File Ref.No.5537/GA - IV - J1/2012/CU

UNIVERSITY OF CALICUT

Abstract

BSc in Biotechnology-CUCBCSS UG 2014-Scheme and Syllabus- Approved-Implemented w.e.f 2014 Admissions-Orders issued.

G & A - IV - J

U.O.No. 7203/2014/Admn Dated, Calicut University.P.O, 24.07.2014

Read:-1. U.O. No. 3797/2013/CU, dated 07.09.2013 (CBCSS UG Modified Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

2. U.O. No. 5180/2014/Admn, dated 29.05.2014 (CBCSS UG Revised Regulations) (File.ref.no. 13752/GA IV J SO/2013/CU).

3. Item no. 1 of the minutes of the meeting of the Board of Studies in biotechnology held on 26.05.2014.

4.Item no. 14 of the minutes of the meeting of the Faculty of Science held on 27.06.2014.

5.Orders of the Vice Chancellor on 14.07.2014, in the file no, 18602/GA IV /J1/2013/CU.

ORDER

The Modified Regulations of Choice Based Credit Semester System for UG Curriculum w.e.f 2014was implemented under the University of Calicut vide paper read as

(1). The Revised CUCBCSS UG Regulations has been implemented w.e.f 2014 admission, for all UG programme under CUCBCSS in the University, vide paper read as (2).

The Board of Studies in Biotechnology finalized the syllabus of B Sc. Biotechnology for implementation w.e.f the Academic Year 2014-2015. vide paper read as (3).

The Faculty of Science has also approved the minutes of the Board vide paper read as (4).

The Hon'ble Vice Chancellor, considering the exigency, exercising the powers of the Academic Council has approved the items regarding syllabus implementation in the minutes of the concerned Boards of Studies mentioned in the minutes of the Faculty of Science, subject to ratification by the Academic Council, vide paper read as (5).

Sanction has, therefore, been accorded for implementing the Scheme and Syllabus of BSc. in Biotechnology under CUCBCSS UG 2014, in the University, w.e.f 2014 Admissions.

Orders are issued accordingly.

(The syllabus is available in the website: universityofcalicut.info)

Muhammed S

Deputy Registrar

To

1. All Affiliated Colleges/SDE/Dept.s/Institutions under University of Calicut.
2. The Controller of Examinations, University of Calicut.
3. The Director SDE, University of Calicut.

Forwarded / By Order

Section Officer

RESTRUCTURED COURSE CURRICULUM
(Syllabus)

For

B.Sc. BIOTECHNOLOGY
UNIVERSITY OF CALICUT
Academic year
2014 –'15 onwards

B.Sc. Biotechnology
COURSE STRUCTURE UNDER CCSS

	Course Title		Instruc. Hrs/Week	Credit	Exam Hrs	Marks		
						Int.	Ext.	Total Credit
I semester								
	Common Course		4	4	3hrs	20%	80%	20 credits
	Common Course		5	3				
	Common Course		5	4				
BT1B 01	Core Course I	Cell biology	3	3				
BTIC 01	1st Complimentary course –1	Chemistry	2	3				
BTIC 02(P)	1st Complimentary course Practicals -1	Chemistry Practical	2					
BTIC 03	2nd Complimentary course-1	Environmental Biotechnology	2	3				
BTIC 04(P)	2nd Complimentary course Practicals – 1	Environmental Biotechnology	2 ------- 25	-- ---- 20				
II semester								
	Common course		4	4	3 hrs	20%	80%	20 credits
	Common Course		5	3				
	Common Course		5	4				
BT2B 02	Core course II	General Microbiology	4	3				
BT2C 05	1st Complimentary Course II	Chemistry	2	3				
BT2C 06(P)	1st Complimentary Practical II	Chemistry practical	2	*				
BT2CO7	2nd Complimentary Course II	Environmental Biotechnology	2	3				
BT2CO8(P)	2nd Complimentary Course Practicals II	Environmental Biotechnology	2 ------ 25	* ----- 20				
III semester								
	Common Course		5	4	3 hrs	20%	80%	20 credits
	Common Course		5	4				
BT3BO3	Core Course	Biochemistry	3	3				
BT3BO4(P)	Core Course Practical III	Biochemistry	2	3				
BT3C 09	1st Complimentary course III	Chemistry	3	3				
BT3C10(P)	1st Complimentary Practical III	Chemistry	2	*				
BT3C11	2nd Complimentary Course III	Environmental Biotechnology	3	3				
BT3C12(P)	2nd Complimentary Practical III	Environmental Biotechnology	2	*				
			25	20				

