ST.JOSEPH'S COLLEGE (AUTONOMOUS), IRINJALAKUDA
College with Potential for Excellence

BACHELOR OF SCIENCE IN BIOTECHNOLOGY

(CHOICE BASED CREDIT AND SEMESTER SYSTEM)

Syllabus For
B.Sc. Biotechnology Programme
(2019-20 admission onwards)

PROGRAMME OUTCOMES

At the end of a UG programme, a student would have :

1. Acquired adequate subject knowledge
2. Attained a foundation for higher and lifelong learning
3. Comprehended the basics of research and analytical skills
4. Obtained sound moral and ethical values
5. Become conscious of environmental and societal responsibilities
6. Attained communication skills and entrepreneurial competency
7. Ability to acknowledge diverse ideas and different points of view
8. Become empowered to face the challenges of the changing world

PROGRAMME SPECIFIC OUTCOME

PSO1	**Understanding the types of cells, cell structure and function at biochemical, molecular and genetic level**
PSO2	**Illustrate the cellular molecular and biochemical process that provide the platform for basic research in Biosciences**
PSO3	**Perform procedures in cell biology, microbiology, genetics, biochemistry, Environmental Biotechnology, Molecular Biology, Bioprocess technology, Plant tissue culture and immunology as per laboratory standards**
PSO4	**Understand the applications of Biotechnology in environment Protection, Medical field, Agriculture and industry**

B.Sc. Biotechnology
COURSE STRUCTURE UNDER CCSS

	Course Title		Instruc. Hrs/Week	Credit	Exam Hrs	Marks		
						Int.	Ext.	Total Credit
I semester								
	Common Course		4	4	2/2.5 hrs	20%	80%	19+4 credits
	Common Course		5	3				
	Common Course		5	4				
SJBTY1B01	Core Course I	Cell biology	3	3				
	1st Complimentary course –1	Chemistry	2	3				
	1st Complimentary course Practicals -1	Chemistry Practical	2					
SJBTY1C 01	2nd Complimentary course-1	Environmental Biotechnology	2	2				
	2nd Complimentary course Practicals – 1	Environmental Biotechnology	2	--				
	Audit course I	Environment studies	------- 25	---- 19 4				
II semester								
	Common course		4	4	2/2.5 hrs	20%	80%	19+4 credits
	Common Course		5	3				
	Common Course		5	4				
SJBTY2B 02	Core course II	General Microbiology	3	3				
	1st Complimentary Course II	Chemistry	2	3				
	1st Complimentary Practical II	Chemistry practical	2	*				
SJBTY2C02	2nd Complimentary Course II	Environmental Biotechnology	2	2				
	2nd Complimentary Course Practicals II	Environmental Biotechnology	2	*				
	Audit course 2	Disaster Management	------ 25	----- 19 4				
III semester								
SJA11	General Course	Biodiversity-Scope and Relevance	5	4				
SJA12	General Course	Research Methodology	5	4				
SJBTY3BO3	Core Course	Biochemistry	3	3				

SJBTY3BO4(P)	Core Course Practical I	Biochemistry	2	3	2/2.5 hrs	20%	80%	19+4 credits
	1st Complimentary course III	Chemistry	3	3				
	1st Complimentary Practical III	Chemistry	2	*				
SJBTY3C03	2nd Complimentary Course III	Environmental Biotechnology	3	2				
	2nd Complimentary Practical III	Environmental Biotechnology	2	*				
	Audit course 3	Humanrights/consumer Protection	25	19 4				

IV semester

SJA13	General Course	Natural Resource Management	5	4	2/2.5 hrs	20%	80%	24+4 credits
SJA14	General Course	Intellectual Property Rights	5	4				
SJBTY4BO5	Core Course IV	Genetics	3	4				
	1st Complimentary Course IV	Chemistry	3	3				
	1st Complimentary Practical IV	Chemistry practical	2	*				
SJBTY4 C04	2nd Complimentary Course IV	Environmental Biotechnology	3	2				
SJBTY4 C05(P)	2nd Complimentary Practical IV	Environmental Biotechnology practical	2	4				
SJBTY4 B06 (P)	Core Course Practical II	Practicals in Genetics	2	3**				
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			25					
	Audit course	Gerontology/Gender studies		24 4				

V semester

SJBTY5B 07	Core Course V	Molecular Biology	4	3	2/2.5 hrs	20%	80%	22 credits
SJBTY5BO8	Core Course VI	Immunology and Immuno-technology	4	3				
SJBTY5B09	Core Course VII	Bioprocess Technology	4	3				
SJBTY5B 10(P)	Core Course Practical III	Practicals in Molecular Biology	4	4**				
SJBTY5 B 11(P)	Core Course Practical IV	Immunology and Immuno-technology practical	4	4**				
SJBTY5D 01	Open Course-1 (From other department)	Introduction to Biotechnology	3	3				

SJBTY5B12(P)	Core Course Practical V	Practical's in Bioprocess technology	4 ------- 25	2 ------ 22				
SJBTY6B18	• Project work							
VI semester								
SJBTY6B13	Core course VIII	Plant Biotechnology	4	3	2/2.5 Hrs	20%	80%	17 credits
SJBTY6B14	Core Course IX	Animal Biotechnology	3	3				
SJBTY6B15	Core Course X	Recombinant DNA Technology and bioinformatics	3	3				
SJBTY6B16(P)	Core Course VI Practical	Plant Biotechnology Practical	4	3**				
SJBTY6 B17	Elective Course – (from same subject/ department)	Medical Biotechnology	3	3				
SJBTY6 B18	• Project	Combined Project of 5 students in each group	4 ------- 25	2 ------ 17				

Credits (19+19+19+24+22+17=120

Combined project of 2 group with 5 students starts in the V Semester

*Credits for the complimentary course practicals will be awarded at the end of the IV semester.

** Credits for the main course practical will be awarded at the end of the sixth semester.

Credits for common course and genral courses 22+16		38
Credits for core course including project and elective		55
Credits for complimentary courses	24	
Credits for open course		03
Credits for Audit course		16

N.B.

- Common courses for Semester I and II have been retained as in previous syllabus while that for Semester III have been changed to ‘Biodiversity – Scope and Relevance’ and ‘Research Methodology’ and that for Semester IV are ‘Natural Resource Management’ and ‘Intellectual Property Rights’ as per the decision of Combined meeting of BoS Chairmen discussion on subjects following LPR pattern.
- The project work starts in the V semester and ends on VI Semester.
- A group of 5 students shall be given the combined project to minimize the work load on teachers.
- The VI Semester practical examination for the main course subjects shall be clustered in the form of 3 practicals.
- The practical exams shall be organised for two days (6hrs/day) for each cluster as it is difficult to complete practical examination within 3 hrs for the B.Sc. Biotechnology course.
- Credit awarded for the compliment course is inclusive of practicals.
- Each complementary course including practicals is allotted with 50 marks each.
- Core courses (56 credits) carry 1750 marks.

* Open Course offered for other department students is - BTY5D01-INTRODUCTION TO BIOTECHNOLOGY

SJBTY 1 B01
CELL BIOLOGY

Course outcome

1. *Learn the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles*
2. *Learn underlying principles of mitotic and meiotic division*
3. *Describe cell cycle regulation and apoptosis*

SJBTY 1 B01 CELL BIOLOGY

1. Introduction to cell biology: Milestones in cell biology, Cell theory, Properties of cell. Classification of cell, Structural organization of prokaryotic and eukaryotic cell. Comparison of microbial, plant and animal cells. Origin and evolution of cells. Theory of microscopy and types of microscopes. (6hrs)

   II. Structure and function of plasma membrane. Transport across membranes: active, passive, diffusion and osmosis. Interaction between cell and its environment- cell adhesions, cell junction, extracellular matrix and cell wall. (12 hrs)
   III. Cell Compartments endoplasmic reticulum, Golgi complex, lysosomes, vesicular trafficking- endocytosis and exocytosis, peroxisomes, glyoxysomes and vacuoles. Ribosome and protein synthesis. Mitochondrion- aerobic and anaerobic respiration, chloroplast and photosynthesis. (12 hrs)
   IV. Structure and function of nucleus, nucleolus, chromosomes and types of chromatin. Cytoskeleton- microfilaments, intermediate filaments, microtubule, Cilia and flagella. (10 hrs)
   V. Cell division in prokaryotes and eukaryotes. Cell cycle, phases of cell cycle, mitosis and meiosis. Apoptosis and cell death. A brief overview of cell, stem cells and cancer. (10 hrs)

