osmotic and ionic regulation in crustaceans, fishes, birds and mammals. Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance, acid-base balance.

#Adaptation to Pressure, High altitude – Buoyancy#.

UNIT V Endocrinology and Reproduction

18 hours

Endocrine glands: Structure, Secretion and functions of endocrine glands – Pituitary – Thyroid – Pancreas – Adrenal. Hormones: Chemical nature – functions – deficiency diseases – Mechanism of hormone action. Reproductive processes, gametogenesis, ovulation, endocrine glands in relation to human reproduction.

#Hormonal regulation, Menopause, Pregnancy and Parturition#

#.....#self study

Text books:

T.B -1 Singh, H. R. Animal Physiology and Related Biochemistry. SHOBAN Lal Nagin Chand and co., Educational Publishers, New Delhi.

T.B – 2 P.S.Verma , B.S.Tyagi and V.K. Agrawal, Animal Physiology, S.Chand & Company Pvt.Ltd. 2013

UNIT I Chapter 13 ,14 & 15 166-235 TB 1

UNIT II Chapter 16 236 - 255 TB 1

UNIT III Chapter 21 ,22 329-371 TB 1

UNIT IV Chapter 26 428 – 444 Chapter 466 -474 TB 1

UNIT V chapter 14 306-346 Chapter 16 373-390 TB 2

Books for Reference:

1. Rastogi, S. C. Essentials of Animal Physiology. Wiley Eastern Limited. New Delhi.1979.
2. Berry A. K., A Text book of Animal Physiology. Emkay Publications.1st Edition, 1998.
3. Hoar, S. Williams. General and Comparative Physiology. Prentice Hall.1987.
4. Parameswaran, R., Anantha Krishnan, T. N. Anantha Subramanian. Outlines of Animal Physiology, K. S. Viswanathan Pvt. Ltd. Chennai.

Web Reference

<https://books.google.co.in/books?id=8ARZjwEACAAJ&dq=hill+wyse+anderson+animal+physiology&hl=en&sa=X&ved=0ahUKEwir0Mz1zIXoAhWUA3IKHWkDAsQQ6wEIKzAA>

https://books.google.co.in/books?id=Ba_wAAAAMAAJ&q=animal+physiology&dq=animal+physiology&hl=en&sa=X&ved=0ahUKEwiJmePlzoXoAhVkzTgGHeilAJQQ6AEIKDAA

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper				Hours		Credits	
II	20PZO2CC7		ANIMAL PHYSIOLOGY				6		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		√	√		√	√	√		√	
CO2	√		√	√	√	√		√	√	
CO3	√	√					√			√
CO4	√	√		√	√		√	√		√
CO5		√	√	√	√	√		√	√	√
Number of Matches= 32, Relationship : Moderate										

Prepared By:
SS

Checked by:
Dr. I. Joseph A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
II	20PZO2CC8P	Core – VIII	GENETICS, CELL AND MOLECULAR BIOLOGY, AND ANIMAL PHYSIOLOGY – PRACTICAL II	6	4	100	25	75

Course Outcomes

1. Skills on Drosophila genetics, Chromosome and staining techniques and Calculation of gene Frequency.
2. Ability to identify tissue types, Ability to isolate cells and sub cellular organelles, DNA and Plasmids,
3. Skills on enzyme studies, estimation of physiological compound and respiratory gases.
4. Ability to do microtome sectioning and histochemical staining of tissues.
5. Exposure to Research institutes and Knowledge on Natural environment and ecosystem.

GENETICS

Drosophila culture technique.

Identification of mutants and sexes in Drosophila

ABO Blood groups & Rh - Genetic significance

Staining of chromosomes and G- banding.

Human Karyotyping

Human Pedigree analysis

Calculation of gene frequency for Dominant, recessive, and multiple alleles.

CELL AND MOLECULAR BIOLOGY

Human Buccal Smear

Cockroach Haemolymph smear

Mounting of Sarcomere, Columnar epithelial cells, ciliated epithelial cell

Isolation of nuclei from Animal cells.

Isolation of subcellular organelles from cells (Mitochondria, Lysosomes)

Isolation of DNA from animal tissue

Isolation of plasmid from bacteria (demo)

Agarose gel electrophoresis of DNA samples (demo)

ANIMAL PHYSIOLOGY

Quantitative estimation of Amylase activity

Quantitative estimation of Ammonia and Urea

Rate of Salt loss and Salt gain in fish using different experimental media

Estimation of Blood Chlorides

Rate of oxygen consumption in experimental fish

MICROTECHNIQUE

Preparation of permanent serial sections of tissues Liver, spleen, lungs of Sheep / Goat (10 slides). Tissue sections and histochemical staining for identification of cell structure, protein, carbohydrate and lipids.

Educational Tour

Visit to R & D labs and different natural habitats related to the above subjects and submission of report is compulsory.

Record work

A record of laboratory work shall be submitted at the time of Practical examination.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code			Title of the Paper			Hours		Credits	
II	20PZO2CC8			GENETICS, CELL AND MOLECULAR BIOLOGY, AND ANIMAL PHYSIOLOGY – PRACTICAL II			6		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
CO5	✓	-	✓	✓	✓	✓	-	-	-	✓
Number of Matches= 43, Relationship : Moderate										

Prepared By:
SS

Checked by:
Dr. I. Joseph A. Jerald

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal Marks	External marks
II	20PZO2DE2B	DSE – II	BIOTECHNOLOGY	6	4	100	25	75

Course Outcomes

1. Acquire knowledge on recombinant DNA technology.
2. Apply the concepts of molecular techniques involved in Biotechnology.
3. Acquire knowledge on Animal and Medical Biotechnology.
4. Evaluate the knowledge of industrial biotechnology.
5. Enhance knowledge and skill on Environmental Biotechnology.

UNIT- I RECOMBINANT DNA TECHNOLOGY

18 hours

Molecular Tools of Genetic Engineering - Restriction endonucleases - DNA ligases- Alkaline Phosphatase – Nucleases - Polymerases. Vectors: Plasmids- Bacteriophages, Cosmids, # Shuttle vectors #. Artificial chromosomes (YACs, BACs, PACs, MACs and HACs). Methods of Gene Transfer.

UNIT - II MOLECULAR TECHNIQUES

18 hours

Gene Synthesis –Chemical Synthesis (Phosphoramidite method). *DNA Sequencing* –Maxam& Gilbert method and Sangar Coulson method. *Gene Amplification*- PCR Technique, Types and Applications – Automated DNA sequencing, Cycle sequencing and Next generation sequencing. #*Gene Libraries* – cDNA Library# - Blotting techniques – Southern, Northern and Western blotting.

UNIT- III ANIMAL AND MEDICAL BIOTECHNOLOGY

18 hours

Animal cell culture technology: Primary culture- secondary culture - cell lines- Organ culture - whole embryo culture. Methods involved and applications– Stem cell culture and preservation.

DNA in Disease Diagnosis– DNA Probes, chip & Microarray.

Gene Therapy–*Ex vivo* and *in vivo* therapy- Vector delivery system #Vectors used for gene therapy# *DNA Fingerprinting and DNA Markers*- RFLP, RAPD, Satellite, cell finishing, VNTR, STR, SNP.

UNIT- IV INDUSTRIAL BIOTECHNOLOGY

18 hours

Fermentation– Types– Fermenter designs – Scale up microbial process-Upstream and Downstream processing– Production of hormones, vaccines, Enzymes. Immobilization of enzymes and its applications. Production and application of monoclonal and polyclonal antibody #Vitamins and Single Cell Proteins#.

UNIT- V ENVIRONMENTAL BIOTECHNOLOGY

18 hours

Bioremediation: Bioreduction, Biofiltration, Biosensor, eDNA, Biosorption, Bioleaching of Heavy Metals and Ores: Copper and Gold. Wastewater Treatment: Biological Treatment System – Aerobic and Anaerobic Treatment. Sewage Treatment Plant- Distilleries, Tannery effluent. #Risks in Biotechnology# Biosafety, Bioethics and patenting- IPR.

#.....# **Self study**

Text Book:

1. Satyanarayana, U, Biotechnology, Books and Allied (P) Ltd., Kolkata. 2009.

UNIT I : SECTION III :Pg 76-80, 82- 86, 137- 143.

UNIT II : SECTION III : Pg. 97-119, 120 – 123.

UNIT III : SECTION IV : Pg. 157- 180.: SECTION VI: Pg.437-449, 467—470,

UNIT IV : SECTION V : Pg. 239-254, 267-295, 373-379.

UNIT V : SECTION V : Pg. 400-404. SECTION V III:Pg. 686- 705.

: SECTION V III:Pg. 739- 746.

Books for Reference:

1. Gupta, P. K., Biotechnology and Genetics. Rastogi Publications, Meerut. 2004.

2. Brown, C.M., Campbell, I. and Priest, F.G. Introduction to Biotechnology. Blackwell Scientific Publications, U.K(1988).
3. Old, R. W and Primrose, S B., Principles of Gene Manipulation, An Introduction to Genetic Engineering, Oxford Blackwell Scientific Publications. 1989.
4. Primrose, S. B. Modern Biotechnology. Blackwell Scientific Publications, Oxford, London. 1989.
5. Prentis, S. Biotechnology New Industrial Revolution, Orbis, London. 1985.
6. Smith John, E. Biotechnology. Edward Arnold, London. 1988.

Web reference:

1. ebookpdf.com/recombinant-dna-technology
2. www.khanacademy.org › tag › pcr
3. www.khanacademy.org › science › biology › biotech-dna-technology
4. www.vanderbilt.edu › viibre › CellCultureBasicsEU

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper			Hours		Credits		
II	20PZO2DE2B		BIOTECHNOLOGY			6		4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	√	√		√	√	√	√		√	
CO2	√	√	√	√		√		√	√	
CO3	√	√	√	√	√	√		√		√
CO4	√	√	√		√	√	√	√	√	
CO5		√	√	√	√	√		√	√	√
Number of Matches= 38, Relationship : Moderate										

Prepared By:

Dr. S. Mohamed Hussain

Checked by:

Dr. I. Joseph A. Jerald