IV semester								
	Common Course		5	4	3 hrs	20%	80%	21 credits
	Common Course		5	4				
BT4BO5	Core Course IV	Genetics	3	4				
BT4C13	1st Complimentary Course IV	Chemistry	3	3				
BT4C14 (P)	1st Complimentary Practical IV	Chemistry practical	2	*				
BT4 C15	2nd Complimentary Course IV	Environmental Biotechnology	3	3				
BT4 C16 (P)	2nd Complimentary Practical IV	Environmental Biotechnology practical	2	*				
BT4 B06 (P)	Core Practical IV	Practicals in Genetics	2 --- 25	3** --- 21				
V semester								
BT5B 07	Core Course V	Molecular Biology	4	3	3 hrs	20%	80%	21 credits
BT5BO8	Core Course VI	Immunology and Immuno-technology	4	3				
BT5B09	Core Course VII	Bioprocess Technology	4	3				
BT5B 10(P)	Core Course Practical V	Practicals in Molecular Biology	4	4**				
BT5 B 11(P)	Core Course Practical VI	Immunology and Immuno-technology practical	4	4**				
BT5D 01	Open Course-1 (From other department)	Introduction to Biotechnology	3	2				
BT5B12	Core Course Practical VII	Practical's in Bioprocess technology	4 --- 25	2 --- 21				
BT6B18	• Project work							
VI semester								
BT6B13	Core course VIII	Plant Biotechnology	4	3	3 Hrs	20%	80%	18 credits
BT6B14	Core Course IX	Animal Biotechnology	3	3				
BT6B15	Core Course X	Recombinant DNA Technology and bioinformatics	3	3				
BT6B16(P)	Core Course VIII Practical	Plant Biotechnology Practical	4	3**				
BT6 B17	Elective Course – (from same subject/ department)	Medical Biotechnology	3	2				
BT6 B18	• Project	Combined Project of 5 students in each group	4 --- 25	4 --- 18				

(20+20+20+21+21+18=120)

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

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

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

Credits for common course …….	38
Credits for core course including project and elective.....	56
Credits for complimentary courses……...	24
Credits for open course…….....	02

N.B.

- The project work starts in the V semester and ends on VI Semester.
- A group of 5 students shall be given the combined project to minimize the work load on teachers.
- The VI Semester practical examination for the main course subjects shall be clustered in the form of 3 pract icals.

Cluster I	:	Microbial Genetics Biochemistry
Cluster II	:	Molecular Biology Immunology and Immunotechnology
Cluster III	:	Plant Biotechnology Bioprocess Technology

- The practical exams shall be organised for two days (6hrs/day) for each cluster as it is difficult to complete practical examination within 3 hrs for the B.Sc. Biotechnology course.
- Credit awarded for the compliment course is inclusive of practicals.
- Each complementary course including practicals is allotted with 50 marks each.
- Core courses (56 credits) carry 1750 marks.

BT1BO1. CELL BIOLOGY

I. Introduction to cell biology: Milestones in cell biology, Cell theory, Properties of cell, Classification of cell, Structural organization of prokaryotic and eukaryotic cell. Comparison of microbial, plant and animal cells. Origin and evolution of cells.

(6 hrs)

II. Structure and function of plasma membrane. Transport across membranes: active, passive, diffusion and osmosis. Interaction between cell and its environment- cell adhesions, cell junction, extracellular matrix and cell wall.

(12 hrs)

III. Cell compartments endoplasmic reticulum, Golgi complex, lysosomes, vesicular trafficking- endocytosis and exocytosis, peroxisomes, glyoxysomes and vacuoles. Ribosome and protein synthesis. Mitochondrion-aerobic and anaerobic respiration, chloroplast and photosynthesis.

(12 hrs)

IV. Structure and function of nucleus, nucleolus, chromosomes and types of chromatin. Cytoskeleton- microfilaments, intermediate filaments, microtubule. Cilia and flagella.

(10 hrs)

V. Cell division in prokaryotes and eukaryotes. Cell cycle, phases of cell cycle, mitosis and meosis. Apoptosis and cell death. A brief overview of cell signaling, stem cells and cancer.