References:

1. Molecular biology of cell- Alberts B et al
2. Molecular cell biology- Lodish et al
3. Cell and Molecular Biology: Concepts and Experiments- Gerald Karp and Nancy L Pruitt
4. Reproduction in eukaryotic cells- D M Prescott
5. Developmental biology- S F Gilbert, Sinauer Associates
6. Cell in development and inheritance- E B Wilson
7. The coiled spring- Ethan Bier
8. Fertilisation- F T Longo, Champan and Hall
9. Molecular biology of steroid and nuclear hormone receptors- L P Freedman

SJBTY 1 C01
ENVIRONMENTAL BIOTECHNOLOGY & PRACTICALS
(COMPLEMENTARY COURSE)

Course outcome

1. *Study ecological concepts and ecosystem, biotic and abiotic environmental factors*
2. *Learn with renewable and non renewable sources of energy*
3. *Describe biogeochemical cycles and significance*
4. *Learn about human influences on ecosystem like pollution, ozone depletion , ozone warming etc*

I. Fundamentals of Ecology: Biotic and abiotic environmental factors, energy flow through ecosystems, renewable and non-renewable resources, physiological and behavioural ecology. Major kinds of ecosystems. (6 hrs)

II. Kinds of organism interactions, types of communities, characteristics population, succession, water Cycle, Biogeochemical cycles: carbon, nitrogen cycle, phosphorus and sulphur cycle. (8 hrs)

III. Human Influences on the ecosystem- Pollution, Carbon dioxide and global warming, ozone depletion, acid precipitation, destruction of the tropical forests, loss of biodiversity. Eutrophication. Soil formation, Nutrient availability. (8 hrs)

IV. Pollution control strategies. Pollution management: In process treatment, End of pipe treatment, Remediation of polluted sites. Preserving nonreplaceable resources. Advantages of biological pollution control methods, (8 hrs)

2ND COMPELMENTARY COURSE : PRACTICALS – 1
ENVIRONMENTAL BIOTECHNOLOGY

Course outcome

1. *Learn the aseptic techniques to practise in laboratory*
2. *Learn to prepare and sterilize media*
3. *Isolate and count microorganisms from different sources*
4. *Learn screening of microrganisms through staining*

1. A septic techniques
2. Preparation of media and sterilization.
3. Isolation of microorganisms from airs, water, soil.
4. Isolation of Nitrogen Fixing Bacteria from root nodule of Leguminous plants.
5. Standard plate count of microorganism in sewage water sample.
6. Estimation of biological oxygen demand of polluted water sample.
7. Estimation of chemical oxygen demand of polluted water sample

References:

1. Sylvia S.Mader, 2010 BIOLOGY, LATEST EDITION, McGraw- Hill Companies, Inc
2. T.Srinivas. 2008, New Age International (P) Ltd, Publishers

3. Jogdand, G.N.1995. EBT, Himalaya Publishing House,.
4. EBT: Basic Concepts and Application: Indushekar Thakur (2006). I.K.International Publications.
5. Pelczar, M.J.1998. Microbiology: Concept & Applications, McGraw.

SJBTY 2 B02
General Microbiology

Course outcomes

1. Learn history and classes of microorganisms
2. Study types of media, sterilization and pure culture techniques
3. Studies on growth and reproduction of virus, fungi, bacteria
4. Detail microbial metabolism and microbial diseases

SJBTY2B02. GENERAL MICROBIOLOGY

I. History of Microbiology: Leeuvenhoek and his microscope, Germ theory of disease – Koch's postulates, development in disease prevention, antisepsis, immunisation, chemotherapy, classes of microorganisms, bacteria, virus, fungi. Morphological characters of bacteria & fungi. Difference between eukaryotic & prokaryotic cells. (8 hrs)

II. Preparation of media, eg. nutrient agar, potato dextrose agar, Mac Coukey Agar, Industrial media, Requirements for carbon, N2. Concept of sterilization, Methods of sterilization of media and equipments / glassware. Isolation of pure cultures: Spread plate, streak plate and pour plate. (8 hrs)

III. Growth and reproduction in bacteria, fungi, virus & bacteriophages – lytic cycle, lysogenic. Factors affecting growth – pH, temperture, O2 requirement. Uptake of nutrients: active, passive, facilitated, group translocation. Measurement of growth: dry weight, CFV, turbidometry. (10 hrs)

IV. Microbial metabolism: Aerobic and anaerobic respiration, ē transport chain, pentose phosphate pathway. (7 hrs)

V. Brief account of microbial diseases: eg: Typhoid, AIDS, Dermatomycoses. (3 hrs)

References:

1. Pelczar, MJ., Chan, E.C.S and Kreig, Microbiology: Concepts and Applications (Fifth edition)
2. Ronald Atlas, Principles of Microbiology (second edition)
3. Michel T.Medigan, John M.Martinho, Brock, Biology of Microorganisms (Tenth edition)
4. Precott, Harley, Microbiology (sixth edition)
5. Stainer, R.K.Ingraham, J.L.Wheelis, General Microbiolog, Macmillan Publ.
6. Benson, H.J.1990. Microbiological applications: A laboratory manual in General Microbiology, 5th ed., W.M.C.Brown, Publishing.
7. Cappuccino, J.G.& Sherman, N.1996. Microbiology Laboratory Manual.

SJBTY 2CO2
ENVIRONMENTAL BIOTECHNOLOGY & PRACTICALS
(COMPLEMENTARY COURSE)

Course outcomes

1. Learn Key concepts of water pollution and waste water processes
2. Describe reactors for waste water treatment
3.Learn Principles and applications of water purification methods

SJBTY 2CO2 ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

I. Water pollution: Physical, Chemical and Biological characteristics wastewater, bacteriological examination of water- Escherichia coli as indicator, Presumptive, confirmed and completed test. (6 hrs)

II. Treatment of wastewater - Primary, secondary, tertiary and alternative treatment. Advantages of biological wastewater treatment over other methods. Principles and application of Aerobic and Anaerobic waste water treatment methods. (8 hrs)

III. Biological wastewater treatment processes: Activated sludge, biological filters, rotating biological contactor, Fed Batch Reactor, trickling filters, contact digesters, packed column reactors, Upflow anaerobic sludge blanket, stabilization ponds. Sludge treatment, nitrogen and phosphate removal. Waste treatment using aquatic plants. (8 hrs),

IV. Principles and application of water purification methods: sedimentation, filtration distillation, ultraviolet light and chlorination. Methods used for the removal of nitrogen and phosphorus from waste water. (8 hrs)

2ND COMPLEMENTARY COURSE PRACTICALS II- ENVIRONMENTAL BIOTECHNOLOGY

Course outcomes

1. Learn about aerobic treatment methods
2. Learn to analyse water quality
3. Learn to perform biochemical tests for differentiating microorganisms

1. Aerobic treatment of municipal sewage including sedimentation, filtration (sand filter), chlorination.

2. Enumeration of microorganisms total Vs. viable counts.

3. Presumptive and confirmed tests for water quality.

4. Staining methods.

5. IMViC test: using river and tap water samples.

6. Clarification of municipal sewage wing flocculants and performing standard plate count before and after clarification.

References:

1. Sylvia S.Mader, 2010 BIOLOGY, TENTH EDITION, McGraw- Hill Companies, Inc
2. T.Srinivas. 2008, New Age International (P) Ltd, Publishers
3. Jogdand, G.N.1995. EBT, Himalaya Publishing House,.
4. EBT: Basic Concepts and Application: Indushekar Thakur (2006). I.K.International Publications.

Pelczar, M.J.1998. Microbiology: Concept & Applications, McGraw

SJBTY3 B03 BIOCHEMISTRY

Course outcome

1. Familiarize with biomolecules – lipids, carbohydrates, amino acids, proteins and nucleic acids

2. Describe Vitamins and hormones- types and functions

3. Learn different separation techniques used for biomolecules

SJBTY3B03. BIOCHEMISTRY

I Introduction to bimolecules; chemical bonds (weak interactions),Energy transactions in Biological systems, measurement of pH(Henderson Hasselbalch equation),l buffers & buffer actions (strong & weak acids),Biological buffer systems. (2 hrs)

II Carbohydrates: Classification, occurrence, chemical reactions, structure and functions of monosaccharides, disaccharides & polysaccharides, UDP glucose;glycolysis, Krebs cycle, ETC(Mitochondria) – arrangement of electron carriers in the electron transport chain, Oxidative phosphorylation (Chemiosmotic theory), Fate of pyruvate in alcoholic fermentation ,gluconeogenesis and pentose phosphate pathway (only outline without structures of intermediates). (8 hrs)

III Amino acids: Classification based on structure and polarity, amphoteric property,titration curve of alanine, general chemical reactions of amino acids, urea cycle, metabolism of glycine & phenylalanine, peptide bond formation. Rare amino acids (4 hrs)

IV Proteins: Classification, structure and biological function. (3 hrs)

V Lipids:Classification, fatty acids, triacylglyceride, phosphoglycerides (eg.,lecithins),sphingolipids (e.g., Cerebrorides), Steroids (Cholesterol), Outline study of -oxidation; fattyacid biosynthesis (without structure). (4 hrs)

VI Nucleic acids: Structure of purines, pyramidines, different conformational forms of DNA, Types of DNA. (4 hrs)

VII Enzyme: Classification, Nomenclature, Mechanism of enzyme action, derivation of MichaelisMenten equation, Enzyme inhibition, Factors affecting enzyme activity, Allosteric enzymes, Isoenzymes. (4 hrs)

VIII Vitamins & Hormones: Classification, physiological functions & deficiency disorders of vitamins and hormones (thyroxine, insulin, growth hormones), an overview to the functions of phytohormones. (4 hrs)

IX Separation technique: Chromatography: (adsorption, ion exchange, affinity, gelfiltration). Electrophoresis: PAGE, AGE, SDS-PAGE. (3hrs)

SJBTY3BO4(P)- CORE COURSE PRACTICALS I- BIOCHEMISTRY

Course outcome

1. *Learn to prepare buffers*
2. *Learn to estimate various biomolecules quantitatively*
3. *Learn the procedure of paper and thin layer chromatography*
4. *Learn to determine activity of amylase*

Biochemical techniques

- Preparation of buffers:- Phosphate buffer, Tris Acetate buffer.
- Quantitative estimation of sugars by Anthrone method, DNS method, Biuret method.
- Quantitative estimation of protein by Lowry et al. method.
- Quantitative estimation of RNA by orcinol method, DNA by DPA method.
- Separation of aminoacids by paper chromatography and thin layer chromatography.
- Amylase activity – determination (salivary amylase)

References:

1. Lehninger, Cox and Nelson: Biochemistry
   Voet Voet: Biochemistry
2. Stryer K. Biochemistry 1995, W.H.Freeman & Company, New York
3. Mathews, H.R Freedland R. Miesfeld, R.L.1997 Biochemistry McGraw Hill Wiley-Liss Inc
4. Neal A.C, Chemistry & Biochemistry: A Comprehensive Introduction, McGraw Hill Book Company
5. Donald Voet, Judith G.Voet, Biochemistry Second Edition
6. David L. Nelson, Michael M.Cox, Lehninger, Principles of Biochemistry, third edition.

7. Plummer, D.T.1988, An introduction to Practical Biochemistry, Tata McGraw Hill Co., New Delhi.

SJBTY3C03
ENVIRONMENTAL BIOTECHNOLOGY & PRACTICAL
(COMPLEMENTARY COURSE)

Course outcome

1. Focuses on solid pollution and air pollution monitoring
2. Learn about Xenobiotic degradation
3. Describe composting techniques including vermicomposting
4. Study medical solid waste management
5. Students learn bioremediation , bioaugmentation, biosparging and bioventing

SJBTY3C03 ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

I. Solid pollution: Domestic and industrial wastes, ex situ and in situ Processes, heap technique. Composting – principals and applications, landfill, vermitechnology, phytore mediation, methanogenesis, biogas, medical solid waste management. (8 hrs)

II. Bioremediation: Advantages of bioremediation, types of bioremediation. Monitoring the efficacy of bioremediation. Bioventing for controlling oil spills. Bioaugmentation and Biosparging. (6 hrs)

III. Degradation of xenobiotic by microorganisms, Degradation of Aromatic and chlorinated Hydrocarbons. Degradation mechanisms of naphthalene, benzene, phenol, PCB's, propanil, urea. Biodegradation of petrochemical effluents. (8 hrs)

IV. Air Pollution: Sources, Health effects of air pollution. Greenhouse effect, acid rain, Control of gaseous emissions, control of pollutants from vehicles, Biomonitoring of air pollution. Removal of air pollutants with biosystems. Biofilter, Biotrickling Filter. (8 hrs)

2ND COMPLEMENTARY COURSE PRACTICAL III- ENVIRONMENTAL BIOTECHNOLOGY

Course outcome

1. *Learn the method of vermicomposting*
2. *Study the growth phases of bacteria*
3. *Isolate and screen xenobiotic degrading microorganisms*

1. Delignification of rice straw, rice husk using enzymes (white rot fungi, Pleurotus species) and alkali

2. Preparation of vermicompost
3. Growth curve of bacteria
4. Assessment of microbial growth wet weight, Packed Cell Volume.
5. Isolation of pesticide degrading bacteria from rice field
6. Microbial screening for phenol degrading organisms.

References:

1. Sylvia S.Mader, 2010 BIOLOGY, latest EDITION, McGraw-Hill Companies, Inc
2. T.Srinivas, 2008, New Age International (P) Ltd, Publishers
3. Jogdand, G.N, 1995, EBT Himalaya Publishing House
4. EBT: Basic Concepts and Application: Indushekar Thakur (2006), I.K, International Publication
5. Pelczar, M.J.1998, Microbiology: Concept & Applications, McGraw.

SJBTY4BO5 GENETICS

Course outcomes

1. *Learn fundamentals of Mendel's rules of inheritance and understand range of gene interactions*
2. *Study of chromosomal basis of heredity including chromosomal morphology, number and organization*
3. *Learn human inherited disorders and genetic application in human health and diseases*
4. *Understand the basics of quantitative and population genetics*

SJBTY4BO5 GENETICS

I. Introduction to Genetics: History of genetics, Mendelian genetics and applicationsMonohybrid and dihybrid cross, Principle of segregation, Dominance, Independent Assortment. Gene Interactions, Penetrance, Multiple Alleles. Non-Mendelian InheritanceExtranuclear Inheritance, Maternal Effect, Epigenetic Inheritance, Linkage, Crossing Over; Gene mapping. Pedigree Analysis. (10 hrs)

II. Chromosome: Morphology, Structure and Organization of Chromosome, Eu- and heterochromatin, Special chromosomes, Karyotype, Sex Determination, Sex-Linked Characteristics. Variation in Chromosome number and Structure. Human Genome, Human Inherited disorders. Genetic counseling. Eugenics and Euphenics. (12 hrs)

III. Bacterial genetic system: Viral genome, Bacterial Chromosomes, Plasmids, Transformation, Conjugation, Transduction, Natural Gene Transfer, Isolation of auxotrophs, Replica plating techniques, Analysis of mutations in biochemical pathways. (12 hrs)

IV. Quantitative Genetics- Quantitative Traits, Polygenic Inheritance, Types of Heritability. Population Genetics- Genotypic and Allelic Frequencies, Hardy–

Weinberg Equilibrium, Factors affecting Genetic equilibrium. Genetic Drift. Evolutionary Genetics - Modes of Speciation, Phylogenetic Trees, Molecular Evolution, Molecular Clock. (14 hrs)

SJBTY 4B 06(P)- Core Course Practical II- Practicals in GENETICS

Course outcomes

1. *Identify mitotic and meiotic stages*
2. *Identify Barr bodies and salivary gland chromosomes*
3. *Isolate auxotrophs*
4. *Understand the process of conjugation*

1. Study of mitotic stages in onion root
2. Study of meiosis
3. Karyotyping
4. Observation of Buccal smear Barr bodies
5. Demonstration of salivary gland chromosomes from Chironopous larvae.
6. Isolation of auxotrophs
7. Induced Transformation in E. coli
8. Conjugation

References:

1. Robert J Brooker, 2012, Concepts of Genetics, McGraw – Hill
2. Benjamin A. Pierce, 2012, Genetics A Conceptual Approach, W.H.Freeman and company
3. Principles of genetics: Snustad, Simmons, Jenkins
4. Robert H.Tamarin, Principles of Genetics, Seventh Edition, The McGraw- Hill Companies.

SJBTY4C04 ENVIRONMENTAL BIOTECHNOLOGY

(COMPLEMENTARY COURSE)

Course outcomes

1. *Learn about bioplastics, biofertillizers and biopesticides*
2. *Detail applications of bioresources like methane production, fuel alcohol, biodiesel and biopower*
3. *Familiarise with Single cell proteins and GM organisms*
4. *Learn bioleaching of gold, copper and uranium*

SJBTY4C04 ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

I. Use of biotechnology for environmental protection. Biofertilizers and Biopesticides. Biotechnological application of thuringenesis toxin as a natural pesticide. Principle and application of Bioremediation, Bioventing and Biosorption. (8 hrs)

II. Bioenergy from waste: methane production, biogas, fuel-alcohol from biomass and lignocellulose residues. Production of biodiesel. Advantages and environmental effects of biofuels. Biopower- methods for electricity generation from biomass. (8 hrs)

III. Single cell protein- production and advantages. Biomass production from waste, Bioplastics- Biopols (PHB), Biolac (polylactic acid), Bio-derived polyethylene and Genetically modified bioplastics. Environmental impacts of bioplastics. (8 hrs)

IV. Principle and methods for the Bio leaching of gold, Copper and Uranium. Environmental Significance of genetically modified organisms- Effect on biodiversity. (6 hrs)

SJBYT4C05(P) 2ND COMPLEMENTARY COURSE PRACTICALS – IV ENVIRONMENTAL BIOTECHNOLOGY

Course outcome

1. *Understand bioremediation*
2. *Learn production of value added products from digested lignocellulose*
3. *Learn the technique of production of biogas*
4. *Identify extracellular enzyme producing microorganisms*

1. Removal of copper from waste water using *Trichoderma viridae*.
2. Production of cellulose and ethanol from lignocellulosic waste (biogas)
3. Use of yeast as biosorbant to remove colour from coir retting waste water/industrial effluent
4. Production of biogas and methane from municipal sewage & food waste.

References

1. Sylvia S.Mader, 2010 BIOLOGY, latest EDITION, McGraw-Hill Companies, Inc
2. T.Srinivas, 2008, New Age International (P) Ltd, Publishers
3. Jogdand, G.N, 1995, EBT Himalaya Publishing House
4. EBT: Basic Concepts and Application: Indushekar Thakur (2006), I.K, International Publication
5. Pelczar, M.J.1998, Microbiology: Concept & Applications, McGraw

SJBTY5BO7 MOLECULAR BIOLOGY

Course outcome

1. Students gain an understanding of molecular mechanism of the process of replication, transcription and translation of the genetic material.
2. Study mutations, DNA repair and gene regulation
3. Learn the structure and complexity of genome

SJBTY5BO7 MOLECULAR BIOLOGY

I. Genetic material: Discovery of DNA as genetic material, structure and functions of DNA and RNA. DNA topology, nucleosome and regulation of chromatin structure. Histones and Non Histones. Morphology, types and structural organization of chromosomes. (8 hrs)

II. Genome: Structure, composition and complexity of prokaryotic and eukaryotic genome, Intergenic sequences, pseudogenes, Repeated DNA Sequences, Central dogma. Teminism (8 hrs)

III. DNA Replication: Chemistry, enzymes involved and salient features of prokaryotic and eukaryotic DNA replication. History of DNA Replication. Types of mutation, DNA Repairexcision repair, mismatch repair and double-strand breakage repair. DNA recombinationhomologous and site-specific. Mechanism and type of transposition in prokaryotes and eukaryotes. (12 hrs)

IV. Gene Expression: Details of initiation, elongation and termination of transcription and translation in prokaryotes and eukaryotes, Post transcriptional modification of mRNA, rRNAand tRNA, chemistry and pathway of splicing, alternative splicing, properties of the genetic code, Post translational modification of protein. Inteins and Exteins (12 hrs)

V. Regulation of gene expression: Gene structure in prokaryotes and eukaryotes, lac, trp and ara operon, Transcriptional, processing and translational level control of eukaryotic gene expression. Enhancers and Silencers. Chaperones and proteasomes. (12 hrs)

SJBTY5B 10(P) – CORE COURSE PRACTICALS-III-PRACTICALS IN MOLECULAR BIOLOGY

Course outcomes

1. *Learn to isolate genomic DNA from different sources and to determine the purity*
2. *Learn to measure chromosome length*
3. *Understand the method of induction of lac operon as well as transformation*

1. Isolation of total genomic DNA from plant and bacteria
2. Spectrophotometric determination of nucleic acid purity and concentration
3. Measurement of Chromosome Length
4. Induction of Lac Operon
5. Complementation experiment

References:

1. Karp G 2010, Cell and Molecular Biology Concepts and Experiments, John Wiuley & Sons, Inc
2. Watson JD 2007, Molecular Biology of the Gene, Pearson Benjamin Gummings
3. Alberts B 2008, Molecular Biology of the Cell, Garland Science
4. Cooper GM 2009, The Cell A Molecular Approach, ASM Press
5. Weaver RF 2012, Molecular Biology, McGraw-Hill
6. Bolsover SR 2004, Cell Biology: a short course, John Wiley & Sons. Inc.

SJBTY5B08 IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course outcome

1. *Describe immune system – types, cells and organs*
2. *Detail properties of Antigens and structure of antibodies*
3. *Student understand various Ag Ab reactions*
4. *Familiarise with hypersensitivity and autoimmune diseases*
5. *Students gain an understanding of monoclonal antibody and tumour immunology*

SJBTY5B08. IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. Introduction to immune system: Historical perspectives, early vaccination, natural and artificial immunity, innate immunity and acquired immunity, active and passive immunity, humoral and cell mediated immunity.(3 hrs)

2. Cells of Immune System: Hematopoiesis, Lymphoid cells B & T lymphocytes. N.K.Cells, phagocyte, mast cells, dendritic cells.(4hrs)
3. Organs of the Immune System: Primary lymphoid organs: Thymus, Bone marrow, Secondary lymphoid organs: lymph nodes, spleen, mucosa associated lymphoid tissue.(5 hrs)
4. Antigens: Nature and Properties of antigens: foreigners, molecular size- epitopes : Immune response to Ag, adjuvants, Immune dosage, route of administration superantigens.(4 hrs)
5. Antibodies: Structure of antibodies, Classes of Immuno globulins, hypervariable regions, Complementary determining regions, Frame work regions, Isotype, allotype and idotypic determinants, immunoglobulin super family. (10hrs)
6. Antigen- Antibody interactions: Affinity avidity, measure of Ag-Ab binding, cross reactivity: application of Ag-Ab interactions: agglutination reaction: blood grouping.(5 hrs)
7. Major histocompatibility Complex- Types, HLA, Complement system, Cytokines (2 hrs)
8. Hypersensitivity:- Classes hypersensitive reactions, (type-1) IgE-mediated hypersentitivity- intracellular events in most cell degranulation, pharmacological agents in type 1 reactions, type II, hypersensitivity-erythroblastosisfoetalis type- III hypersensitivity- Immunocomplex mediated hypersensitivity – type- IV – delayed-type hypersensitivity(10 hrs)
9. Immunological disorders: Autoimmunity: Maintenance of tolerance, auto immune diseases, Organ specific- hashimoto's thyroidits, Grave's disease, Systematic autoimmune disease- multiple sclerosis, Rheumatoid arthritis, Immunodeficiency-SCID,AIDS(6 hrs)
10. Tumour immunology: Malignant transformation of cells, oncogenes and induction, tumor of immune system- tumor antigens chemically and virally induced tumorantigen, cancer immunotherapy- cytokine therapy- interferons. Tumor necrosis factors, monoclonal antibodies and immunotoxins.(8 hrs)
11. Monoclonal antibodies and vaccines: Active and passive immunisation, Vaccine designs recombinant vector vaccines(7 hrs)
12. Immunotechniques: RID, ouchterlony, RIA and ELISA, Western blotting, Immunoelectrophoresis, Immunofluorescence, Flow Cytometry, Fluorescence and immunoelectron microscopy.(5 hrs)

SJBTY5B11 (P) CORE COURSE PRACTICALS –IV-Immunology and Immuno-Technology Practical

Course outcome

1. *Identify blood group*
2. *Identify blood cells*

3. *Learn different methods of antigen-antibody interaction*

1. Blood grouping

2. Blood film preparation and identification of cells

3. Preparation of antigens Protected of immunisation in rabbits rats/mice, methods of immunisation, bleeding (demonstration only). Necessary approved from CPCSEA may be obtained for animal experiment.

4. Separation of lymphocytes from peripheral blood

5. Radial immuno diffusion

6. Double diffusion

7. Immuno electrophoresis

8. Demonstration of ELISA

References:

1. Kuby Immunology by Thomas Kindt and Richard A.Goldsby and Barbara A Osborne; Ed.6th W.H.Freeman and Company, New York; 2007
2. Cellular and molecular immunology by Abdul K.Abbas and Andrew h.Lichtman and Shiv Pillai; Ed 6th Saunders, 2007
3. Immune biology: the immune system in health and disease by Charles A.Janeway and Paul Travers and Mark Walport and Mark J.Shlomchik; 7th Ed; Garland Science 2008
4. Essentials of immunology & serology by Jacqueline H.Stanley : DELMAR; Australia 2002

SJBTY5B09 BIOPROCESS TECHNOLOGY

Course outcome

1. *Learn isolation, screening, improvement and preservation of industrially important microorganisms.*
2. *Students learn design of bioreactors*
3. *Describe basic fermentation process and optimum parameters for fermentation*

SJBTY5B09. BIOPROCESS TECHNOLOGY

I. Introduction to microbial fermentations. Range of microbial fermentation processes. Recombinant DNA technology assisted products. Flow chart of typical industrial fermentation

process. Concept of value addition shelf life improvement. Low volume - high value and High volume - low value products.

II. Isolation of industrially useful microbes from soil air and water. Microbial screening procedure. Preservation of Microorganisms: Stock culture maintenance. Storage at low temperatures on agar slants and liquid nitrogen. Storage in dehydrated form-dried culture.

III. Industrial strain improvement: Different DNA mutating agents like UV, NTG, Nitrous acid, intercalating agents. Application of genetic engineering and protoplast fusion techniques in strain improvement.

IV. Fermentation media: Media composition. Requirement of Carbon-nitrogen minerals, growth factors, water and oxygen. Media sterilization: Batch and continuous sterilization, filter sterilization of fermentation media (for animal cell culture) and air.

V. Microbial growth kinetics - Batch, fed-batch and continuous cultures: Fermentation equipment and use-parts of fementor. Types of bioreactors - CSTR, air-lift. Packed bed and immobilized reactors. Fermentation process control-control of temperature, pH, dissolved oxygen and RPM.

VI. Fermentation process operation: Inoculum preparation, scale-up of fermentations. Downstream processing: Separation of cells by froath floatation, sedimentation, flocculation, Filtration and centrifugation. Cell disruption for intracellular products. Membrane filtrations, including reverse osmosis. Chromatographi techniques - Adsorption, ion-exchange, affinity and gel exclusion chromatography. Precipitation, crystallization and drying of biologicals

VII. Typical fermentation processes: Antibiotics (Penicillins), organic acids (acetic acid), Microbial enzymes (Amylases and proteases) ethanol. Single cell proteins (SCP), Vatminas (Vti B 12).

VIII. Enzyme technology: Basic concept of enzymes, sources and extraction of enzymes. Control of microbial enzyme production. Immobilization of enzyme of adsorption, entrapment, crosslinking and encapsulation methods. Application of immobilized enzymes

SJBTY5B12 (P) – Core Course Practical – V- Practicals in Bioprocess technology

Course outcome

1. *Isolate and screen antibiotic producing microbes*

2. *Learn to estimate alcohol by distillation*

3. *Learn technique of enzyme immobilization*

4. *Understand different fermentation technique like solid state and submerged fermentation*

1. Isolation of antibiotic producing microbes from soil crowded plate technique and demonstration of antibiotic sensitivity by giant colony inhibition spectrum.
2. Fermentation of grape juice and estimation of alcohol by distillation.
3. Enzyme immobilization using sodium alginate.
4. Production of microbial enzyme (amylase) and conversion of starch to glucose.
5. Detection of formed glucose by anthrone method,
6. Separation of cells by flocculation: Use of alum as an flocculating agent to separate yeast from fermentation broth.
7. Anaerobic fermentations: Production of methane from Glucose

8. Comparative study of surface culture (Mat culture of *Aspergillus niger*/ Penicillin), solid state fermentation (Mushrooms) and submerged cultures.
9. Effect of PH and aeration on biomass production (Bakers yeast) – wet weight as a yard stick.

References:

1. Stanbury, PFA Whitakers and S J Hall (1995). Principals of fermentation technology Pregamon Press
2. Cassida I E, Jr. Industrial microbiology (1994), Wiley eastern.
3. Cruger and Annilesse cruger (1190). A text book of industrial microbiology , sinaser associates. Inc.
4. Demain, A L and Solomon, N A Manual of industrial microbiology and biotechnology (1986) American society for microbiology.
5. Gasesca, PO. And Able, J J (1987). Enzyme technology. Open University Press
6. Purohit, S S (1988). Agricultural Biotechnology. Marcel and Decker Inc. Medium avenue (NY).
7. Alman A (1988) Agricultural Biotechnology. Marcel and Decker Inc. Medium Avenue (NY).
8. Burler, W. (1995). Bioerector design and product yield. Heineman Lincare House, Oxford.
9. Fermentation a practical approach: Ed. B. M. C Neil and L. M. Harvey (1990) University Press.

SJBTY5D01
INTRODUCTION TO BIOTECHNOLOGY

(Open Course – Elective from other department students)

Course outcome

1. *Learn about history and uses of biotechnology*
2. *Study biotechnology applications in food including fermentation, Single cell protein and mushrooms*
3. *Understand applications in agriculture specifically GM plants*
4. *Students will familiarize with application in medicine like paternity testing and DNA finger printing*

SJBTY5D01. INTRODUCTION TO BIOTECHNOLOGY
(Open Course – Elective from other department students)

I. Introduction to Biotechnology. History of biotechnology. Tools in biotechnology. Use of cell and cell process in biotechnology. (8 hrs)

II. Application of Biotechnology in food industry: Basic principle of Fermentation, Production of fermented food products- Bread, wines, vinegar and pickles. Fermented milk products and traditional Indian foods. High value food productssingle cell proteins and mushroom. (8 hrs)

III. Application of Biotechnology in agriculture: genetically modified foods. Bt cotton and Bt brinjal. Biopesticides and biofertilizers. (8 hrs)

IV. Application of Biotechnology in medicine: application in treatment and diagnosis of diseases. DNA figure printing and paternity test. (8 hrs)

Reference :

1. Reinhard Renneberg, Arnold L . Demain , Biotechnology for Beginners. Academic Press
2. William J Thieman, Michael A Palladino. Introduction to Biotechnology. Benjamin Cummings
3. Sang Yup Lee. An Introduction to Molecular Biotechnology: Fundamentals, Methods, and Applications, John Wiley & Sons, Inc.
4. Chawla Introduction To Plant Biotechnology. Oxford and IBH Publishing

SJBTY6B13 PLANT BIOTECHNOLOGY

Course outcome

1. *Learn basic techniques of tissue culture, types of cultures and in vitro morphogenesis*
2. *Learn genetic manipulation with special focus on agrobacterium mediated gene delivery*
3. *Learn about transgenic plants and applications of genetically modified plants*
4. *Understand applications in horticulture, agriculture, pharmacology*

SJBTY6B13. PLANT BIOTECHNOLOGY

I. Basic techniques of plant tissue culture (Introduction, Definition, Medium preparation and sterilization, inoculation, explant selection, growth regulators, subculture, conditions of culture room, etc.) (7)

II. In vitro morphogenesis (Organogenesis – Meristem culture, Production of virus free plants, embryogenesis and synthetic seeds, significance studies on regeneration – single / multiple shoot, root formation, somaclonal variation and its significance, transfer and establishment of whole plants into soil). (15)

III. Different types of culture (Callus culture, studies on different types of callus formation, cell culture / suspension culture). (5)

IV. Organ culture: (ovary, ovule, endosperm triploid production, embryoculture, induction of polyembryony, anther culture, in vitro production of haploids and its significance in crop improvement). (8)

V. Tissue culture and Biotechnological applications in agriculture, horticulture, pharmacology, industry. (8)

VI. Protoplast isolation and fusion, importance of hybrids and cybrids culture, importance and applications in crop improvement. (9)

VII. Cryopreservation, germplasm storage, and establishment of gene banks, viability & potentiality test, gene sanctuaries. (5)

VIII. Genetic manipulations: Recombinant DNA technology – production of transgenic plants, hairy root culture – basic concepts, practical applications of genetic transformations. GMO crops and issues related to it. Biosafety, Bioethics and IPR in Plant biotechnology (15)

SJBTY6B16 (P) – CORE COURSE PRACTICAL – VI_ BIOTECHNOLOGY PRACTICAL

Course outcome

1. *Learn preparation of plant tissue culture media*
2. *Learn sterilization of plant tissue culture media*
3. *Learn the method of callus induction*

1. Medium Preparation
    a. Stock Preparations
        i. Macro and micro nutrients
        ii. Hormones
        iii. Vitamins
    b. PM adjustments
    c. Sterilization
        i. Cotton plugging
        ii. Autoclaving
        iii. Explant collections
        iv. Surface sterilization
        v. Practices in Lamine flow chamber
        vi. Personal Hygenic
    d. Inoculations
        i. Monitoring for callus induction and Regeneration

Reference:

1. Herlaw, F. & David L D (Eds)1998. Antibodies: A Laboratory Manual, Coldspring Harbor Laboratory
2. Coligan, J E Kruisbeck, A M Margulies, D H Shevach, E M and W. Strober 1996. Current Practices in Immunology, John Wiley & Sons Inc.
3. Dixon, R A & Genzales, R A (Eds) 1994. Plant Cell Culture – A Practical Approach, IRL Press, Oxford.
4. Smith, R H 1992 Plant Tissue Culture Techniques and Experiments. Academic Press
5. Edwin F George (1993). Plant propagation by Tissues Culture, Part I. The Technology II Ed. Exegetics Ltd.
6. Edvin F George, 1993/1996. Plant Propagation y Tissue Culture, Part Ii In Practice II Ed.
7. Pierik, R L M 1989. In vitroculture of higher palnts. Martinus Nijhoff Publishers, Dordrecht, Netherlands
8. M Z Abdin et. Al (eds) 2017 Plant Biotechnology: Principals and Applications, Sprnger Nature Singapore Pre Ltd.
9. Kamle, S & Ali S (2013) Genetically modified crops: Detection strategies and biosafety issues. Gene, 522(2), 123-132
10. Bhajmani & Razdan. Plant Tissue Culture, Theory and Practice.

11. Reinrt & Bajaj 1977 Plant Cell tissue and Organ Culture, Springer Verlag Berlin
12. S Narayanaswamy, 1994 Plant Cell and Tissue, Tata McGraw Hill Publishing Company Ltd. New Delhi.

SJBTY6B14
ANIMAL BIOTECHNOLOGY

Course outcomes

1. Learn animal cell culture conditions, basic requirements and components of media
2. Describe primary cell culture and cell lines
3. Learn Cytotoxicity assays and cell proliferation assays
4. Understand applications of cell culture and cell cloning

SJBTY6B14. ANIMAL BIOTECHNOLOGY

1. Introduction to animal cell culture: Lab Design and equipments. Sterile area, Laminar flow hood. CO2 incubator. Cryostorage (liquid Nitrogen flask), refrigerated centrifuges freezers (-800C) inverted microscope, Hemocytometer, pH meter, magnetic stirrer, micropipettes and pipetteaid. (10)

2. Media preparation and sterilization: Sterilization of glass wares: Reagents: Balanced salt solutions, preparation stock of solutions such as amino acids, vitamins, salts, glucose, Hormones and growth factors, antibiotics, role of serum in media, physicochemical properties, - CO2 and bicarbonate, oxygen, osmolality, Temperature, viscosity, filter sterilizationofmedia. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. (12)

3. Primary culture: Mouse embryo cell culture, protocol for Isolation of mouse embryo, Primary explants, Enzymatic disaggregation, warm and cold trypsin treatment, collagenase treatment, mechanical disaggregation and sieving separation of viable andnon-viablecells. Secondary cell culture. (12)

4. Cell lines & Cryopreservation: Immortalization of cell lines with viral genes - SV. 40, papillomavirus, Epstein-Barr virus, fibroblast immortalisation, cell line designations maintenance of cell lines, cell morphology, criteria for subculture. States of Cryopreservation, freezing a cells, Thawing of frozen cells. Scaling –up of animal cell culture, Cell synchronization. Cell cloning, micromanipulation and types of cloning. Cell transformation. Application of animal cell culture(15)

5. Cytotoxicity: Estimation of viability by Dye exclusion, cell proliferation assays, MTT-based cytotoxicity assay. (5)

Reference :

1. Culture of Animals cells, 3rd Edition, R. Ian Freshney. A John Wiley & Sons, Inc Publication .
2. Animal Cell Culture- Practical Approach, R W Masters, Oxford Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.

3. Animal Cell biotechnology, Methods and protocols, Nigel Jenkins, Humana Press 4. Biotechnology of Animal Tissue. P R Yadav & Rajiv Tyagi 2006 . Discovery Publishing House. New Delhi.
4. From Genes to Clones Introduction to Gene Technology – winnacker, E L 1987, Panima Educational Book Agency, New Delhi
5. Gene VII – Benjamin Lewin 2000 Oxford University Press, UK
6. Biotechnology, Satyanarayana. U, (2008), Books and Allied (p) Ltd.

SJBTY6B15
RECOMBINANT DNA TECHNOLOGY AND BIOINFORMATICS

Course outcomes

1. *Understand the importance of plasmids and other vectors to genetic engineering and to learn different vectors employed in gene transfer techniques*
2. *Describe how a chimeric genome is constructed, role of restriction endonucleases, and screening*
3. *Understand gene transfer methods like particle gun approach, liposome mediated, PEG mediated and agrobacterium based transfer method*
4. *Learn transgenic plants , animal and GM foods*
5. *Gain knowledge on molecular mapping of genome and molecular markers like RFLP ,RAPD and AFLP*
6. *Understand the basic concept of bioinformatics including databases and database searches*

SJBTY6B15. RECOMBINANT DNA TECHNOLOGY AND BIOINFORMATICS

1. Introduction to gene cloning, enzymes and basic tools involved in gene cloning. (5 hrs)

2. DNA sequencing methods, hybridization techniques (Northern, southern, western blotting), In Situ hybridiztion, PCR (variation RtPCR), DNA finger printing- RFLP, RAPD, AFLP and STR analysis. Isolation and purification of total cell DNA (10 hrs)

3. Cloning vectors in prokaryotes and eukaryotes (pBr 322, puc 18, M13, cosmids, Phagemids, phasmids, yeast vectors, Animal viral vectors - SV40, Plant viral vectors - CaMV, Agrobacterium – Tiplasmid. (10 hrs)

4. Introduction of recombinant DNA into living cells an overview. Selection and screening of recombinant clones. (10 hrs)

5. Application of r-DNA technology - production of recombinant proteins, vaccines, Transgenic plants. (Insect resistance, disease resistance), Transgenic animals - molecular pharming. (10 hrs)

6. Introduction to bioinformatics, pattern recognition and prediction, biological databases, primary and secondary sequence databases, composite protein sequence databases, pair wise alignment technique; database searching NCBI, EMB, FASTA, BLAST BITS etc. algorithms

and programmes, comparison of two sequences, global and local alignment – multiple sequence alignment (9 hrs)

Reference:

1. Watson, J D Gitman, M , Witkowsk, J and Foller M 992, Rcombinant DNA, II edition, Scientific American books, WH Freeman and Co, NewYork.
2. Old. R. W and Primerose , SB 1994 Principles of gene manipulation 0 An introduction to Genetic engineering.
3. TA Brown Gene cloning and DNA Analysis an Introduction
4. –James D Watson, Michael Gilman Recombinant DNA
5. T K Altwood D J Parry-Smith and S Phukan. Introduction to Bioinformatics.
6. David W Mount Bioinformatics: Sequence and Genome Analysis

SJBTY6E17
MEDICAL BIOTECHNLOGY

(Elective for same department / subject/ student)

Course outcome

1. Learn sterilization and disinfection methods
2. Describe antigen antibody reactions and complement system
3. Learn properties of bacteria, viruses
4. Familiarize with diseases caused by bacteria and viruses

SJBTY6E17. MEDICAL BIOTECHNLOGY
(Elective for same department / subject/ student)

I. Morphology and Physiology of Bacteria; Sterilisation and Disinfection; Culture Media and Culture Methods; General identification procedurs for various pathogenic bacteria & fungi. (10 hrs)

II. Infection & immunity, Antigen & antibody, Antigen & antibody reactions, Complement system. Structure & functions of immune system. (10 hrs)

III. General properties of the following bacteria

Staphyolococcus

Streptococcus

Pneumococcus

Clostridium

Enterobacteriacea
- I : Coliforms
- II : Sheigella
- III : Salmonella

Vibrio

Pseudomonas

Mycobacterium I : tuberculosis

Spirochetes & Mycoplasma

Rickettesia & Chlamydea (15 hrs)

IV. General properties of viruses: Virus host interaction
Pox viruses
Herpes virus
Adenonirus
Rhabdoviruses
Hepatitis
Oncogenic viruses
H1N1 disease control and prevention (15 hrs)

V. Human Immunodeficiency Virus : AIDS
Normal Microflora of Human body
Acute diarrhoeal diseases
Antimicrobial therapy
Immunoprophylaxis & Immunotherapy
Nasocomial infections (10 hrs)

Reference:

1. Ananthanarayanan : Textbook of Microbiology, 1994, Oriental Publishers
2. Pelczar : Microbiology
3. Prescott : Microbiology

SJA11

GENERAL COURSE I

BIODIVERSITY – SCOPE AND RELEVANCE

Course Outcome

1. *Assess the importance and value of biodiversity for ecological functions*
2. *Understand the components and magnitude of earths biodiversity*
3. *Evaluate the cause and effects of biodiversity loss*
4. *Apply inventorying and monitoring tools to study dynamics in biodiversity*
5. *Apprise in situ and ex situ methods for biodiversity conservation*

SJA11. GENERAL COURSE I BIODIVERSITY – SCOPE AND RELEVANCE (THEORY) (CREDITS: 4)

SEMESTER – III TOTAL HOURS : 72

Unit 1 Defining Biodiversity (Hours: 12)

The concept of biodiversity. Biodiversity crisis. Importance of biodiversity in daily life. Biodiversity and climate change. India as mega biodiversity nation. Hot spots of biodiversity in India

Unit 2 Components of Biodiversity (hours: 12)

Genetic diversity, species diversity and ecosystem diversity. Brief outlines of the magnitude of bacterial, fungal, protest, animal and plant diversity.

Unit 3 Loss of Biodiversity (Hours: 12)

Factors causing loss genetic – species- and ecosystem diversity. Processes responsible for species extinction. Threatened species and IUCN Red List categories. Loss of agrobiodiversity. Significance of wild relatives of cultivated plants and domesticated animals

Unit 4 Values and uses of biodiversity (Hours 12)

Ethical and aesthetic values of biodiversity. Direct and indirect economic benefits of biodiversity. Bio-propecting –micro-organisms and plants as a source of novel enzymes, antibiotics, antiviral agents, Immunosuppressive agents and other therapeutic agents.

Unit 5 Inventorying and Monitoring of Biodiversity. Methods of inventorying and monitoring of biodiversity and their limitations.

Unit 6 Conservation of biodiversity (Hours: 12)

Conservation of genetic – species – and ecosystem diversity. In situ conservation biosphere reserves, national parks, wild life sanctuaries, gene banks, seed banks , botanical gardens , microbial culture collections

SUGGESTED READING

1. Patent, DH Munnoz W 1996 Biodiversity Clarion Books
2. Maiti P K , Maiti P 2011 Biodiversity : Perception, preil and Preservation. Prentice Hall India
3. Maclaurin J 2008 what is biodiversity? University of Chicaga Press.
4. Krishnamurthy K V 2003 Textbook ofBiodiversity. Science Publishers Inc.
5. Wilson E.O.2010. the Diversity of Life. Harvard University Press.
6. Hosetti B B Ramkrishna S 2016, Biodiversity: Concepts and Conservation. Aavishkar Publishers
7. Kumar A 2011 Understanding Biodiversity Discovery Publishing House
8. Hendon J 2017 Textbook of Biodiversity Syrawood Publishing House
9. Adom, D. Umachandran, K Ziarati P Sawicka B, Sekyere P 2019 the Concept of Biodiversity and its Relevance to Mankind : A Short Review. Journal of Agricultural and Sustainability 12(2): 219-231.
10. Ehrlich P R Ehrlich A H 1992 the Value of Biodiversity Stanford University Press

SJA12

GENERAL COURSE II

RESEARCH METHODOLOGY

Course Outcome

1. *Illustrate the methodology for scientific research*
2. *Explain the methodology for proper collection of literature for research*
3. *Evaluate and decide the apt procedures and data analysis tools for research*
4. *Develop a suitable outline for thesis based on the topic*
5. *Identifying the opportunities for publishing research work*

SJA12. GENERAL COURSE II RESEARCH METHODOLOGY (THEORY) (CREDITS: 4)

SEMESTER – III Total HOURS 72

Unit I (Hours: 13)

Topic selection – Planning research – defining objectives – Preparation of work plans. Identification of suitable methodology – Preparation of project proposal – summer school-Training in research institutes

Unit II (Hours: 14)

Collection of literature –News articles – Newsletters – magazines – Books – Journals. Digital library and search of articles – keywords and search – Internet – Google Scholar – PubMed-Inflibnet – Medline – Agricola – Science direct –Open access Journals – virtual sources-other sources. Short communications – review articles

Unit III (Hours: 15)

Collection of protocols and selection of suitable methods according to work plan. Observational and experimental research. Data analysis – construction of tables – headings –footer – Tabulation – Presentation of results – Use of statistical software to analyze the results SPSS.

Unit IV (Hour: 15)

Thesis structure – components –writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature –Arriving at conclusion – Preparation of Summary / abstract – Arrangement of Bibliography and how to quote reference in thesis – Appendix

Unit V (Hours: 15)

Publishing of Articles in newspapers / newsletters – Selection of journals – ISSN Number Peer –reviewed journals – components – plagiarism – Submission and Publication – reprints and pdf formats, paper presentation in Conferences.

SUGGESTED READING

1. Anderson, Dinston & Polle 1970 : Thesis and assignment , writing Wiley Eastern Limited
2. Booth W C 2016 The Craft of Research Univerity of Chicago Press
3. Rajendrakumar C. 2008 Research Methodology . New Age International Publishers
4. Kothari C R 2004 Research Methodology . New Age International Publishers
5. Gurumani N 2006 Research Methodology for Biological Sciences. MJP Publishers
6. Marczk G Dematteo D Festinger D 2005 Essentials of research dewsign and methodology John Wiley.

SJ A13

GENERAL COURSE III

NATURAL RESOURCE MANAGEMENT

Course Outcome

1. *Evaluate the economics, ecological and socio-cultural approaches for sustainable utilization of natural resources*
2. *Develop methods for the sustainable utilization of soil, water and energy resource*
3. *Analyze National Biodiversity Action Plan for conservation*
4. *Design strategies for conservation of forest and its resources*
5. *Evaluate the applicability of national and international efforts for natural resource management and conservation*

SJA13. NATURAL RESOURCE MANAGEMENT
(THEORY)
(CREDITS:4)

SEMESTER-IV TOTAL HOURS: 72

Unit 1: Introduction to natural resources (hours:8)

Definition of natural resources. Types of natural resources. Need for protecting natural resources.

Unit 2: Sustainable utilization (hours 8)

Concept of sustainable utilization. Economics, ecological and socio-cultural approaches.

Unit 3: Land (Hours:8)

Agricultural, pastoral, horticultural and silvicultural land utilization, Soil degradation and soil management.

Unit 4: Water (Hours 8)

Fresh water (rivers, lakes, groundwater) Marine, Esturien, Wetlands, Threats and management strategies

Unit 5: Biological Resources (Hours 8)

Biodiversity- definition and types, Significance, Threats, Management strategies, bioprospecting, National Biodiversity Action Plan

Unit 6: Forests (Hours 8)

Definiton: Types of forests, forests cover and its significance (with special reference to India) Major and minor forest products Forest depletion Forest management.

Unit 7: Energy (Hours 8)

Renewable and non renewable sources of energy

Unit 8- Contemporary practices in natural resource management (hours :8)

Environmental impact Assessment, Remote Sensing, Geographic information System'

Participatory Resource Appraisal. Ecological footprint with emphasis on carbon footprint

Resource Accounting: Waste management

Unit 9: National and international efforts in natural resource management and conservation (hours 8)

SUGGESTED READING

1. Singh K.K. 2008 Natural Resources Conservation & Management M.D Publications Pvt. Ltd
2. Singh J.S Singh S.P and Gupta S.2006 Ecology Environment and Resources Conservation Anamaya Publications

3. Rogers, P P Jalal, K.F and Boyd J A 2008 An Introduction to Sustainable Development Prentice hall of India
4. Pandey. B.W 2005 Natural Resource Management, Mittal Publications.
5. Lynch D.R 2011 Sustainable Natural Resource Management Cambridge University Press
6. Nuberg.I Geroge b.Reid R 2009. Agroforestry For Natural Management CSIRO Publishing
7. Camp W.G Heath Camp B 2016 Managing Our Natural Resources, Cengage Learning Pte.Ltd
8. Chiras, D.D Reganold, J.P 2009 Natural Resource Conservation: Management for a Sustainable Future Pearson
9. Campbell B.M Sayer, J.A 2003 Integrated Natural Resource Management : Linking Productivity the Environment and Development CABI publishing
10. Deal K.H 2011 Wildlife and Natural Resource Management Delmar Cengage Learning

SJA14

GENERAL COURSE III

INTELLECTURAL PROPERTY RIGHTS

Course Outcome

1. *Understand the concept of intellectual property right*
2. *Explain patent system and documentation procedure*
3. *Analyze the usability of copyright, trademark and industrial design laws for the mutual benefit of user and manufacturer*
4. *Evaluate geographical indication protection system for identifying a particular type of product*
5. *Appraise the role of IPR in biotechnology industry*

SJA14 INTELLECTURAL PROPERTY RIGHTS

(THEORY)

(CREDITS)

SEMESTER – IV TOTAL HOURS : 72

Module 1: Overview of intellectual property (hours 4)

Introduction and the need of intellectual property right (IPR). IPR in India – Genesis and Development. Some important examples of IPR

Moduel 2: Patents (Hours :10)

Macro-economic impact of the patent system. Patent and kind of inventions protected by a patent. Patent document. How to protect your inventions? Grating of patent. Rights of a patents. How extensive is patent protection? Why protect inventions by patents? Searching a patents. Drafting of a patent. Filing of a patent

Module 3: Copyright (Hours :10)

What is copyright? What is covered by copyright? How long does copy right last? Why protect copyright?

Module 4 : Trademarks (Hours 14)

Definition of trademark. Rights of trademark. Kinds of signs that can be used trademarks. Types of trademark. Function that a trademark performs. How is a trademark protected? How is a trademark registered? How long is a registered trademark protected for? How extensive is trademark protection? What are well known marks and how are they protected? Domain name and how does it relate to trademarks?

Module 5: Geographical indications (Hours : 4)

What is a geographical indication? How is a geographical indication protected? Why protect geographical indications?

Module 6: Industrial designs (hours 10)

What is an industrial design? How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

Module 7: Biotechnology and IPr (Hours 20)

Rationale for intellectual property protection in biotechnology. Concept of novelty in Biotechnology inventions. Concepts of Inventive Step in Biotechnological inventions. Microorganisms as biotechnological inventions. Patenting biological inventions. Patenting microorganisms patenting other biological processes and products. Protection of new varieties of plants. Justification for Protection. Biotechnology and International Treaties such as Convention on Biological Diversity and TRIPs.

SUGGESTED READING

1. T.M.Murray M.J Mehlman, 2000. Encyclopaedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons
2. P N Cheremisinoff PR P Ouellette and R M Bartholomew. 1985 Biotechnology Applications and Research, Technomic publishing Co. INc
3. D Balasubramaniam C F A Bryce K Dharmalingam J Green and K Jayaraman 2002. Concepts in Biotechnology, University Press
4. Bourgagaize, Jewwll and Buiser 2000. Biotechnology Demystifying the Concepts, Wesley Longman
5. ASjith Parulekar Sarita D Souza 23006 Indian Patents Law – Legal & Business Implications: Macmillian India
6. B L Wardehra 2000 Law Relating to Patents Trade marks Copyright design & Geographical Indications Universl law Publishing Pvt Ltd
7. P Narayanan 2010 Law of Copyrightan f Industreial Designs Eastern law House
8. NS Gopalakrishnan, T.G.Agitha 2009 Principles of Intellectual property.Eastern Book Company
9. T.Ramakrishnan (Ed.) 2003, Biotechnology and Intellectual property Rights, CIPRA, NLSLU Bangalore.
10. N.K Acharya 2012 Text book on Intellectual Property Rights, 6th ed.Asia Law House

11. M.M.S.Karki 2009 Intellectural Propety Rights: Basic Concepts Atlantic Publishers
12. N.S. Sreenivasalu 2007 Intellectual Property Rights Neha Publishers & Distributors
13. Pal P 2008 Intellectual Property Rights in India: General Issues and Implications. Regal Publications.

MODEL QUESTION PAPERS FOR GENERAL PAPERS

Research methodology

Time: 2 hrs and 30 min. Marks 80

Section A

Answer any 12 questions. Each question carries 2 marks (Ceiling 25 marks)

1. What is the role of keywords in a research paper?
2. What is meant by a protocol?
3. What is meant by trial and error method?
4. What is Google Scholar?
5. Define plagiarism
6. What is meant by impact factor of journals?
7. What is meant by Science Citation Index
8. What are the basics of data collection?
9. What is SPSS? Explain its uses in research.
10. What is ISSN Number?
11. Define the term thesis?
12. What are open-access journals?
13. Explain the role of bibliography in a thesis
14. What is meant by data analysis?
15. What is meant by peer-reviewed journals?

Section B

Answer any 7questions. Each question carries 5 marks (Ceiling 35marks)

16. Which are the different components of a thesis?
17. Differentiate between a research article and a monograph.
18. What is the significance of review of literature in research?
19. Briefly explain the significance of INFLIBNET.
20. Discuss summer school and training research institutes in India
21. Explain the basics of manuscript writing for a journal.
22. Differentiate between observational and experimental research.
23. What is a predatory journal?

Section C

Answer any 2 questions. Each question carries 10 marks (Ceiling 20 marks)

24. Explain the different steps in the preparation of a manuscript for publishing in a journal.
25. Explain the significance of planning in research.

26. What is a research project proposal? What are the different components of a project proposal?

27. What are the main steps of research and analysis of results?

Model Question Paper for Core /Complementary papers

Cell Biology (Subject code:BTY1BO1) Total Marks: 80

Time: 2.5 Hours

Section A **(Ceiling-25)**

Short Answers carries 2 marks each

1.What is endoplasmic reticulum?

2.What are peroxisomes?

3.Differentiate endocytosis and exocytosis?

4.What is plasmodesmata?

5.Cyclins?

6.Cdk inhibitors?

7.Watson-Crick model of DNA?

8.Ribosomes?

9.Karyotyping?

10.Euploidy and Aneuploidy

11.Diakinesis?

12.What is apoptosis?

13.What are oncogenes?

14.Distinguish heterochromatin and euchromatin?

15. Polyribosomes?

Section B **(Ceiling-35)**

Paragraph type carries 5 marks each

16.Compare structural organisation of prokaryotic and eukaryotic cell?

17.Define gap junction and tight junction.Give their structure?

18.Explain role of ribosomes in biosynthesis of protein?

19.Explain different types of chromatins?

20. What is MPF? Explain its structure and function?

21.Explain role of chloroplast in photosynthesis?

22. Explain the function of lymphokines,nerve growth factors and platelet derived growth factors?

23. What are telomerases?

Section C **(2X10=20 Marks)**

Essay type carries 10 marks Answer any two

24.Explain cell cycle with neat diagram?

25.Explain protein synthesis with neat diagram?

26.Explain function and types of microscopes with diagram?
27.Explain the molecular organisation and functional role of mitotic apparatus