SRI VENKATESWARA UNIVERSITY: TIRUPATI
SVU COLLEGE OF SCIENCES
MASTER OF SCIENCES
DEPARTMENT OF ZOOLOGY
Re – Structured P.G Programme (CHOICE BASED CREDIT SYSTEM (C.B.C.S), as per NEP – 2020, National Higher Education Qualification Frame Work (NHEQF) And Guidelines Of APSCHE
(WITH EFFECT FROM THE BATCH ADMITTED IN THE ACADEMIC YEAR 2024-2025)
CHOICE BASED CREDIT SYSTEM (C.B.C.S), SYLLABUS ANDSCHEME OF EXAMINATION
(WITH EFFECT FROM THE ACADEMIC YEAR 2024-2025)
M.Sc., ANIMAL BIOTECHNOLOGY

SEMESTER - I								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	101	**Bio-molecules and Metabolic Regulation**	4	4	70	30	100
2		102	(A) **Stem Cell Biology** (B) **Biosafety, Bio Ethics & Intellectual Property rights**	4	3	50	25	75
3		103	(A) **Animal Cell Culture Techniques** (B) **Medical Biotechnology**	4	3	50	25	75
4	*P	104	**Practical I (related to CC 2 & 3)**	6	2	35	15	50
5	SOC	105	(A) **Environmental Biotechnology** (B) **Apiculture**	4	3	50	25	75
6		106	(A) **Bioanalytical Techniques-I** (B) **Histology and Histochemistry**	4	3	50	25	75
7	*P	107	**Practical II (related to SOC 1 & 2)**	6	2	35	15	50
8	Audit Course	109	**Indian Knowledge Systems - 1**	4	0	0	100	0
			Total	**36**	**20**	**340**	**260**	**500**

SEMESTER - II								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	201	**Transgenic Animal Technology**	4	4	70	30	100
2		202	(A) **Genetic Engineering** (B) **Applied Animal Biotechnology**	4	3	50	25	75
3		203	(A) **Fermentation Technology** (B) **Immunotechnology**	4	3	50	25	75
4	P	204	**Practical III (related to CC 5 & 6)**	6	2	35	15	50
5	SOC	205	(A) **Molecular Biology** (B) **Human Health and Infectious Diseases**	4	3	50	25	75
6		206	(A) **Enzymology** (B) **Bio resource Technology**	4	3	50	25	75
7	P	207	**Practical IV (related to SOC 3 & 4)**	6	2	35	15	50
8	OOTC	208	**Open Online Transdisciplinary Course – 2**	-	2	-	100	100
9	Audit Course	209	**Indian Knowledge Systems - 2**	4	0	0	100	0
			Total	**36**	**22**	**340**	**360**	**600**

SEMESTER - III								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	301	**Cell Biology and Immunobiology**	4	4	70	30	100
2		302	(A) **Drug Designing and Development** **(B) Animal Genomics and Proteomics**	4	3	50	25	75
3		303	(A) **Toxicology** (B) **Cancer Biology**	4	3	50	25	75
4	P	304	**Practical V (related to CC 8 & 9)**	6	2	35	15	50
5	SOC	305	(A) **Bio analytical techniques-II** (B) **Biostatistics and Bioinformatics**	4	3	50	25	75
6		306	(A) **Microbiology** (B) **Vaccine Biotechnology and Applications**	4	3	40	25	75
7	P	307	**Practical VI (related to SOC 5 & 6)**	6	2	35	15	50
8	OOTC	308	**Open Online Transdisciplinary Course – 2**	-	2	-	100	100
*	**Seminar / tutorials / remedial classes and Quiz as part of internal assessment**			4	-	-	-	-
			Total	**36**	**22**	**340**	**260**	**600**

SEMESTER - IV								
S. No	**Course**	**Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	OOSDC	401	Open Online Skill Development Courses	-	8	-	200	200
2	PW	402	Project Work – Orientation Classes	24	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**300**	**200**	**500**
Total Semesters				**144**	**84**	**1320**	**1080**	**2200**

CORE COURSE-101: BIOMOLECULES AND METABOLIC REGULATION

Course Objectives:

While studying the Biomolecules and Metabolic Regulation course, the student shall be able to:

1. This course is designed to introduce the organic structure of living systems mainly dealing with biomolecules like carbohydrates, lipids, proteins and nucleic acids laying foundation for other advanced courses.
2. To develop understanding of chemistry used in biological processes and to perform wide range of analytical techniques to explore biological activities.
3. Physiological and biochemical understanding through scientific enquiry into the nature of mechanical, physical, and biochemical functions of humans, their organs, and the cells of which they are composed.
4. To understand the Interactions and interdependence of physiological and biochemical processes and thus to help the student to navigate the discipline of Biochemistry that explains how the collection of inanimate molecules.
5. Provide a concise and unifying approach of knowledge-sharing of the structure, function and interaction of biomolecules & bioprocesses at molecular and metabolic levels thus paves way for understanding the biochemical integrity of various life processes and the metabolic Pathways.
6. The Intermediary Metabolism: Concept and Regulation is designed as an advanced course for understanding the interaction, network and regulation of certain important metabolic pathways and their roles in health and disease.
7. The course also explains the interplay and energetics, catalysis and design of living systems. It is designed for students who have already taken up the courses and elementary biochemistry and macromolecular structures at the undergraduate level.

UNIT-1.

1.1 Chemical Bonds (Covalent, Ionic and Hydrogen Bonds) and Thermodynamic principles in Biology (Enthalpy, Entropy, Free energy, First law and Second law of thermo-dynamics in relation to Biological system).

1.2 Carbohydrates: Definition and Classification- Structure and function of Mono, Oligo and Polysaccharides.

1.3 Intermediary Metabolism-I: Glycolysis, TCA Cycle and their Bio-medical importance.

1.4 Intermediary Metabolism-II: Gluconeogenesis, HMP Shunt and their Bio-medical importance.

UNIT-2.

2.1 Proteins: Definition and Classification- Structure (Primary, Secondary and Tertiary structures, Protein folding, denaturation and Ramachandran plot)

2.2 Bio-synthesis of nutritionally non-essential amino acids and their Bio-medical importance.

2.3 Catabolism of Proteins and Amino acids-I: Biosynthesis of Urea and detoxification of ammonia, Metabolic disorders of Urea cycle.

2.4 Catabolism of Proteins and Amino acids-II: Phenylalanine, Tryptophan, Biosynthesis and degradation of Polyamines and their Bio-medical importance.

UNIT-3.

3.1 Biomedical importance, Classification of lipids; Saturated and unsaturated fatty acids; Triacylglycerols (tri-glycerides), Phospholipids, Glycolipids, Steroids, Lipid peroxidation.

3.2 β- oxidation of fatty acids, Oxidation of unsaturated fatty acids, Ketogenesis.

3.3 Biosynthesis of long chain fatty acids (Palmitic acid), Clinical aspects.

3.4 Metabolism of Vitamins.

UNIT-4.

4.1 Chemistry of purines, pyrimidines, Nucleosides, Nucleotides, Synthetic derivatives.

4.2 Biosynthesis of purine nucleotides, Catabolism of purines.

4.3 Biosynthesis of pyrimidine nucleotides, Catabolism of Pyrimidines,

4.4 Clinical disorders of purine and pyrimidine metabolism; Hyperuricemia or gout; Hypo-urocemia, Orotic aciduria.

Course Outcomes:

After the completion of the course, student will be able to achieve following outcomes:

1. The student will learn about chemical bonding patterns, chemical structures and classification ofcarbohydrates and their structural and metabolic role in cellular system i.e. different pathways associated with carbohydrate metabolism.

2. The student will learn about definition and classification of Proteins, Carbohydrates, Lipids etc and their importance in metabolism

3. Student would gain expertise to develop understanding of biological processes at chemical, biochemical and molecular level to perform vide range of analytical techniques to explore biological activities.

4. The student will be able to learn carbohydrate metabolism i.e. catabolism and its association with cellular energy production and carbohydrate anabolism in animal cells.

5. The student will learn and understand about the Biosynthesis of Purines and Pyrimidine Nucleotides, degradation of Nucleotides, salvage pathways, biosynthesis and biodegradation of Amino acids, inborn errors of metabolism.

SUGGESTED READING MATERIAL:

1. D. Voet and J.G Voet, Biochemistry, 1. Wiley & Sons.
2. David L. Nelson and Michael M. Cox, Lehninger; Principles of Biochemistry, McMillan Lange Medical. Eighth Edition- 8th
3. Robert K.Murrey, D.K. Granner, P.A. Mayes and V.W. Rodwell; Harper's Biochemistry, Worth Publishers. Thirty-First Edition 31st Edition
4. Stryer, Lubert, Berg, Jeremy M., Tymoczko, John L., Gatto Jr., Gregory J Biochemistry 9th Edition.
5. Satyanarayana.UBiochemistry 6th edition.
6. James P. Allen Biophysical Chemistry.

CORE COURSE-102(A): STEM CELL BIOLOGY

Course Objectives:

1. To understand animal cell culture, biology of stemcells and embryonic stem cell.
2. To learn propagation of embryonic stem cells, nuclear transfer technology, animal cloning and stem cell differentiation.
3. To gain knowledge on stem cell plasticity, stem cell assay and protocols, stem cell separations and stem cell therapies.
4. To learn stem cells and tissue engineering, human embryonic stem cells and society, intellectual property results.

UNIT-1.

1.1 Introduction to animal cell and tissue culture: Components of cell culture, cell types and cell lines, different substrates, types of culture.

1.2 Animal cell culture: experimental works – Technological uses of Animal cell cultures - Prospects.

1.3 The biology of stem cells: Overview; different types of stem cells- embryonic Stem cells, fetal tissue stem cells, adult stem cells; nuclear transfer of stem cells; human & animal cloning. Animal stem cell protocols & research.

1.4 Embryonic stem cells: the blastocyst and inner cell mass cells primitive endoderm implantation; blastocyst development in vitro.

UNIT-2

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2.1 Isolation and propagation of embryonic stem cells; chimeras; generation of knockout mice.

2.2 Nuclear transfer technology: Transfer of nuclei into eggs; development potential of transplanted nuclei; reprogramming a nucleus.

2.3 Animal cloning: Overview; challenges in human therapeutic cloning; somatic cell nuclear transfer in humans: pronuclear early embryonic development.

2.4 Stem cell differentiation: Overview; adult stem cells; fetal stem cells; human embryonic stem cells; human parthenote stem cells.

UNIT-3.

3.1 Stem cell plasticity: Overview; self-renewal potential; differentiation versus stem cell renewal; transdifferentiation; cell cycle dynamics of different stem cells.

3.2 Stem cell assays and protocols: Isolation of defined stem cell populations; progenitor cell assays, sources of progenitor cells, cytokine and chemotherapy approaches to mobilization of progenitor cells; flow cytometric techniques; methods of cell selection using monoclonal antibodies.

3.3 Magnetic approaches to cell separation, Dyna beads, nano particle preparations; growth factors and ex-vivo expansion of hematopoietic stem / progenitor cells bioreactors for expansion.

3.4 Stem cell therapies: Clinical applications of stem cell therapy; neurodegenerative diseases-Parkinson's disease, Alzheimers, spinal cord injury, other brain syndromes; tissue systems failures diabetes, cardiomyopathy, kidney failure, liver failure hemophilia, lymphoma and leukemic malignancies requiring stem cell therapy.

UNIT-4.

4.1 Stem cells & tissue engineering: Role of nanoparticles; organ development; nanoparticles as scaffolds.

4.2 Human Embryonic Stem Cells and Society: The religious, legal, ethical and scientific debate; the future of the debate; the regulatory aspects of therapeutical use of stem cells.

4.3 Bioethical, Environmental and Health issues related to Biotechnology.

4.4 Intellectual property results – patents and protection of ideas – Risk and Reward.

Course Output:

1. Knowledge will be gained animal cell culture, biology of stemcells and embryonic stem cell

2. Propagation of embryonic stem cells, nuclear transfer technology, animal cloning and stem cell differentiation can be learnt

3. Stem cell plasticity, stem cell assay and protocols, stem cell separations and stem cell therapies can be understood

4. Stem cells and tissue engineering, human embryonic stem cells and society, intellectual property results can be proficient

SUGGESTEDREADINGMATERIAL:

1. HandbookofStemCellsVolume1and2EdsRobertLanzaandothersElsevierAcademicPress.
2. Austen C.R. and Short. R.V. Reproduction in animals.
3. Schatten and Schatten. Molecular Biology of Fertilization.
4. R.G.Edwards.HumanReproduction.
5. S.F.Gillbert.DevelopmentalBiology.SinauerAssociation Inc.,Massachusetts.

CORE COURSE 102(B): BIOSAFETY, BIOETHICS & INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

1. To understand socio-economic and legal impact of biotechnology, use of genetically modified organisms, moral and ethical issues in biotechnology and safety issues with GMO
2. To learn intellectual property right, evaluation of patenting, application of GATT and IPR and WTO Act and global and Indian biodiversity
3. To gain knowledge on Indian Patent Act 1970, role of country patent office, U.S. Patent trademark office and U.S. Paten system Vs Indian Patent system
4. To gain knowledge on Ethics and genetic engineering, patent of genes, human cloning, stem cel, regulatory requirements for drugs and biologics, GLP and GMP

UNIT-1.

1.1 Socio–economic and legal impacts of biotechnology, rDNA guidelines, national and international guidelines, experimental protocols approval, levels of containment.

1.2 Use of genetically modified organisms, their release in the environment.

1.3 Moral and ethical issues in biotechnology.

1.4 Safety issues with GMO.

UNIT-2.

2.1 Intellectual property Rights: Definition of IPR, Types of IPR, Patents to Trade secrets, copyrights, trademarks– legal Implications.

2.2 Evaluation of patenting, IP relevance to Biotechnology and few case studies.

2.3 Application GATT & IPR, WTO Act.

2.4 Global & Indian biodiversity act.

UNIT-3.

3.1 Indian Patent Act 1970, Recent Amendments filing of a patent application – Precautions before patenting-disclosure/non-disclosure.

3.2 Role of a country patent office.

3.3 U.S. Patent Trademark Office.

3.4 U.S. Patent system Vs Indian Patent System.

UNIT-4.

4.1 Ethics and Genetic Engineering, Patent of Genes.

4.2 Human cloning, Stem cells,

4.3 Regulatory requirements for drugs and biologics.

4.4 GLP,GMP.

Course Output:

1. Socio-economic and legal impact of biotechnology, use of genetically modified organisms, moral and ethical issues in biotechnology and safety issues with GMO can be understood
2. Intellectual property right, evaluation of patenting, application of GATT and IPR and WTO Act and global and Indian biodiversity can be leant
3. Knowledge will be gained on Indian Patent Act 1970, role of country patent office, U.S. Patent trademark office and U.S. Patent system Vs Indian Patent system
4. Ethics and genetic engineering, patent of genes, human cloning, stem cell, regulatory requirements for drugs and biologics, GLP and GMP can be proficient

SUGGESTEDREADINGMATERIAL:

1. Sasson A, Biotechnologies and Development, UNESCO Publications,1988
2. SassonA, Biotechnologies in developing countries present and future, UNESCO publishers, 1993.
3. Singh K. Intellectual Property Rights on Biotechnology, BCIL, NewDelhi.
4. Understanding biotechnology, aluizioborem, fabricior. Santos. Davide. Bowen.

CORE COURSE 103(A): ANIMALCELL CULTURE TECHNIQUES

Course Objectives:

1. To understand Animal cell culture, culture medium, characteristics of cell in culture
2. To learn primary culture, established cell line culture, Measurement of viability and cytotoxicity , cell types and apoptosis
3. To gain knowledge in scaling up of animal cell culture, cell transformation, tissue engineering, transgenic animals, animal cloning
4. To become proficient in improvement of biomass, pharming products, plasminogen activator and ethical issues related to biotechnology products

UNIT-1.

1.1 Animal Cell Culture: Equipment and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations.

1.2 Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium.

1.3 Brief account on the chemical, physical and metabolic functions of different constituents of culture medium, role of carbon di oxide, serum and supplements.

1.4 Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication

UNIT-2.

2.1 Primary Culture: Behaviour of cells, properties, utility. Explant culture; suspension culture.

2.2 Established cell line cultures: Definition of cell lines, maintenance and management; cell adaptation.

2.3 Measurement of viability and cytotoxicity: Cell cloning, cell synchronization and cell manipulation.

2.4 Cell types and Apoptosis: Various methods of separation of cell types, advantages and limitations; flow cytometry. Measurement of cell death, Apoptosis (death domain, role of cytochrome C)

UNIT-3.

3.1 Stem cells: Scaling up of animal cell culture. Cell transformation. Scope, embryonic and adult stem cells, properties, identification, stem cells culture, techniques and their applications in modern clinical sciences.

3.2 Tissue Engineering: biomaterials used in tissue engineering, three dimensional culture and transplantation of engineered cells.-Skin, bone and neuronal tissues.

3.3 Transgenic Animals: Methods involved in the production of transgenic animals, importance and applications of transgenic animals. Gene knock out and mice models for tackling human diseases.

3.4 Animal cloning: methods of cloning and their importance with reference to domestic animals. IVF- technology for livestock and humans.

UNIT-4.

4.1 Improvement of biomass, disease resistant, recombinant vaccines for poultry, livestock.

4.2 Pharming products. Pharmaceutical products produced by mammalian cells.

4.3 Plasminogen activator, erythropoietin, blood clotting factors, Glycoprotein hormones, interleukins, interferons, Cell culture based vaccines.

4.4 Ethical issues related to biotechnology products-Ecological risks of engineered microorganisms remedies.

Course Output:

1. Animal cell culture, culture medium, characteristics of cell in culture can be understood
2. Primary culture, established cell line culture, Measurement of viability and cytotoxicity , cell types and apoptosis can be learnt
3. Knowledge will be gained in scaling up of animal cell culture, cell transformation, tissue engineering, transgenic animals, animal cloning
4. Improvement of biomass, pharming products, plasminogen activator and ethical issues related to biotechnology products will be proficeint

SUGGESTEDREADINGMATERIAL:

1. Ballinic C.A. , Philips J. P and Moo Young M. Animal Biotechnology. Pergamon press, NewYork. 1989.
2. Berger S. L. and A.R. Kimmel. Methods in enzymology guide to molecular cloning techniques (Vol 152). Academic Press Inc. San Diego.1996.
3. JanFreshney.R. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications (6thEd.) Wiley & Sons. 2010.
4. John Davis., Animal Cell Culture: Essential Methods (1st Ed.) Wiley-Black well and Sons publisher. 2011.
5. Ernst-L Winnacker, From Genes to Clones: Introduction to Gene Technology. WILEY-VCH Verlag GmbH, Weinheim, Germany Reprinted by Panima Publishing Corporation, New Delhi. 2003.
6. Animal cell Biotechnology, R.E. Spier and J.B Griffiths. Academic Press.(1998).
7. Living resources for Biotechnology, Animal cells; a. Doyle, R. Hayand B.E. Kirsop (1990), Cambridge University Press, Cambridge.
8. Gene therapy–From Laboratory to the Clinic, Hui, K.M. World Scientific Publishing Co.Pvt.Ltd. Singapore, 1994.

CORE COURSE 103 (B): MEDICAL BIOTECHNOLOGY

Course Objectives:

1. To understand disease diagnosis, monoclonal antibodies and detection of genetic disease

2. To learn Disease treatment, interferons, growth factor, and antisense nucleotide as therapeutic agent

3. To gain knowledge on gene therapy, types of gene therapy, augmentation therapy and targeted transfer

4. To become proficient on forensic medicine, preparation of DNA sample. Approaches for DNA analysis and applications of forensic medicine

UNIT-1.

1.1 Introduction, Disease prevention (Vaccines), Anideal vaccines.

1.2 Disease diagnosis: Probes.

1.3 Monoclonal antibodies.

1.4 Detection of Genetic Disease.

UNIT-2.

2.1 Disease treatment.

2.2 Interferons.

2.3 Growth factor.

2.4 Antisense nucleotide as therapeutic agent.

UNIT-3.

3.1 Gene Therapy.

3.2 Types of genetherapy.

3.3 Augmentation therapy.

3.4 Targeted transfer.

UNIT-4.

4.1 Forensic medicine.

4.2 Preparation of the DNA Sample.

4.3 Approaches for DNA Analysis.

4.4 Applications of Forensic medicine.

Course Output:

1. Disease diagnosis, monoclonal antibodies and detection of genetic disease can be understood

2. Disease treatment, interferons, growth factor, and antisense nucleotide as therapeutic agent can be learnt

3. Knowledge will be gained on gene therapy, types of gene therapy, augmentation therapy and targeted transfer

4. Forensic medicine, preparation of DNA sample. Approaches for DNA analysis and applications of forensic medicine will be proficient

SUGGESTEDREADINGMATERIAL:

1. Biotechnology by B. D. Singh. Kalyani Publishers, 2007.
2. Text Book of Biotechnology By H.K. Das (Wiley Publications).
3. Strategies in Transgenic Animal Sciences - By Glemn M.M. and James M. Robl ASM.2000.
4. Essentials of Biotechnology for Students By Satya N. Das.2001.
5. Gene series By Benjamin Lewin, Oxford University Press
6. Molecular Biology of Cell By Bruce Alberts
7. Molecular Biology David Freifelder, Narosa Publishing House
8. E.coli and Salmonella typhimurium-Cellular and Molecular Biology By Neidhardt, American Society for Microbiology, USA.
9. Molecular Biology of the Gene by Watson.

SOC 105 (A): ENVIRONMENTAL BIOTECHNOLOGY

Course Objectives:

1. To gain knowledge on waste and pollutants, hazards from wastes and pollutants and hazards from chemicals in wastes
2. To understand waste treatment, treatment of liquid wastes, treatment of solid waste and contributions of biotechnology to waste treatment.
3. To become proficient in aerobic waste water treatment and measurement of pollution levels.
4. To learn anaerobic treatment of waste water, biodegradation of xenobiotics compounds, hazards from xenobiotics and bioremediation

UNIT-1.

1.1 Waste and Pollutants: Manufacturing, energy production, agriculture and dairy, transport, House Building and Domestic activities.

1.2 Hazards from wastes and pollutants; biological agents present in wastes.

1.3 Hazards from chemicals in wastes.

1.4 Hazards from physical pollutants.

UNIT-2.

2.1 Waste treatment: Biofilters.

2.2 Treatment of Liquid wastes

2.3 Treatment of solid waste.

2.4 Contributions of Biotechnology to waste treatment.

UNIT-3.

3.1 Aerobic waste water treatment.

3.2 Measurements of the level of pollution.

3.3 The process of waste water treatment. Aerobic reactors or digesters, Microorganisms.

3.4 Anaerobic treatment of waste water: Microorganisms, Sludge Treatment.

UNIT-4.

4.1 Biodegradation of Xenobiotic compounds: Types of Recalcitrant Xenobiotic compounds.

4.2 Hazards from Xenobiotics, General features of Biodegradation of Xenobiotics.

4.3 Biodegradation of halogenated compounds. The origin of capacity to degrade Xenobiotics.

4.4 Bioremediation: Microbial Bioremediation.

Course Output:

1. Knowledge will be gained on waste and pollutants, hazards from wastes and pollutants and hazards from chemicals in wastes
2. Waste treatment, treatment of liquid wastes, treatment of solid waste and contributions of biotechnology to waste treatment can be understood
3. Aerobic waste water treatment and measurement of pollution levels will be proficient
4. Anaerobic treatment of waste water, biodegradation of xenobiotics compounds, hazards from xenobiotics and bioremediation will be learnt

SUGGESTEDREADINGMATERIAL:

1. A Text Book of Biotechnology, HDK umar (WEPub.)
2. Biodegradation and Detoxification of Environmental Pollutants–Chakrabarthy
3. Biotechnology by B. D. Singh. Kalyani Publishers, 2007.
4. Concepts in Biotechnology–Balasubramanian, Bryce, Dharmalingam, Green and Jayaraman.
5. Environmental Biotechnology by Alan Scragg. Pearson Education Limited, England.
6. Environmental biotechnology by S.N. Jogd and. Himalaya Publishing House. Bombay.
7. Environmental chemistry by A.K. DeWiley Eastern Ltd. NewDelhi.
8. Environmental Microbiology–Grant and Long.
9. Environmental Microbiology–Mitchall.
10. Introduction to Biodeterioration by D.Allsoppandk.J.Seal,ELBS/EdwardArnold.
11. Microbial Ecology– Fundamentals and Applications –Atlas and Bartha.
12. Prescott and Dcenn, S Industrial Microbiology– Reed(Ed).

SOC I05(B): APICULTURE

Course Objectives:

1. Understand the historical significance of apiculture, the evolution of beekeeping practices, and the cultural importance of bees in different societies.
2. Identify and compare the characteristics, behavior, and threats faced by Apis Mellifera (European Honey Bee) and indigenous bee species used in beekeeping.
3. Analyze the life cycle of bees, the social structure within bee colonies, and the mechanisms of communication and foraging behavior in bees.
4. Examine the external anatomy of bees, specialized structures such as the proboscis and stingers, and metabolic processes involved in energy production and temperature regulation.
5. Evaluate different types of beehives including Langstroth, Top-Bar, Warre, and Observation hives, considering their pros, cons, and suitability for various purposes.
6. Demonstrate knowledge of essential beekeeping equipment and safety gear such as smokers, hive tools, protective clothing, gloves, and boots, and understand their uses in hive inspection and manipulation.
7. Develop skills in apiary management including site selection, hive orientation, inspection schedules, and swarm prevention techniques across seasons.
8. Explore the diverse range of bee products including varietal honeys, bee pollen, royal jelly, propolis, beeswax, and other bee-derived products, understanding their composition, properties, health benefits, and various applications.

Unit 1:

1.1 History and Importance of Apiculture, Evolution of Beekeeping Practices, Cultural Significance of Bees in Different Societies, Role of Bees in Pollination, Global Impact of Decline in Bee Populations.

1.2 Characteristics and Behavior of Apis Mellifera (European Honey Bee), Indigenous Bee Species Used in Different Regions, Threats and Challenges Faced by Bee Species in Apiculture.

1.3 Life Cycle of Bees: Egg, Larva, Pupa, Adult; Social Structure in Bee Colonies: Queen, Worker, Drone; Communication Among Bees.

1.4 External Anatomy of Bees: Head, Thorax, Abdomen; Specialized Structures in Bees: Proboscis, Pollen Baskets, Stingers; Metabolic Processes in Bees: Energy Production, Temperature Regulation.

Unit 2:

2.1 Langstroth Hives: Pros and Cons; Top-Bar Hives: Suitability for Natural Comb Building; Warre Hives: Vertical Hive Design; Observation Hives: Educational and Research Purposes

2.2 Smoker: Purpose and Techniques of Smoking Bees; Hive Tool: Uses for Inspecting and Manipulating Hives; Bee Suit and Veil: Importance of Protection in Beekeeping; Gloves and Boots: Safety Gear for Handling Bees

2.3 Locating Apiaries: Factors to Consider for Beeyard Placement; Hive Orientation: Sunlight, Wind Protection; Hive Inspection Schedule: Regularity and Best Practices; Swarm Prevention and Control Methods.

2.4 Spring Colony Management: Queen Assessment, Brood Inspection; Summer Honey Flow Management: Adding Supers, Harvesting Honey; Winter Hive Management: Insulation, Ventilation, Pest Control

Unit 3:

3.1 Varietal Honeys: Acacia, Clover, Orange Blossom; Raw Honey vs. Processed Honey: Nutritional Differences; Medicinal Properties of Honey: Antibacterial and Antioxidant Effects; Culinary Uses of Different Honey Varieties.

3.2 Composition of Bee Pollen: Proteins, Vitamins, Minerals; Health Benefits of Bee Pollen: Allergy Relief, Energy Boost; Processing and Storage of Bee Pollen.

3.3 Health Benefits of Royal Jelly: Anti-Aging, Immune Boosting; Propolis: Natural Antibiotic Properties; Use of Royal Jelly and Propolis in Traditional Medicine.

3.4 Composition and Properties of Beeswax; Uses of Beeswax in Cosmetics, Candles, and Crafts; Harvesting and Processing Beeswax; Other Bee Products: Bee Venom, Bee Brood, Bee Bread.

Unit 4:

4.1 Importance of Pollination in Agriculture and Ecosystems; Decline in Pollinators and Impact on Food Security; Bee-Friendly Farming Practices.

4.2 Common Pests and Diseases Affecting Bee Colonies; Non-Chemical Pest Control Methods.

4.3 Principles of Organic Beekeeping: Avoiding Chemical Inputs; Organic Hive Management Techniques: Hygienic Behaviors, Natural Swarming; Challenges and Benefits of Organic Beekeeping.

4.4 Value-added Bee Products: Honey, Pollen, Propolis Skincare Products; Marketing and Branding for Bee Products; Export Opportunities and International Trade Regulations for Bee Products

Course Outcomes

1. Gain a comprehensive understanding of the historical significance and cultural importance of apiculture, beekeeping practices, and the role of bees in pollination.

2. Identify and analyze the characteristics, behavior, and challenges faced by different bee species used in apiculture, with a focus on Apis Mellifera and indigenous bee species.

3. Demonstrate knowledge of the life cycle of bees, social structures within colonies, mechanisms of communication, foraging behavior, and the role of specialized bee structures.

4. Acquire a detailed understanding of the external anatomy of bees, metabolic processes involved in energy production and temperature regulation, and the significance of specialized bee structures.

5. Evaluate and compare different types of beehives, understanding their design, advantages, and suitability for different beekeeping purposes.

6. Develop proficiency in using essential beekeeping equipment and safety gear, ensuring proper hive inspection, manipulation, and personal protection.

7. Apply principles of apiary management, including site selection, hive orientation, inspection schedules, and swarm prevention techniques throughout the year.

8. Explore the diversity of bee products, their composition, properties, health benefits, and various applications in culinary, medicinal, skincare, and other fields, and understand their value in the market.

SUGGESTED READING MATERIAL:

1. "The Buzz about Bees: Biology of a Superorganism" by Jürgen Tautz (Publisher: Springer, 2008)

2. "The Honeybee Democracy" by Thomas D. Seeley (Publisher: Princeton University Press, 2010)

3. "The Practical Beekeeper: Beekeeping Naturally" by Michael Bush (Publisher: X-Star Publishing Company, 2011)

4. "The Hive and the Honey Bee" edited by Joe M. Graham (Publisher: Dadant& Sons, 2015)

5. "Bees: Their Vision, Chemical Senses, and Language" by Karl von Frisch (Publisher: Cornell University Press, 1967)

6. "The Backyard Beekeeper: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden" by Kim Flottum (Publisher: Quarry Books, 2010)

7. "Hive Management: A Seasonal Guide for Beekeepers" by Richard E. Bonney (Publisher: Storey Publishing, 1990)

8. "The Complete Idiot's Guide to Beekeeping" by Dean Stiglitz and Laurie Herboldsheimer (Publisher: Alpha, 2004)

9. "Honeybee: Lessons from an Accidental Beekeeper" by C. Marina Marchese (Publisher: Black Dog & Leventhal Publishers, 2009)

SOC 106(A): BIOANALYTICAL TECHNIQUES-I

Course Objectives:

While studying the Bioanalytical Techniques, the student shall be able to:

1. To study the different acid and base conditions and their effect on the biomolecules in biology and research.
2. To learn about the separation of biomolecules through apply the different centrifugal force.
3. To study different types of chromatography used in biology.
4. To learn about different molecular and cellular separation techniques and their application in biological research.
5. To study principles and methods of different spectroscopic techniques.
6. To know the principle and types of different microscopes

UNIT-I

1.1 Electrolytic Dissociation and Electrolytes, Basics of Acidity and alkality- Bronsted-Lowry Theory, Acid-Base Equilibria in Water, Buffers.

1.2 Structure and Functions of Biomolecules with variable pH, Measurement of pH, Uses of Indicators.

1.3 Ion Specific Electrodes: Ion Selective Electrodes - Glass Membrane Electrodes – Solid-State Ion Exchanger Electrodes – Solid-State Crystal Electrodes – Liquid-Membrane Electrodes - Gas-Sensing Electrodes.

1.4 Viscosity: Factors Affecting Viscosity - Measurement of Viscosity – Applications of Viscometry - Significance of Viscosity in Biological Systems.

UNIT-II

2.1 Instrumentation -- Desktop Centrifuge - High Speed Centrifuge - The Ultracentrifuge

2.2 Basic Principles of Centrifugation - Relative Centrifugal Force (RCF) and RPM Factors Affecting Sedimentation – Sedimentation Velocity, Sedimentation Coefficient, Determination of Molecular Weights.

2.3 Fixed-angle Rotors - Vertical-tube rotors - Swinging-bucket Rotors - Wall Effects

2.4 Preparative Centrifugation - Differential Centrifugation - Density Gradient Centrifugation - Rate Zonal Centrifugation, Isopycnic Centrifugation - Gradient Materials - Preparation of Density Gradients

UNIT-III

3.1 Microscopic techniques: Principles of microscopy Scanning and transmission microscopes. Image processing methods in microscopy.

3.2 Different fixation and staining techniques for Light microscope and Electron microscope.

3.3 Microtomy and processing of tissues for Light microscope and Electron microscope. Cryopreservation and cryotechniques for microscopy

3.4 Freeze-etch and freeze-fracture methods for EM.

UNIT-IV

4.1 Basic Principles - The Laws of Absorption - Significance of Extinction Coefficient - Problems - Preparation of Standard Graph - Deviations From Beer's Law-Absorption Spectrum.

4.2 The Chromophore Concept-Instrumentation For UV-Visible And Infrared Sprectrophotometry. Physicochemical Studies - Control of Purification - Difference Spectrophotometry - Turbidimetry and Nephelometry - Theory and Applications of Infrared Spectrophotometry.

4.3 Electronic transitions and optical spectroscopy -X-ray diffraction and extended X-ray absorption fine structure -Magnetic resonance (NMR, MRI).

4.4 Spectrofluorimetry - Structural Factors Which give Rise to Fluorescence - Fluorescence and Phosphorescence, Fluorometry: Theory and Instrumentation. - Applications - Fluorescence Spectra and Study of Protein Structure.

Course Outcomes:

1. Students would be trained the different acid and base conditions and their effect on the biomolecules in biology and research.
2. To learn about the separation of biomolecules through apply the different centrifugal force.
3. Students would be expertise different molecular and cellular separation techniques and their application in biological research.
4. Students would be trained in various tools and techniques used to gain insight into biological processes.
5. Students would be expertise techniques used for imaging, isolation, purification and characterization of various biological substances.
6. Students would gain basic knowledge of the underlying principles and practical strategy of the analytical and preparative techniques that are fundamental to study and understanding of life processes.
7. Identify and describe the different equipment and tools used in a biology laboratory.

8. Correctly operate different laboratory instruments.
9. Identify and Analyse the spectra of biomolecules
10. Isolate and purified the biomolecules through chromatography

SUGGESTED READING MATERIAL:

1. A Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.W. Goulding, ELBS Edn.
2. Animal Cell Culture – A practical approach, Ed.John. R. W.Masters IRL Press.
3. General Zoological Microtechniques - P.M. Weesner.
4. Principles and techniques of Biochemistry and molecular biology by Kein Wilson and John Walker, VIII volume, Cambridge press Edition.
5. Neuro anatomical Techniques, N.J. Stransfed and T.A. Miller Springer Verlag, New York Heidelberg, Berlin.
6. Principles of Neuro Phychopharmacology- Robert S. Feldman, Jerrold S. Meyer and Lind F. Quenzer. Sinauer Associates, Inc. Publishers. Sunderland. Massachusetts.
7. Biophysical chemisty by Upadhyay – Upadhyay - Nath.
8. Analytical Biochemistry (Biochemical techniques) by Dr P. Asokan. Chinnaa publications.
9. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International Edition.
10. Vogel's Qantitative Chemical Analysis by Vogel, ArthurI.

SOC 106(B) HISTOLOGY AND HISTOCHEMISTRY

Course Objectives:
While studying the Bioanalytical Techniques, the student shall be able to:

1. To study the structural organization of different mammalian tissues at the histological level. Understand the types and causes of morphological alterations in cells due to diseases. Comprehend the relationship between etiology, pathogenesis, and histopathological changes in specific diseases.
2. To study the process of permanent slide preparation, immunofluorescence technique, and mechanism for the Identification of total Proteins and Glycoproteins.
3. To study Explain morphological alterations in cells due to diseases, such as cloud, hyaline, hydrophic, and fatty degeneration.
4. To study Review the application of immunohistochemistry and immunofluorescence techniques to localize proteins in endocrine cells (Pituitary cell types or islet of Langerhans).

5. To study Specify and compile applications of Cryotechniques, Cryo ultramicrotomy, microscope, Importance of Enzyme histochemistry, Application of Histochemical methods for the detection of various types of Carcinoma Immunofluorescent techniques.

UNIT-I

1.1 Histology : Histochemistry and Histopathology : Objectives and applications

1.2 Tissues: Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue.

1.3 Muscle: Histology of different types of muscle (skeletal muscle, smooth muscle, cardiac muscle).

1.4 Functional Morphology (mammalian): Histological organization of GI tract- stomach and intestine, lungs, kidney, spleen, thymus, Bone and bone marrow.

UNI-II

2.1 Endocrine System: Histology of mammalian endocrine glands-pituitary, thyroid, parathyroid, pancreas, adrenal gland, testis, ovary.

2.2 Nervous System: Types, structure and function of brain cells (CNS and PNS) and Structure of neuron. Types of synapse, Synaptic transmission and structure and types and functions of bones and cartilages.

2.3 Tissue fixation: Objectives, methods, chemical fixatives-types and chemistry of fixation; Physical methods-:freezing and microwave fixation; choice of fixatives, fixation artifacts.

2.4 Classification and properties of dyes; metachromatic dyes and staining.

Unit-III

3.1 Histochemistry Principles and methods of application

3.2 Utility of classical histochemical Techniques : for localization of glycoproteins (PAS), nucleic acids(Feulgen) and steroid dehydrogenase activity.

3.3 Immunohistochemistry Principles, method of application of Imunohistochemistry

3.4 Immunofluorescence techniques for localization of proteins in endocrine cells (Pituitary cell types or islet of Langherhans) In situ hybridization of nucleic acids.

Unit-IV

4.1 Histopathology : Morphological alterations in cells due to disease, types of degeneration clouding, hyaline, hydrophic and fatty degeneration.

4.2 Etiology, pathogenesis and histopathology of Liver cirrhosis and atheroscelerosis, Neuropathology of alcoholism and methanol poisioning.

4.3 Histopathology Tumors- malignant and non-malignant, types of carcinoma, histopathology of breast and prostate tumors.

4.4 Histochemical classification of Proteins Principles and mechanism for the Identification of Total Proteins and Glycoproteins.

Course Outcomes

1. Explain the structural organization of different mammalian tissues at the histological level. Understand the types and causes of morphological alterations in cells due to diseases. Comprehend the relationship between etiology, pathogenesis, and histopathological changes in specific diseases
2. Illustrate the process of permanent slide preparation, immunofluorescence technique, and mechanism for the Identification of total Proteins and Glycoproteins.
3. Explain morphological alterations in cells due to diseases, such as cloud, hyaline, hydrophic, and fatty degeneration.
4. Review the application of immunohistochemistry and immunofluorescence techniques to localize proteins in endocrine cells (Pituitary cell types or islet of Langerhans).
5. Specify and compile applications of Cryotechniques, Cryoultramicrotomy, microscope, Importance of Enzyme histochemistry, Application of Histochemical methods for the detection of various types of Carcinoma Immunofluorescent techniques.

SUGGESTED READING MATERIAL:

1. Boyd,W. 1976:A text book of Pathology. Structure and function in disease, 4 th edition. Lea and Fibiger, Philadephia.
2. Pearse, A.G.E. (1980): Histochemistry, theoretical and Applied ,J & A, Churchill Ltd., London.
3. Rogers, A.W.(1983): Cells and Tissues, An introduction to Histology and Cell Biology, Academic Press, NY.
4. Telford, I.R. and Bridgman,C.F.(1990). Introduction to Functional Histology, Harper and Row, NY

AUDIT COURSE 109-INDIAN KNOWLEDGE SYSTEMS

Learning Objectives:

- To study the enriched scientific Indian heritage.
- To understanding of Indian Knowledge System.
- Develop an ability to apply the Indian Knowledge System to societal challenges faced today in areas such as holistic health, governance, public administration and sustainable living.

Learning Out comes:

- After completion of study, students able to
- Classify the key concepts of Indian Knowledge System and discuss the multi-faceted nature of knowledge contained in the Traditional Systems of India.
- Identify the importance of Yoga way of living in maintaining a sound physical, emotional and mental health.

- Recognize the relevance of Arthashastra in public administration and effective governance.

SYLLABUS

Unit I	:	Introduction to Indian Knowledge Systems (IKS): About Indian Knowledge System; Definition of Indigenous/ Traditional Knowledge; Scope, and Importance of Traditional Knowledge.
Unit II	:	Indian Heritage of Knowledge: Ancient Indian Knowledge: The Vedas and its components-the Vedangas Ancient Indian books and treaties: The Sastras.; The Great Indian Epics: The Ramayana and The Mahabharata Epics and religious treaties.
Unit III	:	Ancient India- Bharat Varsha: People of Ancient Bharat Varsha; Our great natural heritage: The great Himalayas and the rivers; The civilizations of the Sindhu-Ganga valley, and the Brahmaputra valley; Our coastal plains; Our Nature: Forests and Minerals; Ancient Indian Traditional Knowledge and Wisdom about nature and climate.
Unit IV	:	Contribution of Ancient India to Health Sciences: Traditional Indigenous systems of medicines in India: - Ayurveda and Yoga; Elements of Ayurveda: Gunas and Doshas, Pancha Mahabhuta and Sapta-dhatu; Concept of disease in Ayurveda; Ayurvedic lifestyle practices: Dinacharya and Ritucharya; Important Ayurvedic Texts; Hospitals in Ancient India; Ayurveda: Gift of India to the modern world.

Reference Books:

1. Baladev Upadhyaya, Samskrta Śāstrom ka Itihās, Chowkhambha, Varanasi, 2010.
2. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
3. Astāngahrdaya, Vol. I, Sūtrasthāna and Śarīrasthāna, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
4. Dharampal, The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
5. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavan RN. (2022), Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning Private Ltd.
6. Mukul Chandra Bora, Foundations of Bharatiya Knowledge System. Khanna Book Publishing.
7. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.

CORE COURSE-201: TRANSGENIC ANIMAL TECHNOLOGY

Course Objectives:

1. To become proficient on structure and function of male and female reproductive system; reproductive cycles and contraception in male and females
2. To gain skill on sex determination, selection for qualitative inherited characters, parental determination and verification and progeny testing
3. To understand artificial insemination techniques, in vitro fertilization, embryo transfer technology, microinjection and macroinjection
4. To learn transgenic technology development, generation of chimeric, transgenic and knockout mice

UNIT-1.

1.1 Structure and function of male reproductive system-hormonal regulation of spermatogenesis and spermeiogenesis; inhibin and androgen binding proteins; capacitation of spermatozoa.

1.2 Structure and function of female reproductive system-influence of hormones on development of ovarian follicles and oogenesis;

1.3 Reproductive cycles: estrous and menstrual cycle; ovulation, atresia and corpus luteum formation; pregnancy and lactation; implantation and placentation.

1.4 Contraception in males and females: Hormonal and chemical; recent advances in contraception research.

UNIT-2.

2.1 Introduction - Sex determination; principles of animal breeding; structure of the livestock breeding industry: cattle, Sheep.

2.2 Selection for qualitatively inherited characters-gene frequency and selecting again strecessive genes.

2.3 Parental determination and verification; the use of markers and/or molecular probes, selection criteria: multiple records, pedigrees election, family selection.

2.4 Progeny testing: heritability; correlated characters; selection for maternal ability; factors affecting selection response; genotype-environment interactions

UNIT-3.

3.1 Artificial insemination(AI) techniques and their development: estrus synchronization; semencollection, evaluation, storage.

3.2 I*nvitro*fertilization, ICSI and preservation of endangered species.

3.3 Embryo transfer technology, Superovulation, cryopreservation of embryos, Hormones involved in embryo transfer technology.

3.4 Microinjection and Macroinjection – introduction–procedure–applications advantages and limitations.

UNIT-4.

4.1 An overview of transgenic technology Development of transgenic mice and other animal models: by injection of foreign DNA/gene into zygote; optimization of construct for in vivo expression

4.2 Generation of chimeric, transgenic and knockout mice and other animals and their characterization.

4.3 Transgenic fishes, transgenic poultry and transgenic insects as bioreactors.

4.4 Potential application of transgenic animals: models for various diseases/disorders, production of peptides and proteins of biopharmaceutical interest (molecular farming).

Course Output:

1. Knowledge will be gained on structure and function of male and female reproductive system; reproductive cycles and contraception in male and females
2. Sex determination, selection for qualitative inherited characters, parental determination and verification and progeny testing will be understood
3. Artificial insemination techniques, in vitro fertilization, embryo transfer technology, microinjection and macroinjection can be learnt
4. Transgenic technology development, generation of chimeric, transgenic and knockout mice will be learnt

SUGGESTEDREADINGMATERIAL:

1. Comparative Reproductive Biology. Edited by H. Schatten and G.M. Constanitinescu. Black well Publishers, UK.
2. Comparative Endocrinology and Reproduction. Edited by K.P. Joy, A.Krishna, C.Haldar, Narosa Publishers, Delhi.
3. Daltons Introduction to Practical Animal Breeding. Edited by Malcolm B.Willis, Black well Science, UK..
4. Williams Text Book of Endocrinology, Edited by J.D. Wilson and others, Saunders, USA.
5. Animal Transgenisis and Cloning. Edited by L.M. Houdebine, Wiley, USA

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CORE COURSE-202 (A): GENETIC ENGINEERING

Course Objectives:

1. To understand use of enzymes in DNA and RNA synthesis, restriction enzymes and ligation and modification o DNA
2. To learn vectors for constructions of genomic libraries, expression vectors, promoters and vectors used for cloning
3. To gain knowledge on DNA fragments, cDNA synthesis, PCR
4. To become proficient on ligation between cohesive and blunt end DNA fragments, introduction of cloned genes into host and expression of cloned genes

UNIT-1.

1.1 Enzymes used for the synthesis of DNA: DNA Polymerase I, Klenow fragment, Sequenase, Taq Polymerase, Reverse transcriptase, Terminal Transferase

1.2 Enzymes used for the synthesis of RNA: T3 and T7 RNA polymerases, SP6 RNA polymerase

1.3 Restriction enzymes - Outlines of bacterial restriction and modification systems – Classification of restriction enzymes - Type II restriction enzyme: Nomenclature, Production of DNA fragments with 3‟ protruding ends and blunt ends and their significance in molecular cloning - RFLP and its significance.

1.4 Enzymes used for ligation and modification of DNA: DNA ligase, Methylases, Kinase, Phosphatase.

UNIT-2.

2.1 Vectors for construction of genomic libraries - cosmids, bacterial artificial chromosomes (BACs), yeast artificial chromosomes(YACs)-vectors for construction of cDNA libraries-lamda ZAP. Multipurpose vectors -pUC 18/19,Blue script vectors

2.2 Expression vectors – structure - promoters used in expression vectors - lac, tac, λpL, T7promoters and their significance in constructing expression vectors.

2.3 Promoter-probe vectors – Structure promoter probe vector - Reporter genes (lacZ, gfp, gus, luciferase) and strategies used to assay promoter activity.

2.4 Vectors used for cloning into mammalian cells-SV40Vectors.

UNIT-3.

3.1 Isolation of gene/DNA fragments. Mechanical shearing, restriction digestion, cDNA synthesis, PCR amplification and chemical synthesis of gene.

3.2 cDNA synthesis - Mechanism of cDNA synthesis, Strategies used to obtain full lengthcDNA.5‟and 3‟RACE.

3.3 PCR - Concept and technology- Properties of primers - Inverse, multiplex PCR, RAPD and its significance. Real time PCR.

3.4 Chemical synthesis - Designing gene from amino acid sequence, solid phase synthesis of oligonulceotides -In vitro synthesis of gene

UNIT-4.

4.1 Ligation between cohesive and blunt end DNA fragments - T4 DNA ligase – Conversion of blunt end DNA fragment into cohesive ended DNA - linkers, adapters, homopolyme rtailing.

4.2 Introduction of cloned genes into host-Transformation, conjugation, transduction, electroporation, particle bombardment, microinjection, liposome mediated DNA delivery.

4.3 Identification and characterization of cloned genes-Screening of genomic/cDNAlibraries-genetic, molecular hybridization-immunochemical techniques

4.4 Expression of cloned genes – detection of expressed proteins – biological and molecular methods.

Course Output:

1. Use of enzymes in DNA and RNA synthesis, restriction enzymes and ligation and modification o DNA can be understood
2. Vectors for constructions of genomic libraries, expression vectors, promoters and vectors used for cloning can be learnt
3. Knowledge will be gained on DNA fragments, cDNA synthesis, PCR
4. Will become proficient on ligation between cohesive and blunt end DNA fragments, introduction of cloned genes into host and expression of cloned genes

SUGGESTEDREADINGMATERIAL:

1. Biotech‟s Dictionary of Genetic Engineering by Dinesh Arora.
2. D.Green; Philip Hilter Richard M. Myers Sue. Klapholz; Harold Riethman Jane Roskams.
3. DNA cloning: Mammalian systems – A Practical Approach by D.M.Glover, B.D.Hames.
4. From Genes to clones Introduction to Gene technology by Ernst-L- Winnacker.
5. Genetic disorders of Manby M.R. Goodman.
6. Genetic Engineering and its Applications by P.Joshi
7. Genetics-MonrveW.Strickberger.3rdEd.,May,2000

CORE COURSE-202 (A): APPLIED ANIMAL BIOTECHNOLOGY

Course Objectives:

1. To introduce a detailed achievement of Biotechnology, Genetic Engineering, and r-DNA technology principles.

2. To gain knowledge on cloning vectors and their uses in gene cloning technologies.

3. Principles of Cloning strategies and screening analysis of Recombinations.

4. To apply principles of Biotechnology concepts in veterinary sciences i.e., production of Transgenic animals, Artificial insemination, In vitro fertilization, Embryo transfer technology.

5. Application of Biotechnological principles in Medicine and Gene transfer techniques.

6. To understand the uses of Fresh and marine pearl culture technology, IPR, Patents, and Copyrights.

UNIT-1:

1.1 General Introduction and Achievements of Biotechnology

1.2 Enzymes used in gene cloning - Restriction endonucleases, DNA ligases, Kinase, Phosphatase, Nucleases, Polymerases, Reverse transcriptase

1.3 Cloning vectors (Plasmids, Phages, cosmids, yeasts Shuttle vectors), viral vectors (SV40, Adenovirus, and Baculovirus) used in Gene cloning.

1.4 Cloning and selection strategies of recombinants (antibiotic selection, blue-white screening, colony hybridization, Fluorescence in-Situ Hybridization (FISH), and immunological test.

UNIT-2:

2.1 Preparation of cell lines, types of cell lines.

2.2 Applications of cell culture in Veterinary - Disease diagnosis.

2.3 Application of Biotechnology in Medicine - Production of monoclonal antibodies (Hybridoma technology), Production of vaccines and Production of Growth Hormone

2.4 Gene therapy: Introduction, principle of gene transfer, and examples (Adenosine deaminase deficiency disease, Duchenne Muscular dystrophy disease, and Cystic fibrosis)

UNIT-3:

3.1 Livestock improvement: Manipulation of reproduction in animals (Artificial insemination, multiple ovulations, in vitro fertilization, Embryo transfer technology)

3.2 Methods of gene transfer – Microinjection, electroporation, lipofection, and viral-mediated gene transfer techniques

3.3. Gene editing - Gene silencing - CRISPR-associated protein-9 nuclease (Cas9) technology

3.4 Potential application of transgenic animals: models for various diseases/disorders.

UNIT-4:

4.1 Growth hormone transgenics and stem cell technology for the betterment of aquaculture. Sex reversal in fishes and their applications, Production of monosex populations.

4.2 Marine bio/fish resources and its applications in pharmaceutical and Nutraceutical Industries.

4.3 Freshwater and marine (oyster) pearl culture technology, pearl culture in India, uses of pearl culture.

4.4 Intellectual Property Rights: Introduction; Types of IP; Patents and its types, Trademark Copyright & Related Rights, Protection of GMOs; ethical and legal issues in biotechnology.

Course Outcomes:

1. Imparts the knowledge to cell lines and stem cells in culture media.

2. It gives insight into various cell/tissue culture techniques and their applications.

3. Understanding of in vitro culturing of organisms and production of transgenic animals.

4. Understanding of cloning of mammals, large-scale culture, and production from recombinant microorganisms and cloning vectors.

5. This insight allows students to take into consideration the ethical issues involved in the production of transgenic animals and BT products.

6. Use in gene transfer technology, genetic manipulations and in a variety of industrial processes, and prominence of IVF, Artificial insemination, and embryo transfer techniques.

7. Gives knowledge to the culture of animal cells and its culture medium.

8. Learn basic concepts and principles of recombinant DNA technology, Gene manipulation for transgenic animal production and therapeutics/vaccine production.

9. Provides knowledge on Livestock improvement, aquaculture, and pearl culture.

10. Provides knowledge on Intellectual property rights and genetically modified organisms.

Suggested Reading Material:

1. A textbook of Biotechnology - R.C. Dubey, S. Chand & Company Ltd., New Delhi - 1996.

2. A textbook on Biotechnology - (n Ed.) H.D. Kumar, EWP - Private Ltd., New Delhi - 1998.

3. Animal Biotechnology - M.M. Ranga, Agrobios (India), 2000.

4. Biotechnology - Fundamentals & Applications - S.S. Purohit & S.K. Mathur, AgroBotonics - 1999.

5. Biotechnology - V. Kumaresan, Saras Publication - 1994.

CORE COURSE-203(A): FERMENTATION TECHNOLOGY

Course Objectives:

1. To understand cell distribution methods, separation techniques, purification by chromatographic techniques and isolation and screening and maintenance of industrially importance microbs
2. To learn bioreactor design, fermentation economics, upstream processing, membrane based separations
3. To gain knowledge on importance of downstream processing economics of downstream processing
4. To become proficient in adsorptive chromatographic separations, electrophoretic process, hybrid separations technologies and gel permeation chromatography dialysis and crystallization

UNIT-1.

1.1 Cell distribution methods: Sonicatron – frush press – freeze than methods. Cell distribution for intracellular products, removal of insolubles, biomass (and particulate debris).

1.2 Separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

1.3 Purification by chromatographic techniques; Reverse osmosis and ultra-filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.

1.4 Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics (an example from each group, particularly with reference to industrially useful microorganisms).

UNIT-2.

2.1 Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation-Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Solid substrate, surface and submerged fermentation.

2.2 Fermentation economics; Fermentation media; Fermenter design-mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization.

2.3 Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.

2.4 Membrane-based separations(micro and ultrafiltration theory, design and configuration of membrane separation equipment, applications, precipitation methods(with salts, organic solvents, and polymers, extactive separations, aqueous two phase extraction, supercritical extraction) insitu product removal, integrated bioprocessing.

UNIT-3.

3.1 Role and Importance of downstream processing in biotechnological processes.

3.2 Problems and requirements of bioproduct purification.

3.3 Economics of downstream processing in Biotechnology, cost-cutting strategies.

3.4 Characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products), physico-chemical basis of bioseparation processes.

UNIT-4.

4.1 Adsorptive chromate graphic separations processes.

4.2 Electrophoretic processes (all electrophoresis techniques including capillary electrophoresis)

4.3 Hybrid separation technologies (membrane chromatography, electro chromatography etc).

4.4 Gel Permeation Chromatography, dialysis, Crystallisation.

Course Output:

1. Cell distribution methods, separation techniques, purification by chromatographic techniques and isolation and screening and maintenance of industrially importance microbs can be understood

2. Bioreactor design, fermentation economics, upstream processing, membrane based separations can be learnt

3. Knowledge will be gainedon importance of downstream processing economics of downstream processing

4. Adsorptive chromatographic separations, electrophoretic process, hybrid separations technologies and gel permeation chromatography dialysis and crystallization will be proficient

SUGGESTEDREADINGMATERIAL:

1. Wankat P.C,“Rate Controlled Separations",Elsevier,1990.

2. Belter PA and Cussler E, “Bioseparations", Wiley, 1985.

3. “Product Recovery in BioprocessTechnology",BIOTOL Series, VCH, 1990.

4. Asenjo J.M,“Separation processes in Biotechnology",1993,MarcelDekkerInc.

CORE COURSE-203(B): IMMUNOTECHNOLOGY

Course Objectives:

1. To introduce the principles and applications of Immunology in the field of Biotechnology.

2. To understand the fundamentals of Immunotechnology including antigen-antibody interactions, immune responses, and immune system components.

3. To explore the techniques and technologies used in Immunology for diagnosis, treatment, and research purposes.

4. To apply Immunotechnological concepts in various industries including healthcare, agriculture, and environmental science.

5. To analyze the role of Immunology in disease prevention, vaccination, and personalized medicine.

6. To examine the ethical and legal considerations related to Immunotechnology and biopharmaceuticals.

UNIT-1:

1.1 Aim and scope of Immunotechnology, Evolution of vaccination strategies, Impact of serological tests in identifying specific antibodies in immune responses.

1.2 Regulation of immune tolerance and mechanisms of self/non-self-discrimination, Interplay between the innate and adaptive immune responses in pathogen recognition

1.3 Differentiation and functions of effector memory T cells in immune memory responses, Role of marginal zone B cells in early antibody responses to blood-borne pathogens, Specialized functions of antigen-presenting cells in priming T cell responses

1.4 Role of Toll-like receptors in recognizing pathogen-associated molecular patterns (PAMPs), Antibody effector functions and complement activation pathways in immune defense

UNIT-2:

2.1 Principles of Immunodiagnostics, Development of ELISA assays, Western Blotting , Role of Immunofluorescence in diagnostics.

2.2 Applications of Monoclonal Antibodies in therapy, Immunomodulators in disease management, Immunotherapeutic strategies in clinical settings

2.3 Genetic basis of immunity in animals, Immunogenomic approaches for disease resistance.

2.4 Utilization of Immune-based sensors for environmental monitoring, Role of Biosensors in detecting pollutants and pathogens in ecosystems.

UNIT-3:

3.1 Classification of Vaccines based on technology, Novel vaccine development approaches, Vaccination schedules and strategies.

3.2 Genetic components of immune responses, Impact of polymorphisms on disease susceptibility, Applications of Immunogenomic studies in personalized medicine.

3.3 Mechanisms of Immunodeficiency disorders, Pathophysiology of Allergic reactions, Autoimmune disease etiology and management.

3.4Genetic manipulation for immune system modification, CRISPR-Cas9 applications in immune cell engineering and disease models

UNIT-4:

4.1 Therapeutic Antibodies for targeted therapy, Adjuvants in vaccine formulations, Immune-modulating drugs for treatment strategies.

4.2 Immune Biomarkers for diagnostics and prognosis, Detection methods for Immunosuppressants in therapeutic monitoring.

4.3 Compliance with Quality Control standards, Implementation of Good Manufacturing Practices in Immunotherapy, Ethical considerations in Immune-based technologies

4.4 Personalized Immunotherapy approaches, Utilization of Immunogenomics for precision medicine, Integration of Immunoinformatics in predicting immune responses and designing novel therapies

Course Outcomes:

1. Comprehensive understanding of Immunology principles and their applications in Biotechnology.

2. Proficiency in performing various immunological techniques for research and diagnostics.

3. Ability to analyze and interpret immune responses in different contexts.

4. Knowledge of how Immunotechnology is applied in healthcare, agriculture, and environmental sectors.

5. Understanding of the importance of Immunology in disease prevention and treatment strategies.

6. Awareness of the ethical, legal, and regulatory frameworks governing Immunotechnology.

7. Skill development in immune engineering and genetic manipulation for therapeutic purposes.

8. Profound insight into the role of Immunotechnology in personalized medicine and future healthcare trends.

Suggested Reading Material:

1. Immunology - A Clinical & Laboratory Manual by Richard R. Roitt.

2. Basic and Clinical Immunology by Mark Peakman and Diego Vergani.

3. Molecular Immunology by William J. Levinson.

4. Immunotechnology: Discovering Antibodies, Antigens, and Supercells by David Burke.

5. Immunology for Dummies by John T. Conner.

SOC-205: MOLECULAR BIOLOGY

Course Objectives:

1. To gain knowledge on DNA structure, genome of Nuclear and mitochondrial and maternal Inheritance
2. To understand replication in prokaryotes, Enzymology of DNA replication, Discontinuous replication and Bidirectional replication
3. To understand synthesis of RNA, Types of RNA, Genetic code and Ribosome structure
4. To learn gene regulation I and II and Operon concepts

UNIT-1.

1.1 Watson and Crick Model: Types of DNA; Properties of DNA(C-value paradox, Cot value)

1.2 Nuclear and mitochondrial genome, mitochondrial and maternal Inheritance

1.3 Structure of gene (Cistron, Muton, Recon, Cis-transtest)

1.4 DNA damage and repair: Biological indication of repair, photo reactivation, Excision repair, Recombination repair, SOS repair, and Mismatch repair.

UNIT-2.

2.1 Replication in Prokaryotes: Geometry of DNA replication, semi conservative replication.

2.2 Enzymology of DNA replication: DNA polymerase I, II and III; Replication of Eukaryotic Chromosomes; Eukaryotic DNA polymerases; Multiple fork; Replication of Chromatin.

2.3 Discontinuous Replication: Fragments in Replication fork and detection offragments; Events in the Replication fork; Denovo initiation and covalent extension.

2.4 Bidirectional replication, Termination of replication.

UNIT-3.

3.1 Synthesis of RNA:- RNA Polymerase, Promoter, Auxiliary Proteins, RNA chain initiation, elongation, termination and Splicing mechanism.

3.2 Types of RNA, Processing of mRNA, rRNA and tRNA, Ribozyme.

3.3 Genetic code, Identification of start and stopcodon, Universality of genetic code Degeneracy, Wobbles Hypothesis. Codonusage, Genetic code of Mitochondria.

3.4 Ribosome structure (Prokaryotic and Eukaryotic), Protein synthesis: Initiation, Elongation and Termination of polypeptide chain, Signal peptide hypothesis, Post translational modification, Polyproteins, Inhibitors of translation.

UNIT-4:

4.1 Temporal response, Induction, Repression, Lac Operon, Galactose Operon.

4.2 Lambda Operon, Tryptophan Operon.

4.3 Gene regulation in Eukaryotes-I: Gene families, Gene alteration (Gene loss, Gene amplification, gene rearrangement), Regulation of synthesis of primary transcripts (gene organization that affects regulation-Activator gene; Transcriptional control by hormones, Methylation).

4.4 Gene regulation in Eukaryotes-II: Brief description of fundamentals of Chromatin remodeling, Enhanceosome, Reporter or Chimeric genes, Role of binding motifs in gene expression(Helix-Turn-Helixmotif, Zincfinger and Leucine Zipper), methods of gene expression at RNA and protein levels.

Course Output:

1. DNA structure, genome of Nuclear and mitochondrial and maternal Inheritance will be understood
2. Knowledge will be gained on replication in prokaryotes, Enzymology of DNA replication, Discontinuous replication and Bidirectional replication
3. Synthesis of RNA, Types of RNA, Genetic code and Ribosome structure can be understood
4. Gene regulation I and II and Operon concepts can be learnt

SUGGESTEDREADINGMATERIAL:

1. Biochemistry by A.L .Lehniger
2. Cell and Molecular Biology - E.D.P.DeRobertisandE.M.F.
3. Concepts in Molecular Biology-S.C.Rastogi, VN. Sharma and Ananda Tandon (1993) Genes VII by Benjamin Lewin.
4. Harper's review of Biochemistry by D.W. Martinet al 1990
5. Molecular Biology by David Freifelder, 1993

SOC 205(B): HUMAN HEALTH AND INFECTIOUS DISEASES

Course objectives:
While studying the **Human Health and Infectious Diseases** course, the student shall be able to:

1. To introduce the basic concepts of pathophysiology of infectious diseases
2. To study the major infectious diseases transmission to humans and response of immunity
3. To understand the Pathogenesis, mechanisms of pathogenesis; transmission and epidemiology of various bacterial, viral, fungal and protozoan diseases.
4. To study the Sexually transmitted diseases.
5. To study the prevention and control measures of infectious diseases

Unit-1.
Introduction to Infectious Diseases: Basic concepts in pathophysiology of infectious diseases, Outline of physiological mechanisms leading to diseased state, Infectious disease transmission, Infection and immunity, Acute and Chronic Infections, Major infectious diseases of humans.

Unit-2.
Bacterial Infections: Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections (Tuberculosis, Cholera, Typhoid).

Unit-3.
Viral Diseases: Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and anti-retroviral therapy of Human immune deficiency virus (HIV/AIDS); Sexually transmitted diseases.

Unit-4.
Fungal and Protozoan Diseases: Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens: (Dermatophytes, Candida, Aspergillus); Protozoal human pathogens (Plasmodia and Trypanosoma).

Course Outcomes:

1. Learn the basic concepts of Infectious diseases and the role of immunity to control infections
2. Provides knowledge on the physiological mechanisms leading to diseased conditions.
3. Students gains knowledge on the pathogenesis and transmission of infectious diseases.
4. This insight allows the students to learn the treatment methods to control the growth and control of microbes.

SUGGESTED READING MATERIAL:

1. A text book of Biotechnology-RC. Dubey. S. Chand& Company Ltd., New Delhi -1996.
2. A text book on Biotechnology-(n Ed.) H.D. Kumar. EWP - Private Ltd., New Delhi -1998.
3. Biotechnology- V. Kumaresan. Saras Publication-1994.
4. Environmental Microbiology, Pepper, I. L., Gerba, C. P. and Gentry, T. J. (2015), 3rd edition, Academia Press, Elsevier
5. Textbook of Environmental Microbiology, Mohapatra, P. K. (2008), I.K. International (P)Ltd.
6. Basic Biotechnology, Ratledge, C. and Kristiansen, B. (2003), 2nd edition, Cambridge University Press
7. Pocket Guide to Bacterial Infections – K. Balamurugan and Prithika Udayakumar (2019). CRC Press.
8. Infections and Infectious diseases (2001). WHO &International Federation of Red Cross and Red Crescent Societies

SOC 206 (A): ENZYMOLOGY

Course Objectives:

1. To understand enzyme specificity, enzyme catalysis and isolation and purification of enzymes
2. To gain knowledge on theories of enzymes kinetics, enzyme kinetics and its importance, effect of reactant concentrations and effect of temperature of pH and enzyme concentration reaction rate
3. To learn inhibition of enzyme activity, kinetics of allosteric enzymes, regulation of enzyme activity and mechanism of enzyme action
4. To become proficient on clinical aspects of enzymology, immobilized enzymes, isoenzymes and enzyme engineering

UNIT-1:

1.1 Historical Background, overview and specific examples, nomenclature and classification of enzymes – IUB system, chemical nature and properties of enzymes.

1.2 Enzyme specificity (Absolute specificity, Group specificity, Broad specificity).

1.3 Enzyme catalysis, Quantitative measurement of enzyme activity, Assay of enzyme activity - units of enzyme activity.

1.4 Isolation and purification of enzymes, intracellular distribution of enzymes.

UNIT-2:

2.1 Theories of enzyme kinetics – kinetic theory and collision theory.

2.2 Enzyme kinetics and its importance, derivation of Michaelis – Menton equation, Methods of Vmax and Km determination, construction of Line Weaver Burk plots.

2.3 Effect of reactant concentrations (Rate constant, First order, Second order and Zero order kinetic reactions, Ramachandran plot, determination of slope).

2.4 Effect of Temperature, pH and enzyme concentration on reaction rate

UNIT-3:

3.1 Inhibition of enzyme activity (competitive, non- competitive, uncompetitive and mixed inhibition).

3.2 Kinetics of allosteric enzymes

3.3 Regulation of enzyme activity (Metabolic regulation), Catalytic efficiency of enzymes (feed back inhibition, covalent modification).

3.4 Mechanism of enzyme action (Lock and Key, Induced fit model), catalytic site, role of metal ions.

UNIT-4:

4.1 Clinical aspects of enzymology, Medical and Therapeutic applications of enzymes; Enzymes – Clinical diagnosis.

4.2 Immobilized enzymes, various methods of immobilization – ionic bonding, absorption, covalent bonding (based on R groups of amino acids).

4.3 Isoenzymes and multiple forms of enzymes

4.4 Enzyme engineering – economic importance of enzyme production. Enzymes in industries - food, biotechnology and other industries

Course Output:

1. Enzyme specificity, enzyme catalysis and isolation and purification of enzymes can be understood

2. Knowledge will be gained on theories of enzymes kinetics, enzyme kinetics and its importance, effect of reactant concentrations and effect of temperature of pH and enzyme concentration reaction rate

3. Inhibition of enzyme activity, kinetics of allosteric enzymes, regulation of enzyme activity and mechanism of enzyme action will be learnt

4. Clinical aspects of enzymology, immobilized enzymes, isoenzymes and enzyme engineering will be proficient

SUGGESTEDREADINGMATERIAL:

1. Biochemical calculations by I. H. Segel, 2nd Ed., John Wiley & Sons.

2. Biochemistry by D.Voet & J.G.Voet ,J. Wiley & Sons.

3. Enzyme Kinetics by I.W.Segil.

4. Enzyme Kinetics by D.V.Roberties, Cambridge University Press.

5. Harper's Biochemistry by Robert K. Murrey, Peter A. Mayer, D. K. Granner, V.W.Rodwell, Lange Medical.

SOC 206 (B): BIO RESOURCE TECHNOLOGY

(APICULTURE, SERICULTURE, AQUACULTURE, VERMICULTURE)

Course Objectives:

1. To understand Types of honey bees, life history of honey bees, management of apiculture and by products of honey bees and economic importance disease and their control
2. To learn historical back ground of sericulture, economic importance of silk
3. To become proficient on fresh water fin fish culture, shell fish (prawn and Pearls) culture
4. To understand historical background of Vermicompost, methods of Vermiculture and problems involved in Vermicompost

UNIT-1: APICULTURE

1.1 Types of Honeybees

1.2 Life History of Honeybees

1.3 Management of Apiculture

1.4 Byproducts of honeybees and economic importance, Disease and their control

UNIT-2: SERICULTURE

2.1 Historical back ground of Sericulture

2.2 Types of Silkworms, Life history of mulberry silkworm

2.3 Economic importance of Silk

2.4 Diseases of Silkworms

UNIT-3: AQUACULTURE

3.1 Fresh water fin fish culture

3.2 Shell fish (Prawn & Pearls) culture

3.3 Fish breeding (Bund & induced breeding)

3.4 Integrated fish farming and Economic importance of Aquaculture

UNIT-4: VERMICULTURE

4.1 Historical background of Vermicompost

4.2 Different methods of Vermiculture

4.3 Advantages and economic importance of Vermiculture, Vermicompost

4.4 Problems involved in Vermicompost

Course Output:

1. Types of honey bees, life history of honey bees, management of apiculture and by products of honey bees and economic importance disease and their control can be understood
2. Historical back ground of sericulture, economic importance of silk can be learnt
3. Fresh water fin fish culture, shell fish (prawn and Pearls) culture can be proficient
4. Knowledge can be gained on historical background of vermicompost, methods of vermiculture and problems involved in vermicompost

SUGGESTED READING MATERIAL:

1. Manual of fresh water Aquaculture by R.Santhanan in Oxford IBH Publications -1987.
2. Aquaculture principles by T.V.R.Pillay in Backwell scientific publications - 1993.
3. Biology, Culture and Production of Indian Major Carbs by Chakaraburthy, in N.M.Narendra publishing house, NewDelhi-1999.
4. Silkworm rearing, Oxford & IBH Publishing Co.Pvt.Ltd.NewDelhi-1997.
5. Silk Dyeing and Finishing, Oxford & IBH Publishing Co.Pvt.Ltd.NewDelhi-1997.
6. Economic Zoology, G.S.Shukla & V.B.Upadyay in Rastoogi publications, 1994.

Audit Course

ZOO-209 - Indian Knowledge Systems – 2

Learning Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of Indian Knowledge System.
- To help student to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
- To make students acquaint with the facets of traditional knowledge& their relevance and help them be able to apply it to their day to day life.

Learning Out comes:

- At the end of the course, students will be able to gain insights into the concept of traditional knowledge and its relevance.
- They will also be able to understand and connect up the basics of Indian traditional knowledge with modern perspective.

- Apply traditional knowledge for sustainability

SYLLABUS

Unit I : **Diversity and Indian Culture:** Diversity and Indian Culture; Indigenous Faith and Religion; Preservation of culture and indigenous knowledge .

Unit II : **Indian Calendar:** Panchanga. Adhikamasas. Solar and Luni-Solar systems.Solar and Lunar Eclipses Angular diameters of the Sun, Moon and Earth's shadow. Possibility of eclipses. Finding the middle of an eclipse by iteration. Amount of obscuration at any time.

Unit III : **Indian Architecture and Town Planning**: Introduction ancient Indian architecture; Sthapatya-Veda: An Introduction; Indigenous tools & techniques for town planning & Temple Architecture. Lothal, Mohan Jo Daro; Temple Art: Lepakshi Temple, Jagannath Puri Temple, Konark Sun Temple.

Unit IV : **Indian Agriculture:** Significance in Human Civilization; Sustainable Agriculture; Historical significance of agriculture and sustainable farming in India; Step Cultivation of India: Special reference to Northeast India; Wet rice cultivation of Assam.

Reference Books:

1. Baladev Upadhyaya, Samskrta Śāstrom ka Itihās, Chowkhambha, Varanasi, 2010.
2. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
3. Astāngahrdaya, Vol. I, Sūtrasthāna and Śarīrasthāna, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
4. Dharampal, The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
5. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavan RN. (2022), Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning Private Ltd.
6. Mukul Chandra Bora, Foundations of Bharatiya Knowledge System. Khanna Book Publishing

7. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
8. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
9. M. S. Sriram, Man and the Universe- An elementary account of Indian Astronomy, (Unpublished 1993).

COURE COURSE 301: CELL BIOLOGY AND IMMUNOLOGY

Course Objectives:

1. Able to learn organization of prokaryotic and eukaryotic cell, Nucleus structure, Eukaryotic chromosome and polytene and lamp brush chromosomes
2. To learn mechanism of cell division, regulation of eukaryotic cell cycle, chromosomal abnormalities and tumor biology
3. To understand types of immunity, types of cell involved in immune response, structure and function of antibody and complimentarily cascade
4. To gain knowledge on Antigen presentation, hypersensitivity reactions, immune tolerance and immunopathology

UNIT-1:

1.1 Organization of prokaryotic and eukaryotic cell Structure, function of Plasmamembrane, mitochondria endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes

1.2 Nucleus – Structure and function of nuclear membrane, nucleolus.

1.3 Eukaryotic chromosome and its high resolution organization

1.4 Polytene and lamp brush chromosomes

UNIT–2:

2.1 Mechanism of cell division, mitiotic apparatus, cytokinesis, chromosome movement – present concept

2.2 Regulation of eukaryotic cell cycle – A over view of cell cycle, Mutation causing cell cycle control. Meiotic process - stages, chromosome pairing, chiasma formation Molecular mechanisms of recombination, synaptonemal complex, non-dysjunction,

2.3 Chromosomal abnormalities - euploidy, haploidy and their fundamental practical significance, Polypliody - induction -Aneuploidy- type and genetic significance

2.4 Tumor biology - cell to cell interaction, cell adhesion, cell transformation mechanism and oncogenesis

UNIT–3:

3.1 Immunity - innate and acquired, innate immune mechanisms, Immunogen and antigens – Properties, factors governing immunogenicity, haptens, epitopes - size and identification. Adjuvants - properties and mechanism of action.

3.2 Cells involved in the immune response – T cells, B cells, CD antigens, neutrophils, Eosinophils and natural killer cells. Macrophages, dendrites, Phagocytosis, Lymphoid tissues.

3.3 Functions of antibody in relation to structure – Antigen - antibody interactions, affinity of antibody, avidity, bonus effect, classical precipitin reaction, antigen - binding site of antibody, forces involved in antigen – antibody complex formation, Generation of antibodies, Theories of antibody formation. Monoclonal and polyclonal antibodies

3.4 Complement-nature, physic – chemical properties, complement cascade pathway, complement fixation

UNIT–4:

4.1 Antigen Presentation – pathways of antigen processing and presentation of intracellular and extracellular antigens. Cell mediated immunity (CMI) : Induction and mechanism

4.2 Hypersensitivity reactions – Classification, Type I – IV reactions. Immunity to bacterial, fungal, viral and parasitic diseases. Allergy : classification and details.

4.3 Immune tolerance, immune suppression, Transplantation and G.V.H. reactions

4.4 Immuno pathology - Auto immune diseases; immune complex diseases; immune deficiency diseases; immunity to infection.

Course Output:

1. Organization of prokaryotic and eukaryotic cell, Nucleus structure, Eukaryotic chromosome and Polytene and lamp brush chromosomes will be understood

2. Mechanism of cell division, regulation of eukaryotic cell cycle, chromosomal abnormalities and tumor biology can be learnt

3. Types of immunity, types of cell involved in immune response, structure and function of antibody and complimentarily cascade will be proficient

4. Knowledge will be gained on Antigen presentation, hypersensitivity reactions, immune tolerance and immune pathology

SUGGESTEDREADINGMATERIAL:

1. Cell and Molecular biology by EDR De Robertis and EMR DeRobertis Jr, Indian edition by B.I.Publications,Pvt. Ltd.

2. The Cell (A Molecular Approach) by Geoffrey M.Cooper, 7th Edition

3. Kuby,J. Immunology,7th edition, W.H.Freeman and Company, New York.

4. Janeway's Immunobiology, 9th edition, Garland Science.

COURE COURSE 302 (A): DRUG DESIGNING AND DEVELOPMENT

Course Objectives:

1. To learn drug design, analog approach of drug designing
2. To understand SAR Vs QSAR, Partition coefficient, Hammets substituent constant and Tafts steric constant, Free Wilson mode, 3D-QSAR approach like COMFA and COMIA
3. To gain knowledge on pharmacological screening and assays, pharmacological screening models for therapeutic areas, cell based assay, biochemical assay, radiological binding assay, small molecule manufacturing
4. To learn Drug Laws, FDA, OECD, ICH, Schedule Y, drug registration, Regulations of human pharmaceuticals and biological products, and clinical trial design

UNIT-1:

1. History of drug design, Current approaches and challenges in drug design.
2. Conventional Methods: Lead, Discovery of lead, Lead optimisation, Objective of lead optimization.
3. Analog approach of drug designing : Bioisosteric replacement, rigid analogs
4. Alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

UNIT-2:

2.1 SAR versus QSAR, History and development of QSAR, Objectives of QSAR

2.2 Types of physicochemical parameters, experimental and theoretical approaches for the determination of physic-chemical parameters such as Partition coefficient, Hammets substituent constant and Tafts steric constant.

2.3 Hansch approach, Free-Wilson model, statistical methods, Non-computer-assisted search operations like Topliss decision tree, Simplex method, Fibon accisearch technique

2.4 3D – QSAR approaches like COMFA and COMSIA.

UNIT-3:

3.1 Pharmacological Screening and Assays: General principles of screening, correlations between various animal models and human situations.

3.2 Pharmacological screening models for therapeutic areas, Correlation between in - vitro and in – vivo screens

3.3 Special emphasis on cell-based assay, biochemical assay, radiological binding assay, high through put screening, specific use of reference drugs and interpretation of results

3.4 Manufacturing & process development; small molecule manufacturing; development of protein therapeutics and vaccines.

UNIT-4:

4.1 Drug Laws, FDA, OECD, ICH, Schedule Y, Design non clinical toxicity studies and clinical development, clinical risk / benefit analysis

4.2 Drug registration: Regulatory affairs, WTO, Patentregime, Accreditation and harmonization process.

4.3 Regulations of human pharmaceuticals and biological products. Clinical Trials: Phases of clinical trial, Non-randomized studies and Randomized controlled trials

4.4 Statistics in clinical research, sample size and assessment of clinical trials

Course Output:

1. Drug design, analog approach of drug designing can be understood
2. SAR Vs QSAR, Partition coefficient, Hammets substituent constant and Tafts steric constant, Free Wilson mode, 3D-QSAR approach like COMFA and COMIA can be learnt
3. Knowledge will be gained on pharmacological screening and assays, pharmacological screening models for therapeutic areas, cell based assay, biochemical assay, radiological binding assay, small molecule manufacturing
4. Drug Laws, FDA, OECD, ICH, Schedule Y, drug registration, Regulations of human pharmaceuticals and biological products, and clinical trial design can be learnt

SUGGESTEDREADINGMATERIAL:

1. Comprehensive Medicinal Chemistry,Vol.IV, Quantitative Drug Design, C. Hansch,Ed.
2. Burger‟s Medicinal Chemistry and Drug Discovery, Vol.I, Vedition, M.E. Wolff.Ed.
3. Quantitative Drug Design, A Critical Introduction, Y.C. Martin, Marcell Dekker.
4. Theoretical Drug Design Methods, Vol. 7, R.Franke, Elsevier,1988.
5. The Organic Chemistry of Drug Design and Action, R.B. Silverman, Academic Press.
6. The Organic Chemistry of Drug Design and Drug Action, by R.B. Silverman.
7. An Introduction to Medicinal Chemistry by G. L. Patrick.
8. Martin YC.“Quantitative Drug Design” Dekker, NewYork.
9. Lien EJ. SAR “Side effects and Drug Design” Dekker, NewYork.
10. William H, Malick JB “Drug Discovery and Development” Humana Press Clifton.
11. Foye WO “Principles of Medicinal chemistry,, Lea & Febiger.
12. Korolkovas A, Burckhalter JH.“Essentials of Medicinal Chemistry” Wiley Interscience.

COURE COURSE 302 (B): ANIMAL GENOMICS AND PROTEOMICS

Course Objectives:

1. To learn structure of Prokaryotic and Eukaryotic genomes, Isolation and purification of genomic DNA, Construction of Physical maps and Whole genome sequence alignment
2. To understand genome annotation, methods for gene identification, functional genomics, transcript profiling
3. To learn protein structure, sample preparation and separation 2D-analysis, Multidimensional liquid chromatography, protein-protein interactions analysis
4. To gain knowledge on DNA /protein sequence homologies, Gene duplication and divergence, and evolution of novel genes and proteins, DNA quantities and non-coding sequences (transposons) in genome evolution

UNIT-1.

1.1 The structure of Prokaryotic and Eukaryotic genomes

1.2 Isolation and purification of genomic DNA. Generation of BAC and YAC libraries.

1.3 Construction of Physical maps–Restriction maps, FISH and STS maps. Maxim & Gilbert, Sanger and Next generation DNA sequencing methods.

1.4 Whole genome sequence alignment; Clone by clone and Shot gum sequencing. Finished sequences and DNA sequence data bases.

UNIT-2.

2.1 Genome annotation, methods for gene identification (location)

2.2 Assigning gene function by experimental analysis: gene inactivation by homologous recombination, RNA interference (RNAi) and gene knockout.

2.3 Functional genomics: Array fabrication, types, method and application of DNA Micro arrays.

2.4 Transcript profiling: Serial analysis of gene expression (SAGE) and Massively parallel signature sequencing (MPSS)

UNIT-3.

3.1 Protein structure: secondary structures, domains, motif and folds

3.2 Sample preparation and separation–2D-analysis,Multidimensional liquid chromatography.

3.3 Characterization of proteins by Mass spectrometry and protein sequencing. Protein microarrays.

3.4 Protein-protein interaction analysis; yeast hybrid systems, phage display and protein complexes.

UNIT-4.

4.1 DNA/protein sequence homologies–Analogy, Orthology and Paralogy.

4.2 Gene duplication and divergence, and evolution of novel genes and proteins

4.3 DNA quantities and non-coding sequences (transposons) in genome evolution.

4.4 Molecular clocks, Molecular Phylogenetics and construction of phylogenetic trees. Applications of genomics in medicine, agriculture and industry.

Course Output:

1. Structure of Prokaryotic and Eukaryotic genomes, Isolation and purification of genomic DNA, Construction of Physical maps and Whole genome sequence alignment can be learnt

2. Genome annotation, methods for gene identification, functional genomics, transcript profiling can be understood

3. Protein structure, sample preparation and separation 2D-analysis, Multidimensional liquid chromatography, protein-protein interactions analysis can be proficient.

4. Knowledge will be gained on DNA /protein sequence homologies, Gene duplication and divergence, and evolution of novel genes and proteins, DNA quantities and non-coding sequences (transposons) in genome evolution

SUGGESTEDREADINGMATERIAL:

1. Griffiths,A.J.F.,Miller,J.H.,Suzuki,D.T.,Lewontin,R.C.,andGalbert,W.M.2000.Anintrod uction to Genetic Analysis, W.H. Freeman Publishers, New York.

2. Douglas J. Futuyma,1998. Evolutionary Biology (3rd.Ed). Sinauer Associates, Inc. Publishers.

3. Brown, T.A. 1999. Genomes 3.John Wiley & Sons, New York, USA.

4. Primrose, S.B .& Twyman, R.M. 2003.Principles of Genomic Analysis and Genomics. (7th Ed.). Black well Science.

5. Brown,T.A. 2001. Gene cloning and DNA Analysis-An introduction (5thEd.), Black well Scientific Publications, Oxford, U.K.

6. Robert F.Weaver. 2008. Molecular Biology(4th Ed.). McGraw Hill Higher Education.

7. Gustafson, J.P.2000. Genomes, Kluwer Academic plenum publishers, NewYork,USA.

8. Jolls, O. and Jornvall, H.(eds.) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.

9. Biochemistry by Lubert Strye r(5th Ed.) (Freeman-Toppan).

COURE COURSE 303(A): TOXICOLOGY

Course objectives:

While studying the Toxicology course, the student shall be able to:

1. Provides broad theoretical knowledge within toxicology and development of a general workingknowledge of the principles and practice of clinical toxicology.
2. Basic toxicology concepts including: mechanisms of toxicology, absorption, distribution and excretion of toxicants, xenobiotic metabolism, toxicokinetics, chemical carcinogenesis, hepatotoxicology. Based on student interest some of the following areas may be included: genetic toxicology, developmental toxicology, renal toxicology, toxic effects of pesticides, toxic effects of metals, toxic effects of radiation, venoms and animal poisons, air pollution, ecotoxicology, food toxicology, forensic toxicology, occupational toxicology, regulatory toxicology, other.
3. This course includes the study of Pesticides that are agrochemicals and used for

   preventing, repelling, mitigating or destroying any pests. It includes insecticides, fungicides, rodenticides and herbicides etc. These insecticides are of chemical or biological origin that control the insect. The course indicates the mechanism of Pest control that may result in the form of killing theinsects or otherwise preventing it from its destructive behaviors. Insecticides are either natural.

Unit-1

1. Definition and scope of toxicology, History of toxicology and Toxic agents & their classification.
2. Principles of toxicology, Dose-response relationship, Acute and Chronic toxicity tests (LD50, LC50, ED50).
3. Receptor concept, Toxicant-receptor interactions, and Mechanism of toxic action of pesticides.
4. Toxicokinetics: i) Classic toxicokinetics, ii) Physiologic toxicokinetics

Unit-2

1. Translocation, Absorption, Distribution and Excretion of Toxicants.
2. Biotransformation of Xenobiotics and Enzymes reactions.
3. Bioconcentration, Bioaccumulation, and Biomagnification of Xenobiotics, Biomagnification of Lipophilic Pesticides.
4. Toxic Effects of Metals: Mercury, Lead, Cadmium, and Arsenic.

Unit-3

1. Toxic Response of Blood, Toxicology of Erythron, Leukon, Platelets, and Impact on Homeostasis.

2. Toxic Response of Liver and Detoxification Mechanisms.

3. Toxic Response of Kidney, Toxic Injury, Biochemical Mechanisms of Renal Cell Injury.

4.Toxic Response of the Reproductive System, Testicular Dysfunction, Ovarian Dysfunction.

Unit-4

1. Xenobiotic effect on basic metabolism (carbohydrates and proteins).

2. Teratogens and teratology: Relationships between maternal and developmental toxicity.

3. Types of antidotes, Antidotal procedures and Antidotal therapy.

4. Risk assessment: Hazard identification, Risk characterization, and Safety evaluation of chemicals.

Course outcomes:

1. The awareness about toxic agents, their effects and knowledge about mode of transformation of toxicants will help in creating skilled personnel in the field of environment protection and research.

2. It is a discipline overlapping with biology, chemistry, medicine that involves the study of toxicants, their mechanism of action.

3. It involves the study of the adverse effects of chemical substances on living organisms.

4. Skill development in environmental and occupational Toxicology.

5. It provides opportunities for students research projects, internships in assessing the effects of toxic pollutants on the environment and in the food chain.

6. Identification of different routes of exposure of environmental toxins.

7. Understanding of the physiological and genotoxic effects of drugs and environmental toxins.

8. Knowledge of various techniques for Toxicity evaluation.

SUGGESTED READING MATERIAL

1. Casarett& Doul's- Toxicology- The basic science of poisons- C.D. Klassen, Mary, O.D & John Doull.

2. Concepts of Toxicology Dr. Omkar, Vishal Publishing C.2003.

3. Environmental toxicology of pesticides- F. Mastimura, G.M.Boush and T.Misato.

4. Introduction of Biochemical Toxicology- E.Hodgson&F.E.Gutherie.

5. Pesticides action and metabolism- O'Brrien.

6. Pesticides and Human Welfare- D.L. Gunn and J.G.R.Stevens. Oxford University Press-1978.

7. The Encyclopedia of Americana- Vol.15

COURE COURSE 303(B): CANCER BIOLOGY

Course Objectives:

1. To gain knowledge on cancer types and tumor development
2. To learn oncogenes, mechanisms of onogene activation and chromosomal translocation
3. To understand cell cycle regulation and cancer, DNA Damage and repair
4. To learn tumor immunology, Vaccine development, tumor cell evasion of immune defenses

UNIT-1

1.1 Introduction: Cancer types, Characteristics of cancer cells.

1.2 Carcinogenesis: Cancer initiation, promotion and progression, termination.

1.3 Factors responsible for carcinogenesis: Physical, chemical and biological.

1.4 Tumor Development: Models, Tumor angiogenesis. Overview of invasion and metastasis. Cell-cell interactions in cancer. Invasion and the extra cellular matrix. Specific cases of Prostate, Breast, Intestinal cancers.

UNIT-2

2.1 Oncogenes and their role in Cancer: Introduction to oncogenes

2.2 Mechanisms of oncogene activation (gene amplification)

2.3 Mechanisms of oncogene activation (chromosomal translocations).

2.4 Chromosomal translocations with dominant negative effects. Introduction to tumor suppressor

UNIT-3.

3.1 Cell- Cycle Regulation and Cancer: Mutations affecting mitogenic signal transduction pathways. Cell Cycle Regulation - Mutations affecting the cell cycle. Loss of check point control and geneticin stability. Replicative senescence

3.2 DNA Damage, Repair failure and Carcinogen Mechanisms: Carcinogens, DNA damage and repair.

3.3 Carcinogenesis: Chemical and physical agents

3.4 Carcinogenesis: Repair mechanisms. Aberrant repair and genetic instability. Genetic predisposition to cancer.

UNIT-4

4.1 Tumor Immunology: Tumor immunology [tumor antigens, cytokines]

4.2 Vaccine development, Immuno therapy and its limitations

4.3 Tumor cell evasion of immune defenses

4.4 Principles of chemotherapy and chemoprevention. Drug screens: High throughput Screening (HTS) approaches

Course Output:

1. Cancer types and tumor development can be understood
2. Oncogenes, mechanisms of onogene activation and chromosomal translocation can be learnt
3. Cell cycle regulation and cancer, DNA Damage and repair can be understood
4. Tumor immunology, Vaccine development, tumor cell evasion of immune defenses can be leant

SUGGESTEDREADINGMATERIAL:

1. Oxidative Stress and Inflammatory Mechanisms in Obesity, Diabetes and the Metabolic Syndrome, Edited by Lester Packer and Helmut Sies, CRC Press LLC(2007).
2. OxidativestressandneurodegenerativedisorderS.G.AliQureshiandS.HasanParvez, Elsevier, St.Louis, MO63146 USA (2007).
3. Oxidative Stress Disease and Cancer. Edited by Singh, World Scientific Publishing (2006).
4. Fatty Acids and Oxidative Stress in Neuropsychiatric Disorders. Edited by Ravinder, M.D.Reddy and Jeffrey K.Yao, Nova Science Pub Inc (2007).
5. Oxidative Stress, Inflammation and Health. Edited by Young- Joon Surhand Lester Packer, CRC Press LLC (2005).
6. Critical Reviews of Oxidative Stress & Aging. Edited by Cutler, World Scientific Publishing (2002).
7. Free Radicals, Oxidative Stress, and Antioxidants: Pathological and Physiological Significance Edited by Tomris Özbenm, Springer (1998).

SOC 305 (A) BIOANALYTICAL TECHNIQES-II

Course Objectives:

While studying the Bioanalytical Techniques, the student shall be able to:

1. To study the different tools used in biology and research.

2. To learn about the operational handling and maintenance of laboratory instruments and glassware.

3. To study different types of Electrophoresis techniques used in biology.

4. To learn about different microscopic techniques and their application in biological research.

5. To study principles and types of isotypes their application in biological research.

6. To learn about the operational handling and maintenance of laboratory for

Cell culture.

UNIT-I

1.1 Migration of an Ion in an Electric Field - Factors Affecting Electrophoretic Mobility - Types of Electrophoresis - 1. Free Electrophoresis - 2. Zone Electrophoresis –

1.2 General Techniques of Zone Electrophoresis - 1. Paper Electrophoresis - 2. Cellulose Acetate Electrophoresis 3. Gel Electrophoresis –

1.3 Specialized Electrophoretic Techniques: Discontinuous (Disc) Gel Electrophoresis; Gradient Electrophoresis - 3. High Voltage Electrophoresis (nv.E.) - 4. Isoelectric Focussing - 5. Two-Dimensional Gel Electrophoresis-6 Immunoelectrophoresis - 7. Pulse-Field Gel Electrophoresis - 8. Electrophoresis on Cellular Gels - 9.

1.4 Capillary Electrophoresis - Electrophoresis in Genetic Analysis - 1. Restriction Mapping - 2. Southern Transfer - 3. Gel Retardation or Band Shift Assay 4. DNA and protein Sequencing and - 5. DNA Foort printing.

UNIT-II

2.1 Techniques of Chromatography - Plane Chromatography -Paper Chromatography - Thin-Layer Chromatography-

2.2 Column Chromatography - Types of Chromatography - Adsorption Chromatography – Partition Chromatography-Liquid-Liquid Chromatography -Gas-Liquid Chromatography (GLC)-

2.3. Gel Permeation Chromatography - Ion Exchange Chromatography - Affinity Chromatography –

2.4 High Performance Liquid Chromatography - Some Specialized Techniques - Hydroxyapatite Chromatography - An Affinity System for Base Dependent Fractionation of DNA - An Affinity System for Fractionating supercoiled and Non-Supercoiled DNA - DNA-Cellulose Chromatography.

UNIT-III

ISOTOPES IN BIOLOGY

3.1 Radioactive Decay - Production of Isotopes - Synthesis of Labeled Compounds - Interaction of Radioactivity with Matter - Measurement of Radioactivity –

3.2 Methods Based Upon Gas Ionization - A. Ionization Chambers - B. Proportional Counters - C. Fundamentals of Geiger Counters –

3.3 Photographic Methods

3.4 Methods Based Upon Excitation - A. Liquid Scintillation Counting - Use of Stable Isotopes in Biology - The Tracer Technique - Use of Isotopes as Tracers in Biological Sciences - Some Information About Commonly Used Isotopes - Safety Aspects - Dosimetry.

UNIT-IV

4.1 The Cell Culture Laboratory and Equipment

4.2 Safety Considerations in Cell Culture Aseptic Techniques and Good Cell Culture Practice.

4.3 Types of Animal Cells, Characteristics and Maintenance in Culture

4.4 Cell-Disruption Methods -Preliminary Purifi cation Steps, Monitoring Protein Purification.

Course Outcomes:

While studying the Bioanalytical Techniques II, the student shall be able to:

1. Students will understand the different tools used in biology and research.

2. Students would gain expertise the operational handling and maintenance of laboratory instruments and glassware.

3. Students would gain expertise different types of Electrophoresis techniques used in biology.

4. Students will understand different microscopic techniques and their application in biological research.

5. Students would gain expertise principles and types of isotypes their application in biological research.

6. Students would gain expertise about the operational handling and maintenance of laboratory for Cell culture

SUGGESTED READING MATERIAL:

1.Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.W. Goulding, ELBS Edn.

2. Animal Cell Culture – A practical approach, Ed.John. R. W.Masters IRL Press.

3. General Zoological Microtechniques - P.M. Weesner.

4. Principles and techniques of Biochemistry and molecular biology by Kein Wilson and John Walker, VIII volume, Cambridge press Edition.

5. Neuro anatomical Techniques, N.J. Stransfed and T.A. Miller Springer Verlag, New York Heidelberg, Berlin.

6. Principles of Neuro Phychopharmacology- Robert S. Feldman, Jerrold S. Meyer and Lind F. Quenzer. Sinauer Associates, Inc. Publishers. Sunderland. Massachusetts.

7. Biophysical chemisty by Upadhyay – Upadhyay - Nath.

8. Analytical Biochemistry (Biochemical techniques) by Dr P. Asokan. Chinnaa publications.

9. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International Edition.

10. Vogel's Qantitative Chemical Analysis by Vogel, ArthurI.

SOC 305(B): BIOSTATISTICS AND BIOINFORMATICS

Course Objectives:

1. To know the importance of bioinformatics, internet basics, sources of websites and data base types
2. To understand prediction of protein structure and protein sequence database, prediction of gene structure, submission of sequence to database, phylogenetic analysis.
3. To learn biostatistics, measures of location and dispersion, curve fitting and correlation and regression
4. To understand probability distribution, tests of significance, student t-test and F-test, chi square test and their application

UNIT-1

1.1 Scope, importance and status of Bioinformatics

1.2 Internet basics, Tools for web search, Data retrieval tools

1.3 Sources of websites

1.4 Database types - primary, secondary and specific annotation databases

UNIT-2

2.1 Database types, Prediction of protein structure and protein folding, Protein sequence databases.

2.2 Prediction of gene structure, Functional genomics, Genomic databases

2.3 Submission of sequence to the database, Homology, BLAST- Types of BLAST

2.4 Phylogenetic analysis, Human genome project

UNIT-3

3.1 Definition of statistics: Biostatistics, classification, variables and attributes, Diagrammatic distribution of biological data.

3.2 Measures of location and dispersion: Arithmetic mean, median and mode. Mean deviation, quartile deviation, Standard deviation and co-efficient of variation

3.3 Curve fitting: Fitting strait line, parabola exponential curve. Fitting of straight line using Ms-Excel

3.4 Correlation and regression: Scatter diagram, types of relationship. Positive and negative correlation, computation of correlation coefficient, Interpretation of correlation coefficient. Simple regression lines and its interpretation

UNIT-4:

4.1 Normal probability distribution & its applications

4.2 Tests of significance: level of significance, null and alternative hypothesis, power of test and p-value of a test

4.3 Student-test for one a sample and two samples means - paired t-tests

4.4 F-test, chi square test and their application, concept of ANOVA.

Course Output:

1. Importance of bioinformatics, internet basics, sources of websites and data base types can be understood
2. Prediction of protein structure and protein sequence database, prediction of gene structure, submission of sequence to database, phylogenetic analysis can be learnt
3. Knowledge will be gained biostatistics, measures of location and dispersion, curve fitting and correlation and regression
4. Probability distribution, tests of significance, student t-test and F-test, chi square test and their application can be understood

SUGGESTEDREADINGMATERIAL:

1. Basic Bioinformatics by S. Ignacimuthu, S.J. Narosa publications, 2005.
2. Bioinformatics by Andreas D. Baxevanis and B.P. Francis Ouellette, 2nd Ed., 2002.
3. Bioinformatics,Methods and Applications, Genomics proteomics and drug discovery, S.C.Rastogi,N. Mendiratla and P. Rastogi, prentice-Hall of India, 2004.
4. Microsoft Office, by Setultz, 1997.
5. Bio-Statistics-An introduct ory text- Gold stein, A The Macmillan Co.,New York,1971.
6. Biostatistics by Lewis Alvin (1971) Affiliated East West Press pvt., Ltd., New Delhi.
7. Interpretation and uses of Medical Statistics – G.J.Bourke & J.Mc.Gilvaray, Blovk well Science Publication, London, 1969.
8. Introduction to Biostatistics– By Sokal – Rohlf (2ndEdn) Freeman International Editor (1973).
9. Introduction to Biostatistics by Holdan Bancroft (1962) Pual B. Hoebar Inc. New York

10. Introduction to Instrumental analysis Ronert Braun.McGraw Hill International edition

SOC 306(A): MICROBIOLOGY

Course Objectives:

1. To understand microorganisms classification and structure of prokaryotic and eukaryotic micoorganism
2. To get knowledge on Nutritional requirements to microorganisms, growth of microorganism, control of microorganism and microbes of biotechnological importance
3. To become proficient in chemical nature of gene, plasmids incompatibility, horizontal transfer of genome among the microbial community and Benzer's classical studied on II locus
4. To learn diseases caused by micoorganisms

UNIT-1.IntroductiontoMicrobiology

1.1 Discovering the microbial world. Classification of microorganisms upto order level-bacteria, algae, fungi, protozoa.

1.2 Structure of prokaryotic and eukaryotic microorganisms. General and distinctive characteristics of the major groups of microorganism bacteria, mycoplasma, chalmidae, rickettsias, actinomycetes, fungi, algae, protozoa Prions and viruses.

1.3 Isolation, cultivation and enumeration of microorganisms - direct and indirect methods, Maintenance of culture.

1.4 Outlines of characterization and identification of common bacteria, fungi, algae and protozoa.

UNIT–2. Microbial nutrition, growth and regulation

2.1 Nutritional requirements to microorganisms - Mode of nutrition - phototrophy, chemotrophy - methylotrophyorganotrophy, mixotrophy, saprophytic, symbiotic and parasitic, Interaction of microbes.

2.2 Growth of microorganism (bacteria) - normal and biphasic growth curve, batch and continuous cultures, chemostats, shift up and shift down. Growth determination, Microbial metabolism - energy yielding and energy requiring processes.

2.3 Control of microorganisms - principles, physical and chemical agents, Assay of antimicrobial action. Batch and continuous sterilization of media and air. Viruses - nature, cultivation and assay methods, structure, physico-chemical properties, classification, pathogenicity, Replication of viruses.

2.4 Microbes of biotechnological importance - examples of bacteria, yeast, algae and viruses.

UNIT-3.Microbial Genetics

3.1 Chemical nature of gene, Concept of gene, operon, mosaicgenes/split genes.

3.2 Plasmids incompatibility. Classification: copy number, control and its significance. Structure and functions of insertion elements (IS)-transposable elements. Mechanism of transposition. Catabolic transposons and their significance.

3.3 Horizontal transfer of genome among the microbial community - transformation, conjugation transduction - generalized transduction, specialized transduction – cotransduction.

3.4 Benzer‟s classical studies on IIlocus. Cistron complementation – Elucidation of co-linearity between DNA and protein sequence. Genetics of viruses – bacteriophage, lambda, SV40, retroviral genome (HIV), replication, lytic and lysogeniccascades.

Unit-4.Diseases caused by microorganisms

4.1 Viral diseases: Flu, Dengue fever, Hepatitis,

4.2 Bacterial diseases: Cholera, tuberculosis, anthrax,

4.3 Fungal diseases: Athlets foot, Dutch Elm disease, ergotism

4.4 Protozoadiseases(Protista):Malaria,Sleepingsickness,dysenteryAndPlantPathogens:TMV, Rust

Course Output:

1. Microorganisms classification and structure of prokaryotic and eukaryotic microorganism can be learnt
2. Nutritional requirements to microorganisms, growth of microorganism, control of microorganism and microbes of biotechnological importance can be understood
3. Chemical nature of gene, plasmids incompatibility, horizontal transfer of genome among the microbial community and Benzer’s classical studied on II locus can be proficient
4. Diseases caused by microorganisms can be understood

SUGGESTED READING MATERIAL:

1. Microbiology-M.J. Pelczar, E.C.S. Chan, Noel R.Krieg. Tata McGraw-Hill Edition.
2. Prescott's Microbiology-Christopher J. Woolverton, Linda Sherwood, Joanne Willey. Tata McGraw-Hill Edition.
3. Textbook of Microbiology- Ananthanarayan and CJ Paniker,7thEdition

SOC 306(B): Vaccine Biotechnology and Applications

Course Objectives:
Understanding different approaches of vaccine development and production
UNIT I

History of vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems

UNIT II

Instruments related to monitoring of temperature, sterilization, environment, quality assurance and related areas. Production techniques, growing the microorganisms in maximum titre, preservation techniques to maintain good antigen quality, freeze drying.

UNIT III

Introduction to newer vaccine approaches namely sub-unit vaccines, synthetic vaccines, DNA vaccines, virus like particles, recombinant vaccines, edible vaccines, Nano particles in vaccine delivery systems, etc.

UNIT IV

Introduction to pharmacopeal requirement, disease security and biosecurity principles and OIE guidelines such as seed management, method of manufacture, in-Process control, batch control, tests on final product.

SUGGESTED READING MATERIAL:

1. Barry R Bloom, Paul-Henri Lambert 2002. The Vaccine Book. Academic Press.
2. Levine MM, Kaper JB, Rappuoli R, Liu MA, Good MF. 2004. New Generation Vaccines. 3rd Ed. Informa Healthcare.
3. Lowrie DB & Whalen R. 2000. DNA Vaccines. Humana Press.
4. Robinson A & Cranage MP. 2003. Vaccine Protocols. 2nd Ed. Humana Press.