(10 hrs)

References:

1. Karp G 2010, Cell and Molecular Biology Concepts and Experiments, John Wiley & Sons, Inc.
2. Lodish H 2008, Molecular cell biology, W. H. Freeman and Company
3. Alberts B 2008, Molecular Biology of the Cell, Garland Science
4. Cooper GM 2009, The Cell A Molecular Approach, ASM Press
5. Lanza R 2006, Essentials of Stem Cell Biology, Elsevier Inc.

BT1C03. ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

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

(6 hrs)

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

(8 hrs)

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

(8 hrs)

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

(8 hrs)

BT1C04 (P) PRACTICALS

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

References:

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

BT2B02. GENERAL MICROBIOLOGY

I. History of Microbiology: Leeuvenhoek and his microscope, Germ theory of disease – Koch's postulates, development in disease prevention, antisepsis, immunisation, chemotherapy, classes of microorganisms, bacteria, virus, fungi.

Morphological characters of bacteria & fungi.

Difference between eukaryotic & prokaryotic cells. (8 hrs)

II. Preparation of media, eg. nutrient agar, potato dextrose agar, Mac Coukey Agar, Industrial media, Requirements for carbon, N_2.

Concept of sterilization, Methods of sterilization of media and equipments / glassware.

Isolation of pure cultures: Spread plate, streak plate and pour plate. (8 hrs)

III. Growth and reproduction in bacteria, fungi, virus & bacteriophages – lytic cycle, lysogenic.

Factors affecting growth – pH, temperture, O_2 requirement.

Uptake of nutrients: active, passive, facilitated, group translocation. Measurement

of growth: dry weight, CFV, turbidometry. (10 hrs)

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

V. Brief account of microbial diseases: eg: Typhoid, AIDS, Dermatomycoses.

(3 hrs)

References:

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

BT2CO7. ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

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

(6 hrs)

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

(8 hrs)

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

(8 hrs)

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

(8 hrs)

BT2CO8 (P) PRACTICALS

1. Aerobic treatment of municipal sewage including sedimentation, filtration (sand filter), chlorination.
2. Enumeration of microorganisms total Vs. viable counts.
3. Presumptive and confirmed tests for water quality.
4. Staining methods.
5. IMViC test: using river and tap water samples.
6. Clarification of municipal sewage wing flocculants and performing standard plate count before and after clarification.

References

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

BT3BO3. BIOCHEMISTRY

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

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

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

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

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

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

VII Enzyme: Classification, Nomenclature, Mechanism of enzyme action, derivation of Michaelis Menten equation, Enzyme inhibition, Factors affecting enzyme activity, Allorteric enzymes, Isoenzymes. **(4 hrs)**

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

IX Separation technique: Chromatography: (adsorption, ion exchange, affinity, gel filtration).

Electroplhoreosis: PAGE, AGE, SDS-PAGE. **(3hrs)**

BT3BO4 (P) PRACTICALS IN BIOCHEMISTRY

Biochemical techniques

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

- Amylase activity – determination (salivary amylase).

References

1. Lehninger, Cox and Nelson: Biochemistry
2. Voet Voet : Biochemistry.
3. Stryer K. Biochemistry 1995. W.H. Freeman & Company, New York.
4. Mathews, H.R. Freedland R. Miesfeld, R.L. 1997. Biochemistry a short course. Wiley-Liss Inc.
5. Neal, A.C., Chemistry & Biochemistry: A Comprehensive Introduction. McGraw Hill Book Company.
6. Donald Voet, Judith G. Voet, Biochemistry, Second edition.
7. David L. Nelson, Michael M. Cox, Lehninger. Principles of Biochemistry, third edition.
8. Plummer, D.T. 1988. An Introduction to Practical Biochemistry, Tata McGraw Hill Co., New Delhi.

BT3CO11. ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

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

(8 hrs)

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

(6 hrs)

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

(8 hrs)

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

(8 hrs)

BT3CO12 (P) PRACTICALS

1. Deliguification of rice straw, rice husk using enzymes (white rot jungi, Pleurotus specis) and alkali.
2. Preparation of vermicompost
3. Growth curve of bacteria.
4. Assessment of microbial growth wet weight, Packed Cell Volume.
5. Isolation of pesticide degrading bacteria from rice field.

6. Microbial screening for phenol degrading organisms.

References:

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

BT4BO5 GENETICS

I. Introduction to Genetics: History of genetics, Mendelian genetics- Monohybrid and dihybrid cross, Principle of segregation, Dominance, Independent Assortment. Gene Interactions, Penetrance, Multiple Alleles. Non-Mendelian Inheritance- Extranuclear Inheritance, Maternal Effect, Epigenetic Inheritance, Linkage, Crossing Over. Pedigree Analysis.

(10 hrs)

II. Chromosome: Morphology, Structure and Organization of Chromosome, Eu- and heterochromatin, Special chromosomes, Karyotype, Sex Determination, Sex-Linked Characteristics. Variation in Chromosome number and Structure. Human Genome, Human Inherited disorders.

(12 hrs)

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

(12 hrs)

IV. Quantitative Genetics- Quantitative Traits, Polygenic Inheritance, Types of Heritability. Population Genetics- Genotypic and Allelic Frequencies, Hardy–Weinberg Equilibrium, Genetic Drift. Evolutionary Genetics- Modes of Speciation, Phylogenetic Trees, Molecular Evolution, Molecular Clock.

(14 hrs)

BT4B 06(P) Practicals

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

References:

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

BT4C15. ENVIRONMENTAL BIOTECHNOLOGY (COMPLEMENTARY COURSE)

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

(8 hrs)

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

(8 hrs)

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

(8 hrs)

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

(6 hrs)

BT4C16 (P) PRACTICALS:

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

References:

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

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

BT5BO7. MOLECULAR BIOLOGY

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

(8 hrs)

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

(8 hrs)

III. DNA Replication: Chemistry, enzymes involved and salient features of prokaryotic and eukaryotic DNA replication. Types of mutation, DNA Repair- excision repair, mismatch repair and double-strand breakage repair. DNA recombination- homologous and site-specific. Mechanism and type of transposition in prokaryotes and eukaryotes.

(12 hrs)

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

(12 hrs)

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

(12 hrs)

BT5B 10(P) PRACTICALS IN MOLECULARBIOLOGY

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

References:

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

BT5B08. IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. Introduction to immune system : Historical perspectives, early vaccination, innate immunity and acquired immunity humoral and cell mediated immunity.(4hrs)

2. Cells of Immune System: Hematopoiesis, Lymphoid cells B & T lymph cytes. N. K. cells, phagocyte, mast cells, dendritic cells.(4hrs)

3. Organs of the Immune system: Primary lymphoid organs: Thymus, Bone marrow, secondary lymphoid organs: lymph nodes, spleen, mucosa associated lymphoid tissue.(5hrs)

4. Antigens: Nature and Properties of antigens: foreigners, molecular size - epitopes : Immune response to Ag, adjuvants, Immune dosage, route of administration super antigens.(7hrs)

5. Antibodies: Structure of antibodies; classes of Immuno globular, hypervariable regions. Complementary determining regions. Frame work regions. Isotype, allotype and idotypic determinants, immunoglobulin superfamily.(10hrs)

6. Antigen - Antibody interactions: Affinity avidity, measure of Ag-Ab binding, cross reactivity: application of Ag-Ab interactions: agglutination reaction: blood grouping, RID, ouchterlony , RIA and Elisa, Western blotting.(7hrs)

7. Hypersensitivity: Classes hypersensitive reactions. (type-1) IgE-mediated hypersensitivity - intracellular events in most cell degranulation, phamacological agents in type I reactions, type II, hypersensitivity - erylbroblastosis fetalis type - III hypersensitivity - Immuno complex mediated hypersensitivity -type IV- delayed - type hypersensitivity.(10hrs)

8. Autoimmunity: Maintenance of tolerance, auto immune diseases: organ specific - Hastimoto's thyroidits, Grave's disease. Systematic autoimmune disease - multiple sclerosis, Rheumatoid arthritis.(7hrs)

9. Tumor immunology: Malignant transformation of cells, oncogenes and induction, tumor of immune system - tumor antigens chemically and virally induced tumor antigen, cancer immunotherapy - cytokine therapy - interferons. Tumor necrosis fuctros, monoclonal antibodies and immunotoxins.(8hrs)

10. Monoclonal antibodies and vaccines: Active and passive immunisation, vaccine designs recombinant vector vaccines.(10hrs)

BT5B11 (P) Practical's in immunology and immunotechnology

1. Blood grouping

2. Blood film preparation and identification of cells

3. Preparation of antigens

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

4. Separation of lymphocytes from periperal blood
5. Radial immuno diffusion
6. Double diffusion
7. Immuno electrophoresis
8. Demonstration of Elisa

References

1. Immunology by Kuby (2007)
2. Cellular and Molecular Immunology
   Abul K. Abbas. A.H. Lichtman & Shiv Pillai (2007)
3. Immunobiology: The immune system in Health and Diseases
   Charles A. Janeway, Paul Trawers
   Mark Walport and J. Donald Copra

BT5B09. BIOPROCESS TECHNOLOGY

I. Introduction to microbial fermentations. Range of microbial fermentation processes. Recombinant DNA technology assisted products. Flow chart of typical industrial fermentation process. Concept of value addition shelf life improvement. Low volume - high value and High volume - low value products.

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

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

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

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

VI. Fermentation process operation: Inoculum preparation, scale-up of fermentations. Downstream processing: Separation of cells by froath floatation, sedimentation, flocculation, Filtration and centrifugation. Cell disruption for intracellular products.

Membrane filtrations, including reverse osmosis. Chromatographi techniques - Adsorption, ion-exchange, affinity and gel exclusion chromatography. Precipitation, crystallization and drying of biologicals

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

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

BT6B12 (P) Practicals in bioprocess technology

1. Isolation of antiobiotic producing microbes from soil by crowded plates technique and demonstration of antibiotic sensitivity by giant colony inhibition spectrum.
2. Fermentation of grape juice and estimation of alcohol by distillation.
3. Enzyme immobilization using sodium alginate.
4. Production microbial enzyme (amylase) and conversion of starch to glucose.
5. Detection of formed glucose by anthrone method,
6. Separation of cells by flocculation. Use of alum as an flocculating agent to separate yeast from fermentation broth.
7. Anaerobic fermentations: Production of methane from Glucose.
8. Comparative study of surface culture (Mat culture of aspergillus niger/Pencillin), solid state fermentation (Mushrooms) and submerged cultures.
9. Effect of pH and aeration on biomass production (Bakers yeast)-wet weight as an yard stick.

References:

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

BT5D01. INTRODUCTION TO BIOTECHNOLOGY

(Open Course –Elective from other department students)

I. Introduction to Biotechnology. History of biotechnology. Tools in biotechnology. Use of cell and cell process in biotechnology.

(8 hrs)

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

(8 hrs)

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

(8 hrs)

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

(8 hrs)

References

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

BT6B13. PLANT BIOTECHNOLOGY

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

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

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

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

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

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

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

VIII. Genetic manipulations: Recombinant DNA technology – production of transgenic plants, hairy root culture – basic concepts, practical applications of genetic transformations. (15)

BT6B16 (P) PRACTICALS

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

References

1. Herlaw, F. & David, L.D. (Eds.). 1998. Antibodies: A Laboratory Manual, Coldspring Harbor Laboratory.
2. Coligan, J.E. Kruisbeck, A.M. Margulies, D.H. Shevach, E.M. and W. Strober 1996. Current Practicals in Immunology, John Wiley & Sons Inc.
3. Dixon, R.A. & Genzales, R.A. (Eds.) 1994. Plant Cell Culture – A Practical Approach, IRL Press, Oxford.
4. Smith, R.H. 1992. Plant Tissue Culture Techniques and Experiments, Academic Press.
5. Edwin F. George (1993). Plant propagation by Tissue Culture, Part I. The Technology II Ed. Exegetics Ltd.
6. Edvin F. George, 1993/1996. Plant Propagation by Tissue Culture, Part II In Practice II Ed.
7. Pierik, R.L.M. 1989. In vitro culture of higher plants. Martinus Nijhoff Publishers, Dordrecht, Netherlands.

8. Bhajmani & Razdan. Plant Tissue Culture, Theory and Practice.
9. Reinert & Bajaj. 1977. Plant Cell, Tissue and Organ Culture, Springer Verlag, Berlin.
10. S. Narayanaswamy, 1994. Plant Cell and Tissue Culture, Tata McGraw Hill Publishing Company Ltd., New Delhi.

BT6B14. ANIMAL BIOTECHNOLOGY

1. Introduction to animal cell culture: Lab Design and equipments. Sterile area, Laminar flow hood. CO_2 incubator. Cryostorage (liquid Nitrogen flask), refrigerated centrifuges freezers (-80^0C) inverted microscope, Hemocytometer, pH meter, magnetic stirrer, micropipettes and pipette aid.(10)

2. Media preparation and sterilization: Sterilization of glass wares: Reagents: Balanced salt solutions, preparation stock of solutions such as amino acids, vitamins, salts, glucose, Hormones and growth factors, antibiotics, role of serum in media, physicochemical properties, - CO_2 and bicarbonate, oxguen, osmolality, Temperature, viscosity , filter sterilization of media. (`12)

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

4. Cell lines & Cryopreservation: Immortalization of cell lines with viral genes - SV. 40, papillomavirus, Epstein-Barr virus, fibroblast immortalisation, cell line designations maintenance of cell lines, cell morphology, criteria for subculture. States of Cryopreservation, Freezing a cells, Thawing of frozen cells. (15)

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

References

1. Culture of Animal cells: A Manual of Basic Techniques (2004) R. Ian Freshney.

2. Animal cell culture methods Jennie P. Mattar and David Barnes.

BT6B15. RECOMBINANT DNA TECHNOLOGY AND BIOINFORMATICS

1. Introduction to gene cloning, enzymes and basic tools involved in gene cloning.

(5 hrs)

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

(10 hrs)

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

(10 hrs)

4. Introduction of recombinant DNA into living cells an overview. Selection and screening of recombinant clones.

(10 hrs)

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

(10 hrs)

6. Introduction to bioinformatics, pattern recognition and prediction, biological databases, primary and secondary sequence databases, composite protein sequence databases, pair wise alignment technique; database searching NCBI, EMB, FASTA, BLAST BITS etc. algorithms and programmes, comparison of two sequences, global and local alignment – multiple sequence alignment

(9 hrs)

References

1. Watson, J.D Gitman, M, Witkowsk, J. and Foller, M. 1992, Recombinant DNA, II edition, Scientific American books, W.H. Freeman and Co, New York.
2. Old. R.W and Primerose, S.B. 1994. Principles of gene manipulation 0 An introduction to Genetic engineering.
3. T.A. Brown. Gene cloning and DNA Analysis an Introduction
4. - James D. Watson, Michael Gilman. Recombinant DNA
5. T.K. Altwood, D.J. Parry-Smith and S. Phukan. Introduction to Bioinformatics.
6. David. W. Mount. Bioinformatics: Sequence and Genome Analysis

BT6B17. MEDICAL BIOTECHNOLOGY

(Elective for same department / Subject/ student)

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

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

III. General properties of the following bacteria

Staphyolococcus

Streptococcus

Pneumococcus

Clostridium

Enterobacteriacea — I : Coliforms; II : Sheigella; III : Salmonella

Vibrio

Pseudomonas

Mycobacterium I : tuberculosis

Spirochetes & Mycoplasma

Rickettesia & Chlamydea (15 hrs)

IV. General properties of viruses:

Virus host interaction

Pox viruses

Herpes virus

Adenonirus

Rhabdoviruses

Hepatitis

Oncogenic viruses

H1N1 disease control and prevention (15 hrs)

V. Human Immunodeficiency Virus : AIDS

Normal Microflora of Human body

Acute diarrhoeal diseases

Antimicrobial therapy

Immunoprophylaxis & Immunotherapy

Nasocomial infections (10 hrs)

References

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

INTELLECTUAL PROPERTY RIGHTS- LANGUAGE REDUCED PATTERN – CLUSTER 4

No. of Credits – 4
No. of instructional hours – 72

Module 1: OVERVIEW OF INTELLECTUAL PROPERTY 4 hrs

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

Module 2: PATENTS 10 hrs

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

Module 3: COPYRIGHT 10 hrs

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

Related rights: What are related rights? Distinction between related rights and copyright. Rights covered by copyright.

Module 4: TRADEMARKS 14 hrs

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

Module 5: GEOGRAPHICAL INDICATIONS 4 hrs

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

Module 6: INDUSTRIAL DESIGNS 10 hrs

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

Module 7: BIOTECHNOLOGY AND IPR 20 hrs

Rationale for Intellectual Property Protection in biotechnology. