ST. JOSEPH'S COLLEGE (AUTONOMOUS)

IRINJALAKUDA, THRISSUR DISTRICT

KERALA – 680121

College with Potential for Excellence (CPE)

NAAC Accredited with 'A' Grade

CURRICULA AND SYLLABI FOR

Post Graduate Programme in General Biotechnology

Under Choice Based Credit & Semester System

2021 Admissions

CONTENT

Minutes of Board of Studies in Biotechnology

Date: 05-02-2021

Platform: Google Meet

Agenda

1. Discuss the scheme and syllabus of B.Sc. Biotechnology admissions 2021
2. Discuss the scheme and syllabus of M.Sc. Biotechnology admissions 2021
3. Discuss conduct of Practicals of UG and PG Biotechnology
4. Discuss conduct of Project of UG Biotechnology
5. Discuss the attainment of Programme outcomes, Programme Specific outcomes and Course Outcomes
6. Evaluation of employability/ entrepreneurship/ skill development potential of courses
7. Identifying integration of Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum
8. Value-added courses updation
9. Discuss the field projects/ internships / student projects
10. Analysis of feedback on curriculum from stakeholders
11. Discuss the decisions of departmental council
12. Evaluate the mentoring system
13. Discuss the progress of faculty and student exchange program
14. Any other matter permitted by Chair

Resolutions

- It has been decided to continuethe scheme and syllabus of B.Sc. Biotechnology admissions 2020 for the admissions 2021.

- In PG syllabus, following modifications were approved:

    a. SJGBT1C01 Cell biology : To delete Biosynthesis of proteins , co and post translational modifications (Module 4) since it is repeated in SJGBT2C02 Molecular biology and to add another Module containing 'Mendelian Genetics and extrachromosomal inheritance'

    b. SJGBT2C02 Molecular biology : To delete Module 10 as it is a repetition from SJGBT1C01 Cell biology and to add another module containing 'Structural and numerical aberrations of chromosomes, Genetic disorders'

- It was suggested to sanitize or UV sterilize microscopes after each use during practicals.
- Bioinformatics related topics or Covid-19 related topics can be adopted for UG projects. Since experimental research is not mandatory according to UG guidelines, surveys or other form of research can be undertaken for project.
- Employability/ entrepreneurship/skill development courses was discussed and approved
- Courses with focus on Professional Ethics, Gender, Human Values, Environment and Sustainability was identified
- Online measurement of attainment of PO, PSO and CO will be implemented from this year onwards.
- Certificate course on 'Safety measures in Lab' is being conducted online.
- It was decided that all the students in UG and PG Biotechnology should do project in the current academic year. In UG, it will be a group project. A discussion with the students on the project was also suggested
- Analysis report of feedback on curriculum from different stakeholders was discussed. Remedial actions were suggested
- Minutes of Department council was discussed and based on the feedback of students and Faculty, following decisions were made:
    a. Include 'Research Methodology' as a certificate course for I year PG students
    b. Include 'Developmental Biology and Genetics' as a course in PG Biotechnology during next revision
    c. Renewable energy based experiments can be given as project topic for UG Biotechnology
- Mentoring system of the department was evaluated
- It was decided to carry out Student exchange and Faculty exchange programs

Changes in the Syllabus

Semester	Paper code & Title	Additions	Deletions	Further Changes
FIRST	SJGBT 1C O1 CELL BIOLOGY	Mendelian Genetics, Extra Chromosomal Inheritance	Module 4- (Biosynthesis Of Proteins)	Protein Folding is rearranged to Module 5
SECOND	SJGBT 2C O2 MOLECULAR BIOLOGY	Structural And Numerical Aberrations And Genetic Disorders	Module 10 (Biology Of Cancer)	

Revised Syllabus

SYLLABI FOR CORE COURSES

Semester : One

Course Code : SJ GBT1C01

Name of the Course : CELL BIOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basics of the biology of the cell and principle of microscopic techniques	PO1/PSO1	R	F	6	-
CO2	Compare the structural organization of prokaryotic and eukaryotic cells	PO1/PSO2	E	C	6	-
CO3	Understand the mechanism of cell cycle to regulate cell division, apoptosis and cancer	PO1/PSO1, PSO2	U	C	8	-
CO4	Analyze the process of	PO1/PSO1	E	C	6	-

	transport of molecules across cell compartments and folding of protein.					
CO5	Understand the concept of cell-cell interactions in plants and animals	PO1/PSO2	U	C	6	-
CO6	Compare mechanism of different cell signaling pathways.	PO1/PSO1, PSO2	A	C	8	-
CO7	Understand the mechanism of cellular energy transactions in mitochondria and chloroplast	PO1,PO5/ PSO2	U	C	6	-
CO8	To understand the molecular basis of Mendelian Inheritance and extrachromosomal inheritance	PO1/PSO1, PSO4	U	C	6	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours:90 Hours**

Sl.No.	Modules	Hours
1.	Cells-diversity of cell size, shape and number, diversity in internal organization-cell theories, Sub cellular organisms Viruses, Prions, Microscopy-types and techniques.	8
2.	Prokaryotic cells and eukaryotic cells-structure and organization. Technique of cell sorting Cellular organelles, plasma membrane, cell wall, mitochondria, chloroplast, endoplasmic reticulum, chromosomes, nucleus, nucleolus and ribosome biogenesis and structural features, Golgi apparatus, lysosomes, microbodies, peroxisomes, cytoskeleton. Cell motility-cilia and flagella-organization and functions.	12
3.	Cell growth and cell division-cancer, oncogenes and tumor suppressors, molecular events and model systems. Regulation of cell cycle-cell cycle checkpoints. Apoptosis – intrinsic and extrinsic pathways.	15
4.	Protein folding. Transport of molecules across cell compartments. Transport across ER and Golgi vesicular trafficking. Protein delivery into peroxisomes, mitochondria and chloroplasts.	17
5.	Cellular responses to environmental signals in plants and animals, principles and mechanisms of signal transduction, cell to cell interaction- extracellular matrix, interaction of cells with other cells, tight junctions, adherence, gap junctions, plasmadesmata.	15
6.	Cellular energy transactions-role of mitochondria and chloroplast-oxidative metabolism in mitochondria, translocation of protons machinery of ATP formation.	13
7.	Medelian genetics – Mendel's Laws of Inheritance- Allelic and non allelic interactions. Extrachromosomal inheritance-,illustrate with examples Maternal inheritance in snail,Male sterility in maize.	10

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 Freedom

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 1C 01– CELL BIOLOGY

Time: Three hours **Max.Weight : 30 weightage**

Section- A
Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Define cellcycle
2. What ischiasma?
3. What are gapjunctions?
4. What is passivetransport?
5. Which organelle is directly involved in cellular aerobicrespiration?
6. Define tightjunctions.
7. What is the function ofchaperons?

Section – B
Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Explain the structure ofviruses.
9. Explain cell cycle checkpoints.
10. Briefly explainmitosis
11. What is extracellularmatrix?
12. Draw the structure of prokaryoticcell.
13. Role of endoplasmicreticulum.
14. Give a detail account of extrachromosomal inheritance.
15. Explain about folding ofpolypeptides.

Section – C
Answer any four questions. Each question carries a weightage of 5 – (2x5=10)

16. Discuss about signaltransduction
17. Describe the molecular events in cancer.
18. Explain about the role of mitochondria in cellular energy transactions.

SYLLABI FOR CORE COURSES

Semester : One

Course Code : SJ GBT1C02

Name of the Course : BIOMOLECULES AND BIOPHYSICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic knowledge and concepts about biochemistry and various biomolecules	PO1/PSO1, PSO4	U	C	5	-
CO2	Discuss the classification, structure and functions of various biomolecules in cells	PO1/PSO1, PSO4	A	C	10	-
CO3	Discuss the classification, structure and functions of	PO1/PSO1	A	C	5	-

	vitamins and hormones					
CO4	Understand Heterocyclic compounds.	PO1/PSO1	U	C	3	-
CO5	Explain the separation techniques such as chromatography techniques,electro phoresis , centrifugation techniques and spectrophotometer to separate products and purification	PO1/PSO1	U	C	20	-
CO6	Explain the analytical techniques and advanced bioinstrumentation techniques	PO1/PSO1, PSO4	U	C	15	-

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***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours: 72 Hours**

Sl.No.	Modules	Hours
1.	Chemical foundations of biology- Introduction to biomolecules, Molecular logic of Life, Energy transformations and Chemical reactions, weak bonds, covalent bonds, weak interactions in aqueous system, ionization of water, weak acids & bases, pH, pKa, Henderson-Hassel Balch equation, titration curves, buffers, buffer systems. Diffusion and osmosis.	6
2.	Thermodynamics- Principles, enthalpy, entropy, free energy concept, standard free energy, thermodynamics governing biochemical systems.	6
3.	Sugar – classification, structure, function and chemical reaction, methods for compositional analysis of polysaccharides.	6
4.	Amino acids- Basic ideas about physiological functions of amino acids, Classification, structure, stereochemistry, physical & chemical properties. Biosynthesis Proteins- Classification, structural hierarchy, Ramachandran map, separation and purification, criteria of homogeneity, end group analysis,	10
5.	Lipids- Classification, structure, functions, physical and chemical properties, Sphingolipids eicosanoids, separation & analysis of lipids.	6
6.	Nucleic acids- Nucleotide structure & function, nucleic acid structure & function. Bio-synthesis; Phosphoribosyldiphosphate- significance.	7
7.	Vitamins & Hormones- Classification, structure & physiological functions, Phytohormones.	5
8.	Heterocyclic compounds- Secondary metabolites in living system, pigments, and Isoprenoids- mevalonate pathway.	5
9.	Separation techniques- Chromatographic techniques-Principle and application, Adsorption and Partition chromatography, Paper Chromatography, TLC, Liquid Chromatography - ion exchange chromatography, Gel permeation chromatography, affinity chromatography, HPLC and GC. Electrophoretic techniques - Principles and applications, PAGE-Native-PAGE, SDS-PAGE, Iso-electric focussing, 2D electrophoresis, capillary electrophoresis. Agarose gel electrophoresis, Pulse-field gel electrophoresis. Analytical Ultracentrifugation: Sedimentation velocity and equilibrium, determination of molecular weights Spectrophotometer-principle and application. UV Visible spectroscopy-Beer Lambert Law, IR spectroscopy, Raman Spectroscopy, Fluorescent spectroscopy.	12

10.	Analytical techniques- Analytical techniques in biotechnology & biophysics for small molecules and macro molecules for quantitation, X-ray crystallography & NMR spectroscopy of proteins Mass spectrometry of proteins- MALDI, ESI, MALDI – TOF.	9

References:

1. Biochemical Calculations, IrwainH.Segel, John Wiley and sons Inc.
2. General Chemistry, Linus Pauling, W.H.Freeman& Company
3. Organic Chemistry, DJ Cram and GS Hammond, McGraw Hill
4. Biochemistry, D Voet and JG Voet, J Wiley and Sons.
5. Principles of Biotechemistry, Lehninger.A.L, Nelson, D.L. and Cox, M.M, CBS Publishers and Distributors.
6. Biochemistry, Jeremy M.Berg, John L.Tymoczko and LubertStryer, W.H.Freeman& Company.
7. Physical Biochemistry, D Freifelder, W.H.Freeman& Company,
8. Laboratory Techniques in Biochemistry and Moleculary Biology, Work and Work.
9. Understanding Chemistry, CNR Rao, Universities Press, Hyderabad.
10. A Biologist's Guide to Principles and Techniques of Practical Biochemistry.K, Wilson KH Goulding, ELBS Edition.
11. Tools of Biochemistry, T.G.Cooper.

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 1C 02– BIOMOLECULES AND BIOPHYSICS

Time: Three hours **Max.Weight : 30 weightage**

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Define Covalent Bond with examples.
2. Write short note on Phytohormones.
3. What is the difference between Nucleotide and nucleoside?
4. Define enthalpy
5. List out Acidic amino acids and their functions?
6. What is the Principle behind electrophoresis technique?
7. Define α –helix.

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. List out Fat soluble vitamins
9. Explain the principle behind Chromatography and its types?
10. Define Homopolysaccharides?
11. List out the types of RNA and their functions.
12. What are secondary metabolites?
13. Explain about the physical-chemical properties of amino acids?
14. Explain about MALDI –TOF.

Section – C

Answer any four questions. Each question carries a weightage of 5 – (2x5=10)

15. Explain classification, structure and function of amino acids?
16. Explain about NMR spectroscopy.
17. Explain buffer and different buffer systems?
18. What are the methods used for the separation and purification of proteins

SYLLABI FOR CORE COURSES

Semester : One

Course Code : SJ GBT 1C 03

Name of the Course : MICROBIOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions	Lab (Hrs)

					(appr.)	
CO1	Discuss the historical background of microbiology	PO1/PSO1	U	C	4	-
CO2	Understand the major concept of identification, cultivation, classification of microorganisms	PO1/PSO1	A	C	15	-
CO3	Discuss different microscopic and sterilization methods used in microbiology	PO1/PSO1	U	C	9	-
CO4	Explain the major concept of microbial metabolism	PO1/PSO1	U	C	10	-
CO5	Describe the microbial interactions and their overall effects to biosphere.	PO1/PSO1,PSO2	Z	C	10	-
CO6	Understand the importance of antimicrobial agents ,their classification and mechanism of toxicity	PO1/PSO1	U	C	8	-

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***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours:72 Hours**

Sl No	Module	Hours
1	History of Microbiology, Discovery of microbial world, role of micorbes in transformation of organic matter and in causation of disease. Microscopy – Light, Phase contrast, DIC microscopy, Fluorescent, Transmission electron microscope, Scanning electron microscope and scanning tunnellingmicroscope,Confocal microscope, Atomic force microscope. Sterilization methods- Physical, Chemical and Biological.	**10**
2	Pure Culture Concepts- Culture Media preparation; selective differential and enrichment media, Pure Cultural Concepts, Microbial growth- different phases, measurement- Bacterial Growth Concepts, Microbial growth- different phases, measurement- Bacterial Growth Curve. Microbial Nutrition – Growth factors, Nutritional Classification of bacteria, uptake of nutrients.	**8**

3	Diversity of Microbial World, Principles of Classification of microbes, approaches in bacterial taxonomy, Biology of Mycoplasmas, Microbial Staining- Grams, Differential, Motility determination.	6
4	Introduction to Mycology- General Characters of Fungi, Cultivation of Fungi, Cultural characters, Microscopic Morphology, Importance of Fungi in industry and Food production. Fungi as pathogen to man, animals and plants.	8
5	Introduction to Virology Bacteriophages- Discovery and structure, Baltimore Classification, Replication- Lyric and Lysogenic Cycles, Cultivation of Viruses. Detection and Enumeration of Viruses- Viral assay.	6
6	Microbial Metabolism- Glycolysis, Krebs Cycle, Glyoxylate Cycle, EntnerDuodroff pathway, HMP shunt, ATP syntheses, Aerobic and Aneorbic respiration, Photo Synthesis, Fermentation, Methanogenesis,	10
7	Microflora of Soil- Rhizosphere, Biogeochemical cycles (Phosphorus, Oxygen, Nitrogen, Sulphur, Carbon), Plant Microbe interaction (symbiotic and asymbiotic). Biopesticides and Bioinsecticides. Microbiology of Air and Water- Dust, Droplets and droplet nuclei. Bacteriological examination of drinking water.	8
8	Microbes and Man- Saprophytes, Commensals, Pathogen. Sources of infection- Reservoirs, Carriers and Vectors. Congenital infections, Mode and source of infections, pathogenesis and prophylactic methods of following diseases- Cholera, Tuberculosis, Diphtheriae, Syphilis, Influenzae, Poliomyelitis, Malaria, Amoebiasis, Dermatomycosis.	6
9	Antimicrobial Agents, Antibiotics, chemotherapeutic agents, major classes and mechanism of action, minimal inhibitory concentration (MIC), Microbial Drug resistance.	10

References

1. Pelczar, M.J.Chan, ECS & Krieg – Text Book of Microbiology.
2. Fundamentals of Microbiology – Alcamo E.
3. Prescott, L.M., Harley J.P &D.A.Klein- Microbiology
4. Benson, H.J.- A Laboratory Mannual in General Micorbiology
5. Cappuccino, J.G.- Laboratory Mannual in Microbiology.

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 1C 03– MICRO BIOLOGY

Time: Three hours **Max.Weight : 30 weightage**

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Explain the principle and application of fluorescent microscope

2. Describe the structure of bacteriophage
3. Explain methanogenesis
4. Sterilization
5. Write a note on microscopy
6. Short note on MIC
7. Write a short note on biochemical identification of microorganisms

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Biological sterilization
9. Classify bacteria based on morphology
10. Contribution of Pasteur in the field of Microbiology
11. Give an account of Biopesticides and Bioinsecticides
12. Mode of infection, pathogenesis and prophylaxis of Malaria
13. Describe bacterial examination of drinking water
14. Explain bacterial growth curve

Section – C

Answer any four questions. Each question carries a weightage of 5 – (2x5=10)

15. Write as essay on different classes of chemotherapeutic agents and their mode of action
16. Describe the role of microbes in phosphorus and nitrogen cycle
17. Describe HMP Shunt and Enter Duodroff pathway
18. Write a note on antimicrobial agents and microbial drug resistance with examples

SYLLABI FOR CORE COURSES

Semester : Two

Course Code : SJ GBT 2C 01

Name of the Course : METABOLISM AND BASIC ENZYMOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic concept of complexity, key reactions, regulation and evolution of metabolic pathways	PO5/PSO1, PSO4	U	F	5	-
CO2	Understand the concept of standard free energy and evaluate the role of high energy and low energy phosphate compounds in biological oxidation-reduction reactions.	PO5/PSO1	U	C	8	-

CO3	Discuss the metabolic pathways involved in the synthesis and degradation of carbohydrates, lipids, amino acids and nucleic acids	PO5/PSO2	U	F	8	-
CO4	Illustrate the functional aspects of electron transport systems in mitochondria and chloroplast	PO1/PSO4	A	F	9	-
CO5	Understand mechanism and factors affecting of enzyme action, expression of enzyme activity and immobilisation of enzyme	PO1/PSO2	E	C	10	-
CO6	Evaluate the methods for determining the kinetic behaviour of enzyme and analyse the regulatory patterns	PO5/PSO2	U	C	10	-

	of activation and inhibition					

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours: 72**

Sl.No.	Modules	Hours
1.	Introduction to Metabolism- Overview of metabolic pathways (carbohydrates, amino acids, lipids, nucleic acids), key reactions of metabolic pathways, regulation of metabolic pathways, evolution of metabolic pathways – RNA world.	5
2.	Bioenergetics – Standard free energy concept, energy of activation, standard free energy, relationship between Standard free energy & equilibrium constant, energy coupled reactions in Metabolism, high energy & low energy phosphate compounds, biological oxidation- reduction reactions.	6
3.	Carbohydrate Metabolism- Glycolytic pathway. Citric acid cycle, glycogenolysis, gluconeogenesis, pentose phosphate pathway.	8
4.	Electron transport systems-Electron transport systems in mitochondria & chloroplast, alternate pathways, glyoxylate pathway, Cyanide insensitive respiration.	9
5.	Amino acid metabolism- Biosynthesis and degradation of amino acids, Urea cycle, overview of nitrogen metabolism, biosynthesis of proteins.	10
6.	Lipid metabolism- Biosynthesis and Oxidation of fatty acids, phospholipids & glycolipid metabolism, biosynthesis of cholesterol.	9
7.	Nucleic acid metabolism- Biosynthesis and degradation of purine, and pyrimidine nucleotides, General account of nucleic acid biosynthesis	8
8.	Enzymes- Classification and nomenclature of enzymes, Mechanism of enzyme action, Lock and key and induced fit hypothesis, factors influencing Enzyme activity, Isolation and purification of enzymes, Expression of enzyme activity, unit of activity, measurement of activity, Specific activity. Kinetics of enzyme, Km value determination – methods. Enzyme inhibition- types and the method for the determinations of inhibitor constants. Transition state analogs, Abzymes.	10
9.	Mechanism of Enzyme Catalysis, Role of coenzymes and metals. Regulation of enzyme activity.. Allosterism, positive and negative modulations, zymogens, covalent modifications . Multienzyme complexes, compartmentation of enzymes, Isozymes, Immobilized enzymes, Enzyme engineering. Applications of Enzymatic analysis in medicine and industry.	7

References

1. Lehninger, A.L.Nelson, D.L.and Cox, M.M.Principles of Biochemistry. CBS Publishers and

Distributors.
2. Voet, D. and J.G. Voet, Biochemistry, John Wiley & Sons, Inc.
3. Murray, R.K., D.K.Granner, P.A.Mayes and Rodwell V.W, Harper's Biochemistry: Appleton & Lange.
4. Gumport, R.I., Jonas, A.Mintel, R. and Rhodes C. Students companion for Stryer's Biochemistry. Freeman and Company.
5. Stumpf, P.K. and Conn, E.E. Biochemistry of Plants. A comprehensive treatise (Series) Academic Press.
6. Gowenlock, A.H., McMurray, J.R. and McLauchlan, D.M.Practical Clinical Biochemistry. CBS Publishers & Distributors.

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 2C 01– METABOLISM AND BASIC ENZYMOLOGY

Time: Three hours **Max.Weight : 30 weightage**

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. What are abzymes
2. Give an idea about the subunit composition of ATPsynthase
3. What is the significance of pentose phosphatepathway?
4. What do you know about amphibolicpathway?
5. Distinguish between enzyme activity and specificactivity
6. What is the function of ribonucleotidereductase?
7. Write a note on chemiosmotichypothesis
8. Distinguish between action of ligases andlyases

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

9. Discuss about the usefulness of Line weaver-Burk plot in studying mechanisms of enzyme inhibition
10. Discuss about the electron flow between electron carriers of ETC
11. What are the different methods to immobilize enzymes? Discuss about the applications of immobilized enzymes
12. Discuss about the degradation of pyrimidine bases
13. Describe beta-oxidation of fatty acids. How many steps of beta oxidation are needed for the

oxidation of stearic acid?

14. Write a note on urea cycle
15. What are the factors affecting enzyme activity?
16. Discuss about the degradation of phenyl alanine and thyrosine

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

17. Write as essay on different classes of chemotherapeutic agents and their mode of action
18. Describe the role of microbes in phosphorus and nitrogen cycle
19. Describe HMP Shunt and Enter Duodroff pathway

SYLLABI FOR CORE COURSES

Semester : Two

Course Code : SJ GBT 2C 02

Name of the Course: MOLECULAR BIOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic structure and concepts of molecular biology and related concepts	PO1/PSO 2	U	C	5	
CO2	Analyze the concept and mechanism of DNA Damage and Mutation with reference to DNA repair system is taught	PO1/PSO 1	Z	C	10	
CO3	Understand about the fine structure and features of gene and to get understand the major mechanisms involved in gene transfer.	PO2/PSO 1	U	C	8	
CO4	Discuss the molecular	PO1/PSO	A	C	15	

	mechanism and machineries involved in replication,transcription,and translation .	2				
CO5	Discuss the significance of operon models, plasmids and Transposons in the living system.	PO1/PSO 4	A	C	12	
CO6	Explain the concept of Central Dogma and importance of the universal Genetic code and its features.	PO1/PSO 2	U	C	5	
CO7	Understand the concept of chromosomal breakage, structural and numerical abnormalities and genetic disorders.	PO1/PSO 1	U	C	5	

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***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours : 90 Hours**

Sl no.	Modules	Hours
1	Molecular Basis of Life – Nucleic Acids and Polypeptides, Structure of DNA – Geneticmaterial, Chargaff's Rule, X-ray Crystallographic studies. Denaturation and Renaturation, super – coiling, Different forms of DNA, Circular DNA.	8
2	DNA Replication- General features; semi-conservative, Mechanism of Replication- Elongation and Termination, rolling circle and theta model, Enzymology of Republication- primase, DNA Polymerase, Gyrase, Topoisomerase, Helicase; Republication fork, Telomerase activity; Republication in cancer Cells.	12
3	DNA recombination and Repair- Mechanism, Proof- reading, Types of DNA damage. Types of DNA Repair; Mismatch, Base-excision, Nucleotide- excision, recombinational and direct repair, SOS repair, DNA recombination models and mechanisms- Holliday model (Homologus), D-loop, double-strand break, site – specific recombination and DNA transpositions, Transposable Elements in Prokaryotes and Eukaryotes, classification of Transposons, Mutations- Types and various mutagens.	12

4	Molecular Genetics- Molecular Mechanisms of Transformation, Transduction and Conjugation.	5
5	Gene Structure- Salient Features of Genes, Fine Structure of Prokaryotic and Eukaryotic Genes; Transcription- Mechanism in Prokaryotes, Types of Transcripts, Eukaryotic Transcription, Post Transcriptional Modification of mRNA, mRNA Maturation, mRNA surveillance, Promoters and promoter elements.	12
6	RNA Splicing- Chemistry of Splicing, Spliceosome Machinery, Splicing Pathways, Modifications in RNA – 5' cap Formation, 3' end Processing and Polyadenylation, RNA Processing, rRNA and tRNA processing, RNA Editing, Ribozymes.	8
7	Gene Regulation – Prokaryotic Gene Regulatory Mechanism; Operon Concept: Lac, trp, gal and ara operons. Gene Regulation in Eukaryotes, DNA methlyations, Regulation of mRNA stability, Transcription Factors, Enhancers and Silencers.	10
8	Genetic Code- Salient Features, Deciphering the Code, Multiple Recognition of Codons and Wobble Hypothesis- Initiation and Termination Codon tRNAs and their charging by amino-acyl transferases-chemical and kinetic proof-reading.	5
9	Proteins Synthesis Mechanism in Prokaryotes and Eukaryotes- Translation initiation, elongation and termination. Post Translational Modifications.	10
10	Structural and numerical aberration of chromosomes and genetic disorders.	8

Reference:

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 Freedom

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 2C 02– MOLECULAR BIOLOGY

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Circular DNA.
2. Topoisomerase.
3. Wooble hypothesis.
4. Ribozymes.
5. SOS repair.
6. snRNA.
7. Turners Syndrome.

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Describe the replication of retroviruses
9. Salient features of Genetic code?
10. Describe different DNA repair mechanisms
11. Discuss different prokaryotic transposons
12. Brief account on Numerical aberrations of chromosome.
13. Discuss different forms of RNA
14. Give a short note on DNA supercoiling.

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Describe the Post translational modification mechanisms
16. Explain gene regulation in prokaryotes
17. Describe the molecular mechanism of DNA recombination
18. Define RNA splicing and mechanism involved in it.

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SYLLABI FOR CORE COURSES

Semester : Two

Course Code : SJ GBT 2C 03

Name of the Course : ENVIRONMENTAL BIOTECHNOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic concept and issues of environmental Biotechnology and different types of pollution's and their management.	PO4/PSO1	U	C	9	-
CO2	Evaluate importance of Biodiversity and their measurement	PO4,PO6/PSO1	U	C	8	-
CO3	Determine biological methods for identification and treatment of different pollution and polluted areas	PO4/PSO2	A	P	9	-
CO4	Explain the microbial involvement in the degradation of toxic products and protection of environment.	PO4/PSO1,PSO 2	A	C	12	-
CO5	Demonstrate production of economically important substance from biological sources	PO3,PO6/PSO1 ,PSO2	Z	P	12	-
CO6	Significance of global environmental issues and the control measures.	PO3,PO4,PO6/ PSO1,PSO2	Z	C	8	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

Sl no.	Modules	Hours
1	Environment- Basic concepts and issues.Biodiversity, its indexing- Shannon diversity index, Conservational biology	6
2	Environment Pollution – Sources, types of pollution, Methods of Measurement of pollution, Air Pollution, sources and control measures. Water Pollution-Water as a scarce natural resource, Need for Water management, Measurement of Water Pollution, sourcing of water pollution, control measures of water pollution.**B**acteriological testing of waste water- MPN	8
3	Microbiology of waste water treatment Waste water collection, physical, chemical and biological waste water treatment methods. Aerobic waste treatment, Activated sludge process, Oxidation Ponds, Oxidation ditches, trickling filters, towers, rotating discs, Anaerobic processes- Anaerobic digestion, anaerobic distillery, tannery, antibiotic industries.	10
4	Solid Waste Management- sources, types of solid wastes, Strategies for Management (Composing, wormiculture, and methane production), treatment of hazardous wastes, and Biomedical wastes. Biosensors- Types and applications in environmental pollution detection and monitoring, Antibody based bio sensors. Biological indicators.	5
5	Bioremediation of contaminated solid and wasteland-Insitu, Exsitu Bioremediation, phytoremediation Bio fertilizers- Symbiotic and asymbiotic nitrogen fixers, Benefits and limitations of Bio fertilizers.	10
6	Microbiology of degradation of xenobiotics in environment, bioaccumulation, biodegradation of xenobiotics, Role of degradative plasmids, degradation of hydrocarbons- substituted hydrocarbons, fate of polychlorinated biphenyls, and fate of surfactants, detergents, and fate of oil spillage, bioleaching, and biosorption.	8
7	Pesticides and its adverse effect on Environment. Bio pesticides in integrated pest management- Preventive IPM Strategies, types of Biopesticides.	6
8	Bioplastics- PHA, PHB, BIOPOL-A	5
9	Biofuels- Production of Alcohols, Methane, Hydrogen from Biomass, energy crops, the future applications. Green composite- Starch based, Concept of green patent.	6
10	Global Environmental Problems- Ozone depletion-UV-B Radiation Flux increase, effect of UVB on biological system, Greenhouse effect, implications of global warming, Effects and measures to control Acidrain.	8

Reference:

1. Waste water Engineering – Treatment, Disposal and Reuse, Metcalf and Eddy.
2. Comprehensive Bio Technology Vol.4, M.Moo-Young.
3. Environmental Chemistry, A.K.De,
4. Introduction to Bio deterioration, D.Allsopp and K.J.Seal.
5. Comprehensive Bio Technology, second edition, Elsevier, 2011, Murray Mor. Young (Editor in chief). ISBN-978-0-08-088504-9
6. Environmental Science and Bio Technology: A.G.Murugesan, C.Rajakumari; MJP Publishers.
7. Environmental Bio Technology; Alan Scragg; Oxford University Press.
8. Environmental Bio Technology; M.H.Fulekar; Oxford & IBH Publishing Co.Pvt.Ltd.

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 2C 03– ENVIRONMENTAL BIOTECHNOLOGY

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Differentiate between BOD and COD
2. What are Biosensors and its application
3. Give an account on biological indicator species
4. What are oxidation lagoons
5. Concept of green patent
6. Write the important features of UASB
7. Comment on Ozone depletion

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Explain the hazardous effects of xenobiotics
9. Biofuels
10. Discuss the role of micro organisms in the degradation of pesticides
11. Bioplastics
12. Write notes on Vermicomposting
13. Biochemistry of Lignin biodegradation

14. Working of Trickling filter.

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Describe the tertiary treatment strategies for waste water.
16. Explain degradation of xenobiotics using microbes
17. Describes various strategies for management of solid waste
18. Discuss sources and control measures for air pollution

SYLLABI FOR CORE COURSES

Semester : Two
Course Code : SJ GBT 2C 04
Name of the Course : BIOSTATISTICS AND BIOINFORMATICS

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Analyse statistical data using measures of central tendency dispersion, MS Excel, MS Word and location	PO1,PO2/PSO2 ,PSO4	Z	F	9	-
CO2	Calculate and interrupt the correlation between two variables	PO1/PSO2	A	P	8	-

	and simple linear regression equation for a set of data					
CO3	Analyse statistical data graphically using frequency distributions and cumulative frequency distributions	PO2/PSO1,PSO 2	Z	F	9	-
CO4	Understand data organization and management of data	PO1/PSO2	U	F	12	-
CO5	Understand the basic concept of bio informatics, including Data management, sequencing, protein modelling and phylogeny	PO1/PSO1,PSO 2	U	C	12	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**
***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

Sl no.	Modules	Hours
1	Population, Sample, variable, parameter, primary and secondary data, screening and representation of data. Frequency distribution, tabulation, bar diagram, histograms, per diagram, and cumulative frequency curves. Mean median mode, quartiles and percentiles, measures of dispersion: range, variance, standard deviation, coefficient of variation, symmetry: measures of skewness and kurtosis.	6
2	Simple linear regression and correlations.	8
3	Understand and interpret results from analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations' flow charts and programming techniques in statistics with R Programming.	10
4	Testing and Significance levels-T-test, Chi-squire test, null hypothesis, test of hypothesis	10
5	Introduction to data structures- Arrays- stacks- Queues- List operations	6

	on Arrays – stacks- Queues- List. Database Management System:- Actors on the scene- database models – structure of DBMS.	
6	Introduction to MS EXCEL-Use of in-built statistical functions for computations of Mean, S.D., correlation, regression coefficients etc. Use of bar diagram, histogram, scatter plots, etc. graphical tools in EXCEL for presentation of data.	6
7	Computer-oriented statistical Technique: Frequency table of single discrete variable, bubble sort, computation of mean, variance and standard deviation, the test correlation coefficient.	7
8	Introduction to Internet and use of the same for communication, searching of database, literature, references etc.	5
9	Introduction to Bio informatics, Databank search, Data management and interpretation, BLAST, Sequence alignment	6
10	Protein Modelling, Protein structure Analysis, Docking, Lig plot interactions, Genes, Primer designing, Primer designing, Phylogenetic Analysis	8

Reference:

1. Applied Bioinformatics- an introduction- (springer) Seizer P.M and others
2. Bio informatics Basics- (CRC)- Rashidi, Hooman H, Lukas K Buchler
3. Structural Bio informatics – (CRC)- Burkowski
4. Bio information a practical guide to the analysis of genes and proteins BexevanisAndress D
5. Practical Bio informatics (springer)- Bujnicki, Janusz M. –ed
6. Bio statistics refoundation for analysis in health sciences (John Wiley) Wayne W Daniel
7. Fundamentals of Bio Statistics a practical approach (Kanishka)- NarenkumarDutta
8. Statistical methods in Biology (Cambridge University Press)- Bailey, Norman T.J
9. Principles of Biostatistics (Wadsworth, USA)- Pagano Marcello
10. Biostatistics for the biological and health sciences (Pearnon) Triola, Mare M, Triola, Mario F

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 2C 04– BIOSTATISTICS AND BIOINFORMATICS

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. What is localalignment?
2. What ismacro?

3. What issample?
4. What isGENbank?
5. What iskurtosis?
6. Histogram
7. Regression

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Define regression and explain linear regressionanalysis.
9. Explain stacks andques.
10. What are the advantages of Data base managementsystem.
11. Describe the important feauturesof MSExcel.
12. Briefly explain computer oriented statisticalt echniques.
13. Define range? Find out range of following series
    a. 62, 70, 89, 15, 78, 86,58.
    b. 19, 19.5, 18.2, 13, 16, 21,23.
14. Describe briefly normal distribution and normal distribution curve

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. What are the different parameters required for primer designing? Add a note on primer design tools.

16. Define and explain correlation and correlation coefficient with examples.

17. Explain measures of dispersion with examples

18. Explain measures of central tendancy with examples

SYLLABI FOR CORE COURSES

Semester : Three
Course Code : SJ GBT 3C 01
Name of the Course : GENETIC ENGINEERING

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic principle, tools, cloning vectors used and transformation strategies followed in genetic engineering experiments	PO1,PO2/PSO3,PSO4	U	F	9	-
CO2	Create gene libraries and understand the methods of selection and screening of recombinant clones	PO1/PSO4	C	C	8	-
CO3	Discuss different prokaryotic and eukaryotic gene expression systems	PO1/PSO3	Z	C	9	-
CO4	Understand the application of molecular markers in genome mapping	PO2/PSO4	U	F	12	-
CO5	Understand the application of molecular markers in genome mapping	PO1/PSO4	U	C	10	-
CO6	Discuss the techniques of gene knockout and transgenic technologies, gene editing, gene correction and regulation	PO1,PO2/PSO3,PSO4	A	C	12	-
CO7	Understand the guidelines for genetic	PO1,PO2/P	U	F	8	-

	engineering experiments and biosafety and analyse general concerns and environmental hazards of genetic engineering	SO3,PSO4				

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**
***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

Sl no.	Modules	Hours
1	Basic principles of genetic engineering, Scope of genetic engineering. Basic tools: restriction and modifying enzymes, Gene cloning vectors: Plasmids, Bacteriophages, Phagemids, Cosmids, Artificial Chromosomes, Introduction of recombinant DNA into prokaryotic and eukaryotic systems. cDNA and genomic libraries.	10
2	Recombinant screening and selection- markers, nucleic acid hybridizations: colony, plaque, dot blot, southern and northern.	10
3	DNA sequencing techniques, Sanger-Coulson method, Maxam Gilbert method, Automated DNA sequencing, Next generation sequencing. PCR and us applications. PCR steps, Primer design Studying PCR products, Types of PCR Study of gene regulation, DNA transfection, Northern analysis, S1 mapping, Primer extension, RNase protection and Reporter assays.	10
4	Expression vectors Expression in prokaryotic and eukaryotic systems. Antibody based screening for recombinant proteins. Expression of heterologous genes: Bacterial, Yeast, Insects Baculovirus system. Mammalian cells (Human viral vectors shuttle vector) Processing of Recombinant proteins, Intra cellular periplasmic and extra cellular expression of protein. Purification and refolding. Characterization of recombinant proteins. Stabilization of proteins. Phage display system.	15
5	Molecular mapping of genome. Genetic and physical maps, Chromosome micro dissection and micro cloning, Molecular markers in genome analysis (SST, SSR, SNP, VNTR, ISTR,ISSR,AFLP, RAPD, and AFLP analysis, molecular markers linked to disease resistant genes) Application in forensic, Disease prognosis, Genetic counselling, Pedigree analysis, Taxonomy and biodiversity.	8

6	Transgenic and gene Knockout technologies, Gene therapy, Vectors and gene delivery, Gene replacement/augmentation, Gene correction, Gene editing- Gene editing tools CRISPER- Cas 9, Gene regulation and silencing DNA Micro array technology.	9
7	Genetic engineering guidelines, cloning and patenting of life forms Biosafety Introduction, GMOs, General Concerns, Hazards of environmental engineering, Bio-safety Guidelines and regulations Operation of Biosafety guidelines and regulations.	10

Reference:

1. Molecular cloning : A laboratory manual- Sambrook
2. DNA cloning: A practical approach- D.M.Glover and B,D,Hames.
3. Molecualr and cellular methods in biology and medicine- Kaufman
4. Methods in enzymology – Vol 152: A guide to molecular cloning techniques- S.L.Berger and A.R.Kimar.
5. Methods in enzymology: VOI 185:gene expression technology – D.V.Goeddel
6. DNA science: A first course in recombinant technology: D.A.Mickloss and G.A.Frier.
7. Molecular biotechnology-S.B.Primrose
8. Molecular biotechnology-Glick and Pasternak

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 3C 01– GENETIC ENGINEERING

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. What is meant by purification tag?
2. What are Shuttle vectors?
3. What is TALEN?
4. What is Lipofection?
5. What is pGEM3Z
6. What is Colony PCR
7. Write the principle behind flavrsavr tomato.

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Write note on YAC and BAC.
9. Briefly explain DNA microarray technology.
10. Explain in detail about Biosafety.

11. What are the principle and applications of knockout mice?
12. Write note on types and applications of Restriction enzyme in genetic engineering.
13. What are expression vectors?
14. Write note on Sangers and automated DNA sequencing methods

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Explain in detail about the principle, types and applications of PCR?
16. Discuss the different purification and characterization methods of recombinant protein?
17. Narrate the applications of molecular markers in different field of lifesciences.
18. Write an essay on Mammalian expression Vectors

SYLLABI FOR CORE COURSES

Semester : Three

Course Code : SJ GBT 3C 02

Name of the Course : BIOPROCESS TECHNOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Discuss the use of living organisms in bioprocess technology, engineering, medicine and agriculture	PO1,PO2/PSO3	U	C	9	-
CO2	Understand the major concept of bioprocess technology, bio reactor designing, media formulation and optimization	PO1/PSO3,PSO4	U	C	10	-
CO3	Explain the kinetics of microbial growth in different culture systems	PO1/PSO3	Z	C	9	-
CO4	Describe various parameters used for the measurement and control of bioprocess techniques	PO1/PSO3,PSO4	A	C	9	-
CO5	Explain the downstream process for fermentation products	PO2/PSO3,PSO4	Z	C	10	-
CO6	Design a fermentation process for the production of microbial metabolite.	PO2/PSO3,PSO4	C	P	8	-

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***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

SL No	Module	Hours
1	Introduction to Bio process engineering. The chronological development of the fermentation industry Microbial biomass, Microbial metabolites, Recombinant products, Transformation process	3
2	Bioreactors: A typical bioreactor. Configuration of a bioreactor. Body construction. Aeration and agitation. Achievement and maintenance of aseptic conditions. Sterilization of fermenter, air supply exhaust gas from fermenter. Inoculation, Different ports and Probes. Valves and steam traps.	10
3	Isolation, preservation and maintenance of micro-organisms. Selection of natural variants important characteristics. Screening methods strain improvement Random mutagenesis and site directed mutagenesis. Isolation of induced mutants synthesizing improved levels of primary metabolites and secondary metabolites.	10
4	Kinetic of microbial growth and death. Batch culture, Continuous culture, Multistage systems Feedback systems. Comparison of batch and continuous culture in industrial processes. Feedback culture Variable volume Fixed volume and Cyclic fed batch culture. Specific growth rate. Monod equation.	7
5	Media for fermentation typical media composition. Medium formulation. Carbon, Nitrogen, Minerals, and Energy sources. The addition of precursors and metabolic regulators to media Medium optimization. Oxygen requirements. Antifoams. Air and media sterilization – Media and Air sterilization. Batch, continuousand Filter sterilization.	8
6	Types of fermentation process, Types of reactors. Analysis of batch fed batch and continuous bio reactions. Stability of microbial reactors. Analysis of mixed microbial populations. Bio reactors like pulsed, fluidized, photo bioreactors, Plug flow.	8
7	Measurement and control of bio process parametersmethods of measuring Process Variables (temperature, oxygen, pressure etc.). Online Analysis of other chemical factors. Control systems. Computer applications in fermentation technology. Mass/Oxygen transfer resistance. Aeration and agitation. Yield and energy consideration. Reynoldsnumber and power number.	8
8	Downstream processing. Removal of microbial mass and solid matter. Foam separation Filtration, Precipitation, Centrifugation. Cell disruptions methods. Liquid- liquid extraction. Chromatography Membrane process. Drying and crystallization.	8

9	Industrial production of chemicals. Alcohol (ethanol), Acids, (citric, acetic and gluconic), Solvents (glycerol, acetone and butanol),Antibiotics (penicillin, streptomycin and tetracycline), Amino Acids(lysine, glutamic acid). Single Cell protein Whole Cell immobilization and their industrial applications.	10

Reference:

1. Bio chemical engineering, Alba.S, Humphrey, A.E and Millis
2. Bio chemical reactors, Atkinson, B,
3. Principles of fermentation technology, Stanbury, P.F and Whitaker
4. Bio process technology, fundamentals and applications, KTH, Stockholm
5. Process engineering in biotechnology, Jackson, A.T.Prentice Hall, Engelwood
6. Bioreaction engineering principles, Nelson, J and Villdsen, J.Plenum press

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 3C 02– BIOPROCESS TECHNOLOGY

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. What is secondary screening?
2. Describe the method of entrapment for immobilization.
3. What is photo-bioreactor? Write a note on its application
4. What is yield coefficient and power number
5. Mention the methods of agitation in fermenter
6. What you mean by anti-foam agents?
7. Distinguish between primary and secondary metabolites

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Discuss the online analysis of parameters in a fermentation process.

9. How the analysis of mixed microbial population in fermentation is achieved?
10. Distinguish between primary and secondary metabolites. Briefly explain the microbial production of any secondary metabolite.
11. Which are the important primary screening techniques?
12. Explain microbial transformation with a suitable example.
13. Describe the sterilization techniques used in bioprocesses.
14. Explain the microbial production of citric acid.

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Which are the important factors to be considered in the body construction of a typical fermenter?
16. Discuss the different techniques involved in the downstream processing of bioprocess fermentation.
17. What is Single Cell Protein? Explain the production of SCP with a suitable example. Discuss the advantages and disadvantages of single cell proteins.
18. Describe the media formulation in a typical bioprocess.

SYLLABI FOR CORE COURSES

Semester : Three

Course Code : SJ GBT 3C 03

Name of the Course : PLANT BIOTECHNOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Explain the basic concepts, sterile practices and maintenances of a tissue culture lab	PO5/PSO1,PSO3	U	C	5	-
CO2	Define molecular farming, plant tissue culture, embryogenesis and protoplast culture	PO5/PSO3,PSO4	U	C	8	-
CO3	Explain secondary metabolite production and its applications also describe the role of plant as a bioreactor	PO1/PSO2,PSO3,PSO4	U	C	8	-
CO4	Describe the various techniques and vectors involved in plant transformation	PO2/PSO2,PSO3,PSO4	R	C	8	-
CO5	Discuss about the GM crops and their products	PO5/PSO3	A	C	10	-
CO6	Understand the strategies for the improvement of crops and yields	PO2/PSO3,PSO4	U	C	15	-

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***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

Sl no.	Module	Hours
1	Plant tissue culture introduction and techniques- lab organization, media preparation and types, aseptic manipulation, contamination, disease indexing and eradication, vitrification. Cell biology of plant cell culture and development- Major cell types in culture, separation of cell types, growth of cells in suspension, role of growth regulations in growth regulators in growth and differentiation in culture, hormone, habituation.	6
2	Micro propagation- Principle, stages, applications. Micro propagation in commercial perspectives- advantages, economics, robotics and automation. Regeneration in vitro- Pathways and factors controlling regeneration. Organogenesis. Somatic embryogenesis- Induction, development and maturation, somatic embryo vs zygotic embryo, synseed production and applications.	8
3	Somatic hybridization- Protoplast isolation, purification, viability, test, culture- conditions and media, culture methods, micocalli, regeneration, fusion methods-mechanical, chemical, selection and isolation of heterokaryons, genetic consequences, cybridization.	8
4	Haploid production-anther and microscope culture, pathways of androgenesis, media, factors controlling androgenesis, applications in plant breeding. Triploid production- Techniques, media, explants, organogenesis, factors affecting callus and shoot bud formation, applications in plant breeding. Tree biotechnology- modification of wood quality.	8
5	Embryo culture-Types of embryo, media, role of suspensor, precious germination, morphogenesis of undifferentiated embryo, embryo rescue, applications in plant breeding. Culture of ovule	8

	and ovary, factors affecting seed-set after in vitro pollination, applications.	
6	Somaclonal and Gametoclonal variation- Molecular basis of variation, variants, selection. Application in plant breeding. Mutation breeding in tissue culture Spontaneous, induced, Chimeras, adventitious bud technique. Germplasm conservation Modes of conservation, in vitro methods of conservation, viability testing, applications.	8
7	Secondary metabolite production by plant tissue culture- Factors affecting production. Bioreactors Bio transformation, Immobilized plant cells, Hairy root cultures. Applications- Production of antibodies, viral antigens and peptide hormones in plants, biodegradable plastics in plants, Metabolic Engineering.	8
8	Plant transformation- Ti &Ri plasmids as vectors, basis of tumor formation Mechanism of DNA transfer, role of 'vir' genes, binary and co-integrate vectors, viral vectors, use of 35s, inducible, tissue specific promoters, nuclear transformation, multiple gene transfer, direct gene transfer methods-macro – and micro-injection, particle gun method, electroporation, transformation of monocots. GM plants with animal gene-plantibodies and plant vaccines. Metabolic engineering	8
9	Applications of plant transformation- Herbicide resistance: phosphinothricin, glyphosphate (Round up technology), sulfonyl urea, atraize; Insect resistance: Bt genes, non Bt genes, non Btlike protease and amylase inhibitor genes, Virus resistance: coat protein mediated, nucleocapsid gene; Disease resistance: chitinase, 1-3 ….-glucanase, RIP, antifungal proteins, thionins, PR proteins, Nematode resistance; Abiotic stress, Post-harvest losses, Long shelf life of fruits and flowers, use of ACC synthase, poly galacturonase, ACC oxidase, male sterility, carbohydrate composition and storage, ADP glucose pyrophosphate.	10

Reference:

1. Bhojwani S.S and Razdan M.K. Palnt Tissue Culture, Elsevier, Amsterdam.
2. Debergh P C. and Zimmerman R.H. (Eds.) 1991. Micro propagation technology and application, Kluwer, Dordrecht.
3. Dixon R.A & Gonzales R.A (Eds.) Plant cell culture-A practical approach, IRI Press. Oxford.
4. Gamborg O.L and Philips G.C. Plant cell, tissue and organ culture. Narosa publishing house, New Delhi, 1995.
5. Radenbaugh K. (ed.) Synseeds: application of synthetic seeds to crop improvement, CRC Press, Boca Ration, FL.
6. Chawla H.S, "Introduction to Plant Bio Technology", 3rd Edition, Science Publishers,2009.

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 3C 03– PLANT BIOTECHNOLOGY

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Embryo rescue
2. Meristem culture
3. Diplodization
4. Protease inhibitors
5. B5 medium
6. Molecular farming
7. Surface sterilants.

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Somaclonal and gametoclonal variation
9. Production and application of artificial seed.
10. Discuss the various growth regulators used in plant tissue culture and their specific functions.
11. Describe embryo, ovary, ovule culture and their applications.
12. What are slow growth cultures? Explain their applications.
13. Explain direct and indirect organogenesis and discuss the factors effecting organogenesis
14. Whatare possible methods to increase the shelf life of fruits ?

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Explain the role of different bioreactors in plant secondary metabolite production"
16. Discuss the applications of plant transformation with specific examples
17. Describe different methods to create transgenic plants.
18. Explain somaclonal variation and its applications

SYLLABI FOR CORE COURSES

Semester : Three

Course Code : SJ GBT 3C 04

Name of the Course : IMMUNOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the major aspects of immune system.	PO5/PSO3	U	C	9	-
CO2	Discuss the properties of antigen and antibodies and mechanism of their interactions.	PO5/PSO3	Z	C	10	-
CO3	Significance of MHC, T-cell, B-cell receptors and their regulations.	PO1,PO5/PSO3,PSO4	E	P	9	-
CO4	Explain hypersensitivity, autoimmunity and their treatment process	PO5/PSO3	U	C	9	-

CO5	Understand basic concept of immunity against infectious agents and transplantation process.	PO1,PO5/PSO3	U	C	10	-
CO6	Describe the mechanism of tumor development and therapeutic techniques against cancer	PO1,PO5/PSO3	Z	C	10	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total Hours 72**

SL No	Module	Hours
1	Introduction to immune system. Types of Immunity- Innate, Acquired, Passive and Active. Factors affecting Immune System.	5
2	Hematopoeisis and differentiation- Hematopoietic growth factors. Genetic regulation of hematopoiesis. Cells of Immune system- lymphocytes (T and B cells), null cells, mononuclear cells, granulocytes, dendritic cells. Organs of Immune System- primary lymphoid and secondary lymphoid organs, lymphatic system.	8
3	Antigens- properties-types. Immunogenicity and antigenicity. Factors affecting immunogenicity. Antigenic epitopes, Epitope mapping, Adjuvants, haptens, super antigens. Antibodies basic structure, Immunoglobulin domains, antigenic determinant on immunoglobulin-isotype, allotype, idiotype, B-cell receptors (BCR) – Immunoglobulin genes.	10
4	Antigen – antibody interaction- Affinity and avidity, cross- reactivity, precipitation, agglutination and agglutination inhibition reactions, Hemagglutination, Bacterial agglutination and particle agglutination and its applications.	7

5	MHC-structure, organization and inheritance, Cellular distribution of MHC-Antigen presentation pathways- immune response,diseasesusceptibility,HLAtyping and cross matching. T-cell and B-cell receptors. Antigen processing and presentation. Effector responses-Humoral and Cell-mediated response. NK cell mediated cytotoxicity, Antibody dependent cell mediated cytotoxicity, Macrophage mediated cytotoxicity. Regulation of immune response. Activation of B and T lymphocytes.	8
6	Cytokines- Properties and therapeutic use- cytokine secretion by TH1 and TH2 Cells- Cytokine related diseases: Bacterial septic- Shock, Chaga's disease, lymphoid and myeloid cancers. Complement system-pathways- Role in immune regulation.	8
7	Hypersensitivity- Types. Diagnosis and treatment approaches Autoimmunity and Autoimmune diseases- Organ specific: thyroid and Systemic: SLE Diagnosis and treatment approaches.	6
8	Immunity to infectious agents- viral, bacterial, protozoan and helminthes infections. Immune aversion mechanisms.	8
9	Transplantation immunology- Tissue and organ transplantation. Immunology of rejection- mechanism, Immunosuppressive agents, Tumor Immunology – Oncogenes and cancer induction. Tumor antigens and immune response. Cancer immunotherapy.	6
10	Vaccines: Active and passive immunization. Whole organism vaccines, Recombinant vector vaccines, DNA vaccines, Synthetic peptide vaccines, Multivalent vaccines- Hybridoma technology- Monoclonal antibodies and therapeutic applications, Humanized vaccine	6

Reference:

1. Godkar P.B (1998): A Text Book of Medical Laboratory Technology. BhalaniBhalani Publishing House Mumbai.
2. Janiskuby (2000). Immunology .7th ed. W.H.Freeman& Co. New York.

3. Chakraborty A.K (2006) Immunology and Immuno technology. Oxford University Press.
4. Peter Parham (2004): The immune system (Second edition, Garlands, New York)
5. Eli Benjamini, Richard Coico, Geoffrey Sunshine (2000) Immunology- A short course Wiley- New York; Chichester:
6. William Paul (2012) Fundamentals of Immunology – Wolters Kluwer, Luppincott, Williams & Wilkins
7. David Male, Jonathan Brostoff, David Roth & Ivan Roitt (2012)- Immunology- Saunders.

MODEL QUESTION PAPER

M.Sc. DEGREE THIRD SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 3C 04– IMMUNOLOGY

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Give the significance of HAT medium.
2. List the important functions of interferons
3. Differentiate between passive and active immunity
4. What is the role of macrophages in immunity?
5. How does autoimmunity affect thyroid gland?
6. Briefly explain the typical structure of antibody.
7. Discuss the important properties of antigens.

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Give the principle of ELISA. With the help of figures describe the types of ELISA.
9. What are oncogenes? How can they induce cancer?
10. Comment on the applications of MAb.
11. Which are the defense mechanisms against bacterial infections?
12. Describe the mechanism of Graft rejection
13. Give the significance of class II MHC.
14. Discuss the regulation of immune response.

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Discuss the different techniques based on antigen antibody interactions.
16. Give a description on primary and secondary lymphoid organs.
17. Explain the treatment approaches towards hypersensitivity reactions. Add a note on the types of hypersensitivity reactions.
18. Give a description **o**f natural defence mechanism against bacterial, virus and protozoan infections

SYLLABI FOR CORE COURSES PRACTICALS

Semester : One

Course Code : SJ GBT1L01

Name of the Course : LABORATORY 1- CELL BIOLOGY, BIOMOLECULES & BIOPHYSICS AND MICROBIOLOGY

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Demonstrate the basic microbiology handling techniques like sterilization and media preparation	PO2,PO5/PSO2,PSO3	U	C	-	15
CO2	Describe about staining and slide preparation techniques	PO5/PSO3	A	P	-	10
CO3	Demonstrate various separation techniques	PO2,PO5/PSO2,PSO3,PSO4	Z	P	-	20

	such as chromatography techniques, electrophoresis, centrifugation techniques and spectrophotometer					
CO4	Understand the reactions of amino acid, sugar and lipids	PO2,PO5/PSO3,PSO4	Z	P		10
CO5	Discuss about different microscope principles and to be well versed with the handling of microscope	PO2/PSO3,PSO4	U	P		10
CO6	Understand the cell division principle and its various stages and to determine the presence of Barr body	PO5/PSO2,PSO3	Z	P		10
CO7	Determine the Anti-Microbial Activity by different methods and to analyse the bacteriological water quality	PO2,PO5/PSO3,PSO4	A	P		15

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total hours: 90**

SL NO.	Name of Practicals&Modules	HOURS
	Cell Biology	
1.	Microscopy : Bright field, phase contrast and fluorescence microscopy	3
2.	Microtomy	3
3.	Mitosis and meiosis	5
4.	Histochemical techniques	2
5.	Observation of Barr body	3
6.	Subcellular fractionation	2
7.	Squash preparation- polytene chromosome	5
8.	Karyotyping	4
	Biomolecules (Practicals)	
1.	Titration of amino acids- Determination of pK and pI values	3
2	Reactions of amino acids, sugars and lipids.	6
3	UV, visible & fluorescence spectroscopy, absorption spectra.	2
4	Quantitation of Sugars & Proteins.	5
5	Analysis of oils- iodine number, saponification number.	5
6	Chromatography (Gel permeation, Ion exchange, TLC)	5
7	Electrophoresis (PAGE, SDS- PAG, Agarose)	10
	Microbiology (Practicals)	
1	Equipments- Hot air oven, Autoclave, Seitz and membrane filter, Microscopy.	2
2	Media Preparation – Nutrient broth and Nutrient Agar, Mac conkey Agar, Blood Agar, Potato Dextrose Agar, Yeast Extract Mannitol	2

	Agar.	
3	Staining Techniques- Simple and Gram Staining, Spore and Capsule Staining. Fungal Staining, Acid Fast Staining.	1
4	Motility Determination – Hanging drop method	2
5	Isolation of Pure Colonies of Bacteria- Streak, Spread and Pour Plate Methods.	4
6	Biochemical Tests- Indole Test, Methyl Red test, VogesPrauskaur test, Citrate Utilisation test, Triple Sugar Iron test.	4
7	Cultivation Microscopic Examination of fungi Penicilium	4
8	Bacteriological Analysis of Water- Presumptive	4
9	Determination of Anti-Microbial Activity by Disc Diffusion method (Kirby Bauer Method)	4

MODEL QUESTION PAPER

M.Sc. DEGREE FIRST SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJGBT1L01-LABORATORY 1- CELL BIOLOGY, BIOMOLECULES AND MICROBIOLOGY

Time: 6 hours Total Weightage: 30

PART A

(**Each questions carries 6 weightage**)

Perform any two experiments and submit the results

1. Mitosis
2. Estimation of protein by Lowery's method
3. Gram's staining

PART B

(**Each questions carries 3 weightage**)

Perform any one experiment and submit the results

4. Separation of aminoacids by thin layer chromatography
5. Disk diffusion (antibiotic sensitivity- against any 3 antibiotics)

PART C

(**Each question carries 4 weightage**)

Write down the principle and procedure of the experiments

6. DNA estimation

7. MPN

PART D

Identify five spotters – 3 weightage

Viva-2 weightage

Record-2 weightage

SYLLABI FOR CORE COURSES PRACTICALS

Semester : Two

Course Code : SJ GBT2L01

Name of the Course :LABORATORY II- METABOLISM & BASIC ENZYMOLOGY, MOLECULAR BIOLOGY AND ENVIRONMENTAL BIO TECHNOLOGY.

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Design an experiment for the extraction and purification of enzyme	PO1/PSO2/PSO4	A	P	-	10
CO2	Understand the principles of basic molecular and biochemical techniques	PO5/PSO4	Z	P	-	20
CO3	Evaluate enzyme activity using assay protocols	PO1/PSO2,PSO4	E	P	-	20
CO4	Analyse the factors affecting enzyme activity	PO1,PO5/PSO4	Z	P	-	10

CO5	Discuss the techniques for the estimation of water quality, nitrate content, water pollution parameters BOD, COD	PO5/PSO2	A	P	-	20
CO6	Understand the concept of buffer preparation, isolation and quantification of nucleic acids and restriction – ligation experiments	PO1/PSO1,PSO4	A	P	-	10

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total hours: 90**

SL NO.	Name of Practicals&Modules	HOURS
	Metabolism and Basic Enzymology (Practicals)	
1.	*Extraction and purification of Enzymes. (Choose suitable enzymes)*	
	I. Extraction from plant tissues/Animal in suitable media and its activity measurement.	3
	II. Fractional precipitation using ammonium sulphate/organic solvents.	3
	III. Dialysis and desalting by gel filtration.	3
	IV. Purification by Ion exchange, adsorption chromatography and molecular sieving.	3
	V. PAGE for the enzymes.	4
2.	*Enzyme assay and quantitative measurement of activation by methods such as colorimetry and spectrophotometry.*	
	VI. Velocity measurements and calculation of specific activity.	3

	VII. Determination of optimum pH, enzyme concentration, temperature and time for enzyme activity.	5
	VIII. Substrate saturation and determination of Michaelis-Menton constant	2
	IX. Determination of temperature coefficient. Determination of energy of activation.	2
	X. Effect of inhibitors: Competitive and non-Competitive inhibition.	2
	Environmental Bio Technology (Practicals)	
1	Detection of Coli forms determination of the purity of potable water.	5
2	Determination of dissolved oxygen concentration of water sample.	5
3	Determination of biological oxygen demand (BOD) of sewage sample.	2
4	Determination of Chemical Oxygen demand (COD) of a sewage sample.	2
5	Isolation of xenobiotic degrading bacteria by selective enrichment technique.	6
6	Survey of degradative plasmids in microbes growing in polluted environment.	2
7	Effect of sulphur dioxide on crop plants.	4
8	Estimation of nitrate in drinking water.	2
9	Study on biogenic methane production.	2
	Molecular Biology	
1	Preparation of Buffers- Phosphate, Acetate, Tris HCI and Borate	5
2	Quantitation of Nucleic Acids.	3

3	DNA and RNA Agarose Gel Electrophoresis, SDS- PAGE	5
4	Restriction Digestion and Ligation Experiments.	5
5	Isolation of Total RNA	2
6	Isolation of Plasmid DNA	3
7	Isolation of Genomic DNA from bacteria, plant and animal tissues.	7

MODEL QUESTION PAPER

M.Sc. DEGREE SECOND SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 2L 01- LABORATORY II- METABOLISM & BASIC ENZYMOLOGY, MOLECULAR BIOLOGY AND ENVIRONMENTAL BIO TECHNOLOGY.

Time: 6 hours **Total Weightage: 30**

PART A

(Each questions carries 6 weightage)

Perform any two experiments and submit the results

1.Isolation of genomic DNA from plant or bacteria

2.Isolation of plasmid DNA by alkaline lysis method

3.Effect of substrate concentration on enzyme activity.

4.Determination of optimum pH for salivary amylase

PART B

(Eachquestions carries 3 weightage)

Perform any one experiment and submit the results

5.Estimation of COD in Water.

6. Assay of enzyme activity-salivary amylase

PART C

(Eachquestions carries 4 weightage)

Write down the principle and procedure of the experiments

7.Nitrate estimation
8. SDS-PAGE

PART D

Identify the 5 spotters – 3 weightage

Viva-2 weightage

Record-2 weightage

SYLLABI FOR CORE COURSES PRACTICALS

Semester : Three

Course Code : SJ GBT 3L 01

Name of the Course :LABORATORY III- GENETIC ENGINEERING, BIO PROCESS TECHNOLOGY, PLANT BIOTECHNOLOGY AND IMMUNOLOGY.

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Design transformation experiment	PO1/PSO4	C	P		12
CO2	Understand DNA amplification using PCR and Blotting techniques	PO2/PSO3	A	P		10
CO3	Design small scale production unit of ethanol, organic acid, enzymes and antibiotics	PO1/PSO3	Z	P		10
CO4	Understand the technique of Whole cell immobilization	POI/PSO3	U	P		10

CO5	Demonstrate callus initiation and organogenesis in different plantlets	PO5/PSO3	A	P		15
CO6	Comprehensive understanding of basic immunological principles	PO5/PSO3	Z	P		15

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS **Total hours: 72**

SL NO.	Name of Practicals&Modules	HOURS
	Genetic Engineering (Practicals)	
1	Preparation of competent cells	4
2	Calcium Chloride mediated transformation of *E.Coli*	4
3	Shot-gun cloning in plasmid or phagemid vectors	5
4	Southern blotting	3
5	Northern blotting	3
6	Reporter gene assay (Gus/CAT/b-GAL)	3
	Bioprocess Technology (Practicals)	
1	Isolation of industrially important microorganisms for microbial processes	3

2	Comparative studies of ethanol production using different substrates	4
3	Microbial production of citric acid using *Aspergillusniger*	3
4	Microbial production of antibiotics (Pencillin)	4
5	Production and estimation of Protease	3
6	Use of alginate for cell immobilization	3
	Plant Biotechnology (Practicals)	
1	Preparation and sterilization of glasswares,explant, etc.	1
2	Preparation stock solution for and media	2
3	Large scale isolation of mesophyll cells from leaves.	2
4	Initiation and maintenance of callus.	1
5	Organogenesis from callus	1
6	Somatic embryogenesis from root cultures.	2
7	Induction of haploids from another and pollen cultures.	2
8	Cultures, isolation and culture of protoplasts from leaf/call us by	2
9	Quantitation of tissue culture procedures: Determination of fresh and dry weights, cell culture density, PCV and MI.	2
	Immunology (Practicals)	
1	Blood film preparation and identification of cells, ABO Blood grouping	1
2	Lymphoid organs and their microscopic organization	1
3	Immunization and collection serum	1
4	Antibody titration	2

5	Double immune diffusion, Radial Immunodiffusion and immune electrophoresis.	2
6	Western Blotting	2
7	ELISA	2
8	Separation of mononuclear cells by Ficoll-Hypaque and its cell culture by mitogen induction	2
9	Widal and VDRL tests.	2

MODEL QUESTION PAPER

M.Sc. DEGREE THIRD AND FOURTH SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJGBT3L01-LABORATORY III- GENETIC ENGINEERING, BIO PROCESS TECHNOLOGY, PLANT BIOTECHNOLOGY AND IMMUNOLOGY

Time: 6 hours **Total Weightage: 30**

PART A

(Each questions carries 6 weightage)

Perform any two experiments and submit the results

1. PCR
2. Radial immunodiffusion method
3. Callus induction
4. Microbial production of antibiotics

PART B

(Each questions carries 3 weightage)

Perform any one experiment and submit the results

5. Blood film preparation and identification of blood cells.
6. Immobilization of enzymes

PART C

(Each questions carries 4 weightage)

Write down the principle and procedure of the experiments

7. ELISA
8. Transformation experiment

PART D

Identify the 5 spotters – 3 weightage

Viva-2 weightage

Record-2 weightage

SYLLABI FOR ELECTIVE COURSES

Semester : Three

Course Code : SJ GBT 3E 01

Name of the Course :Stem Cell Biology (PART – A)

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Define the basic terminology in stem cells	PO1/PSO2	R	C	15	-
CO2	Understand the Sources and classification of stem cells	PO2/PSO4	U	C	15	-

CO3	Discuss the developmental aspects of embryogenesis, Nuclear Transfer Technology, Stem cell differentiation and Stem cells cryopreservation	PO1/PSO3	U	C	20	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS Total Hours 72

SL No	Module	Hours
1	Introduction to stem cells, classification, Sources, programming and reprogramming, tissue specific stem cells Embryonic hematopoietic and neural stem cells, Classification and Sources.	31
2	Embryonic Stem Cells Blastoyst and inner cell mass cells; Organogenesis; Mammalian Nuclear Transfer Technology; Stem cell differentiation; Stem cells cryopreservation.	31

MODEL QUESTION PAPER
M.Sc. DEGREE THIRD SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 3E 01 STEMCELL BIOLOGY (PART A)

Time : 3 hours
Max. Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. TotiPotency
2. Hayflich limit
3. Cryoprotectant
4. Plasticity of stem cell
5. SCNT
6. Organogenesis
7. Blastocytes

Section – B

Answer any fourquestions. Each question carries a weightage of 3 – (4x3=12)

8.Programming of stemcell
9. Properties of stem cells
10. Transplantation of stem cells.
11. Stem cell banking.
12. Write a short note on inner cell mass
13. What is neurulation? Explain the process detail.
14. Stem cells cryopreservation

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Describe the stages of Stem cell differentiation
16. Explain how Stem cell therapy is useful for diseases
17. Write a note on organogenesis and development process.
18. Explain in detail about classification of stem cells.

SYLLABI FOR ELECTIVE COURSES

Semester : Four

Course Code : SJ GBT 4E 03

Name of the Course :Stem Cell Biology (PART – B)

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Discuss Neurodegenerative diseases and Application of stem cells in therapy	PO5/PSO3	A	C	10	-
CO2	Analyse the concept of human embryonic stem Cells with reference to ethical and religious consideration	PO1,PO5/PSO3	Z	C	15	-

CO3	Examine various model organisms in the field of stem cell research	PO1/PSO3	U	C	10	--
CO4	Understand Stem cell isolation & characterization techniques	PO1.PO2/PSO3	U	C	15	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS Total Hours72

SL No	Module	Hours
1	Application of stem Cells Overview of embryonic and adult stem cells for therapy Neurodegenerative diseases; Parkinson' Alzheimer, Spinal Code Injuries and other Brain Syndromes; Tissue systems failures; Diabetes; Cardiomyopathy; Kidney failure; Liver Failure; Cancer; Hemophilia.	25
2	Human Embryonic Stem Cells and society. Human stem cells research: Ethical consideration; Stem cell religion consideration; Stem cell based therapies: Pre clinical regulatory consideration and Patient advocacy.	25
3	Various model organisms. Stem cell isolation & characterization techniques.	22

Reference:

1. Ann A Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartett, 2003.
2. Peter J.Quesenberry, Stem Cell Biology and Gene Therapy. 1st Edition, Willy-Less, 1998.
3. Robert Lanja, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.

4. A.D.Ho., R.Hoffiman, Stem Cell Transplanation Biology Processes Therappy, Willy – VCH 2006.

5. C.S.Potten, Stem Cells, Elsevier, 2006.

MODEL QUESTION PAPER
M.Sc. DEGREE FOURTH SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJGBT 4E 03STEMCELL BIOLOGY

Time :3hours
Max. Weight :30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. TotiPotency
2. Hayflich limit
3. Cryoprotectant
4. Plasticity of stem cell
5. Blastocyte
6. yamanaka factors
7. zebra fish

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Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8.Stem cells for liver regeneration
9. Umbilical cord as a source of stem cell
10. Stem cell therapy in Cardiomyopathy
11. Clinical testing of stem cells.
12. Stem cell therapy in liver cells
13. Stem cell therapy in neurodegenerative disease.
14. Ethical regulations in stem cells

Section – C

Answer any twoquestions. Each question carries a weightage of 5 – (1x5=5)

15. Discuss the Ethical Guidelines of stem cell therapy
16. Explain how Stem cell therapy is useful for diseases
17. Write a note on stem cell differentiation.
18. Explain role of model organisms in stem cell therapy.

SYLLABI FOR ELECTIVE COURSES

Semester : Three

Course Code : SJ GBT 3E 02

Name of the Course :Virology (Part A)

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the basic concept of isolation, cultivation, classification and enumeration of viruses.	PO1,PO5/PSO1,PSO4	U	C	15	
CO2	Explain viral tropism and replication mechanism of viruses	PO5/PSO3	A	C	15	
CO3	Describe virus host interactions	PO5/PSO1,PSO4	A	C	15	

Syllabus

Sl NO	Module	Hours
1	General properties of viruses- Structure and Morphology, Cultivation. Methods used for viral quandification and enumeration. Electronmicroscopicstudies.Viral classification DNA and RNA viruses, Laboratory requirements for cultivation. Lawn culture, Embryonated egg inoculation, Animal inoculation, Permissive and non-permissive hosts or cells. Tissue- Types of Cell-lines used for the study Detection of virus growth in cell culture.	31
2	Viral Tropism, Factors responsible for viral tropism. Replication of DNA viruses and RNA viruses, effects of viruses on the host cells-cytopathic effect. Immune aversion mechanism of viruses, Emerging viral diseases. Virus Host interaction- Acute infection, chronic/persistent infection latent infection and slowly progressive virus infection Viral	31

	inclusion bodies- methods of staining and demonstration.	

MODEL QUESTION PAPER

M.Sc. DEGREE THIRD SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 3E 02 Virology Part A

Time : 3 hours

Max. Weight : 30weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Write a note on different methods for virus isolation and cultivation.
2. Discuss the laboratory test for detection of viruses.
3. Discuss the mechanism of viral tropism
4. Write a note on commonly used cell lines for virus cultivation
5. Lygogenic cycle of virus
6. Lytic cycle of virus
7. What is mean by viral tropism

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. What are the general properties of viruses?
9. Write a note on replication of DNA and RNA virus.
10. Write a note on immune aversion mechanism of virus.
11. Discuss about viral inculsion bodies staining and detection methods.
12. What are the emerging viral diseases.
13. Write a note onelectronmicroscopicstudies of virus.
14. Explain culture methods of viruses

Section – C

Answer any one question. Each question carries a weightage of 5 – (1x5=5)

15. Discuss about different virus host interaction and immune aversion mechanism of virus.
16. Discuss the general properties and classification of virus.
17. Explain the viral tropism and factors effecting viral tropism.

SYLLABI FOR ELECTIVE COURSES

Semester : Four

Course Code : SJ GBT 4E 04

Name of the Course :Virology (Part B)

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Describe about different types of virus and their control measures.	PO5/PSO3	U	C	12	
CO2	Explain different types of bacteriophages	PO1/PSO4	U	C	10	
CO3	Determine the economic losses due to virus	PO1,PO5/PSO3,PSO4	A	P	10	
CO4	Discuss about various viral detection and enumeration techniques.	PO3/PSO2,PSO3	Z	C	12	

Syllabus Hours:72

Sl No	Module	Hours
1	Animal viruses Pox viruses, Papilloma Viruses, Human Herpes Viruses, adeoviruses, Pcornaviruses, Rotaviruses, Retroviruses, Flaviviruses,	16

	Coronaviruses Human Swine fever virus Cancer causing RNA and DNA Viruses. Viral arthritis. Control of animal viral diseases, Antiviral agents, Combination therapy, Nucleic acid based therapies.	
2	Bacteriophages Lambda Phage, T Phages, Fuilamentousphages M 13 Phages.Lytic and Iysogenic cycles of Lambda phage. M13 replication Types of plant viruses, Economic losses due to important viruses; DNA viruses, RNA viruses, satellite viruses, viroids, virusoids; Disease symptoms, local and systemic movement of viruses, plasmodesmata and virus movement.	15
3	Virus detection and diagnosis; Infectivity assays- Sap transmission, insect vetor transmission, agroinfection (using Agrobacterium); Ultra centrifugation, electron microscopy, serological methods, immunelectrophoresis in gels, direct double – antibody sandwich method, Dot ELISA Immunosorbent electron microscopy (ISEM), Nucleic acid based viral detection.	31

Reference

1. Ed.C.L.Mandahar, Molecular Biology of Plant Viruses, Kluwer academic publishers, Dordrect, 1999.
2. Roger Hull (Ed.) Mathews Plant Virology, 4th Edition, Academic Press. Sam Diego 2002.
3. D.G.A Walkey (Ed), Applied Plant Virology, 2nd Edition, Chapman & Hall, London 1991
4. Text Book of Microbiology :AnanthanarayananJayaramPanikkar
5. Medical Virolgy :Fenner and Whte
6. Principles and Practice of Infectious diseases- Madell, Bennett, Dolin Vol-1 & 2
7. Medical Microbiology : David Greenwood, Slack, Peutherer
8. Essentials of Diagnostic Virology: G.Storch
9. Notes on Medical Virology By Morag C. Timbury
10. Diagnostic methods in Clinical Virology: N.R.Grist.
11. Fundamentals of Molecular Virology by Nicholas H.Acheson.

MODEL QUESTION PAPER

M.Sc. DEGREE THIRD SEMESTER EXAMINATION – MONTH, YEAR

PROGRAMME – M.Sc. BIO TECHNOLOGY

SJ GBT 4E 04 Virology Part B

Time : 3hours

Max. Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Write a short note on cancer causing DNA and RNA viruses.
2. How antiviral agents help to eliminate virus?
3. Write note on lytic and lysogenic cycles of lamda phage.
4. What are the common techniques for isolation of viruses
5. Bacteriophages Lambda Phage
6. T Phages
7. Filamentousphages M 13 phages

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. Write a detailed note on DNA viruses
9. Write a note on viroid
10. Explain infectivity assays
11. Discuss about Papilloma Virusesand Herpes virus

12. What are the important diagnostic methodsfor virus detection?

13. Short note on types of plant virus

14. Explain structural properties and pathophysiology of coronaviruse

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Discuss about control mechanism of viruses and its diagnostic methods

16. Explain indetail about the oncogenic RNA viruses.

17. Give a note on HIV , pathophysiological conditions

SYLLABI FOR ELECTIVE COURSES

Semester : Four

Course Code : SJ GBT 4E 05

Name of the Course :Industrial & Food Bio Technology

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Understand the historical aspects and applications of bioprocess and biotechnology in food processing	PO1/PSO1,PSO3	U	C	15	-
CO2	Analyse the commercial use of different microorganisms and microbial enzymes in fermentation and food processing	PO1,PO5/PSO3	Z	C	15	-

CO3	Discuss the strain improvement strategies of microbes for the production of food processing enzymes	PO1,PO5/PSO3	Z	C	10	-
CO4	Understand the applications of cell and enzyme immobilization, biosensors and bioprocess monitoring	PO1/PSO3	U	C	11	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS Total Hours 72

SL No	Module	Hours
1	Industrial and Food Biotechnolgy; Introduction; History ; Importance; Applications of Bioprocess and Biotechnology in food processing; significant advaces; Risk factors; Safety regulations.	13
2	Bioprocessing- Industrial use of micro organisms; Microbes exploited commercially- Saccharromyces, Lactobacillus; Penicillium, Acetobactor, Bifidobacterium, Lactococcus, streptococcus, Fermentation – process media and system; upstream and down stream processing, product development; Diary fermentation and fermented products.	16
3	Microbial enzyme in food processing; Industrial production of enzymes- proteases amylase, invertase, pectinase and cellulases; High Fryctose Corn Syrup (HFCS), Food and beverage fermentation – Alcoholic and nonalcoholic beverages, Food additives and supplements-probiotics, health care products, Neutraceuticals, vitamins and antibiotics, Fuels and industrial chemicals- Alkanes, industrial ethanol.	16
4	Modification of Microbes/enzymes- Strain improvement, enzymes/cofactors recombinant enzymes, Applications in product development/improvement.	13

5	Cells and enzymes immobilization. Product enhancement- Classic examples; Biosensors and Bioprocess monitoring, Basic components and the utility and applications.	14

Reference

1. Gautam N.C, Food Biotechnology in Comprehensive Biotechnology, Vol.6, Shree Publishers,
2. Gutierrez- Lopez, G.F.et Al. Food Science and Foos Biotechnology, CRC Publishers, Washington 2003
3. Maheshwari, D.K.et.Al., Biotechnological applications of microorganisms, IK, International, New Delhi, 2006.
4. Stanbury, P.F et., al., Principles of Fermentation Technology, 2nd Edition, Elsevier, UK, 1995.
5. Waites, M.J.et. al., Industrial Biotechnology: An Introduction, Blackwell publishing, UK, 2007.
6. Food Microbiology, William C, Fraizer&Deniss C Westhoff, TafaMaGraw-Hill, 2008.
7. Industrial Microbiology Casida L.E., Wiley 2007.

MODEL QUESTION PAPER
M.Sc. DEGREE FOURTH SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 4E 05 Industrial & Food Bio Technology

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Briefly describe the industrial production of amylases and cellulases
2. Write a note on probiotics
3. HFCS
4. What are recombinant enzymes?
5. What are alkanes
6. Biosensors
7. Alcoholic fermentation

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8. What are the applications of bioprocess technology
9. Give an account on vitamins Write a short note on industrial use of microorganism with suitable example
10. Give an account of dairy fermentation and fermented products
11. Short note on antibiotics
12. Brief notes on industrial chemicals

13. Short note on enzyme immobilization
14. Give an account of bioprocess monitoring

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15. Write an essay on enzyme modification and its application in product development and improvement
16. Write an essay on Upstream and down stream processing
17. Write an essay on enzyme modification and its application in product development and improvement
18. Write an essay on product enhancement with classic enhancement

SYLLABI FOR ELECTIVE COURSES

Semester : Four

Course Code : SJ GBT 4E 06

Name of the Course :Nanobiotechnology

	Course Outcome	POs/ PSOs	CL	KC	Class Sessions (appr.)	Lab (Hrs)
CO1	Define Nano biotechnology and understand the basic concepts and applications of Nano biotechnology	PO5/PSO1,PSO2	U	F	15	-
CO2	Understand the concept of Molecular Nanobiotechnology	PO1/PSO1,PSO4	U	C	15	-
CO3	Analyse basic characterization techniques for nanoparticles	PO1/PSO2,PSO3	Z	C	15	-
CO4	Understand the use of nanostructures for drug delivery, diagnostic purpose and construction of devices for sensor development	PO1,PO5/PSO2,PSO3	A	C	10	-

***R-remember, U-understand, A-apply, Z-analyze, E-evaluate, C-create**

***F-factual, C-conceptual, P-practical/procedural**

SYLLABUS Total Hours 72

SL No	Module	Hours
1	Introduction to Nano-Biotechnology, Nanotechnology definition and concepts, Cellur Nanostructures, Nanoprocess, Bio molecular motors; Criteria for suitability of nanostructures for biological applications.	15
2	Molecular nanotechnology, Nanopowdersnanomaterials: Sol-gels and their use, Use of natural nanoparticles, Nanobiometrics, Lipids as nano-bricks, proteins as nanomolecules, DNA in nanotechnology, Present and future of nanotechnology applications in Molecular biology and Medicine.	15
3	Basic characterization techniques, Electron microscopy, Atomic force microscopy, Photon Correlation sepectroscopy, Thin Films, Colloidal nanostructure, Nanovesicles; Nanospheres, Nanocapsules.	15
4	Nanostructures for drug delivery, concepts, targeting, routes of delivery and advantages	15
5	Nanostructures for diagnostics and biosensors; Nanopartcles for diagnostics and imaging.Nano devices for sensor development.	12

Reference:

1. Multilayer Thin Films, Editors (s): GeroDecher, Joseph B.Schlenoff, Multilayer Thin Films, Wiley-VCH Verlag, GmbH &Co.KGaA ISBN: 3527304401

2. Bionanotechnology: Lessons from Nature Author: David S.Goodsell Publisher: Wiley-Liss ISBN : 047141719X

3. Biomedical Nanotechnology Editor: NeelinaH.Malsch Publisher: CRC Press ISBN: 0-8247-2579-4

4. GeroDecher, Joseph B.Schlenoff, Multilayer Thin Films, Wiley-VCD Verlag, GmbH &Co.KGaA, 2003.

5. David S.Goodsell, Bionanotechnology: Lessons from Nature, 1st Edition, Wiley- Liss, 2004.

6. Neelina H. Malsch, Biomedical Nanotechnology, 1st Edition, CRC Press, 2005.

MODEL QUESTION PAPER
M.Sc. DEGREE FOURTH SEMESTER EXAMINATION – MONTH, YEAR
PROGRAMME – M.Sc. BIO TECHNOLOGY
SJ GBT 4E 06- Nanobiotechnology

Time: Three hours Max.Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2– (4x2=8)

1. Short notes on colloidal nanostructures
2. What are the applications
3. Short note on cellular nanostructures
4. Briefly explain Nanobiometrics
5. Define Nanospheres and nanovesicles.
6. Define Nanotechnology
7. Natural nanoparticles

Section – B

Answer any four questions. Each question carries a weightage of 3 – (4x3=12)

8.Explain about sol-gels and their use

9.Briely explain photon correlation spectroscopy

10.Write a note on nanostructures as biosensors

11.Write a note on nanoparticles for diagnostics and imaging

12.Write a note on proteins as nano molecules

13.Role of Dna in nanotechnology

14.Biomolecular motors.

Section – C

Answer any two questions. Each question carries a weightage of 5 – (2x5=10)

15.Essay on molecular nanotechnology

16.Explain the nanostructures for drug delivery

17.Explain in detail about electron microscopy and atomic force microscopy and its applications

18.Application of Nanotechnology in molecular biology and medicine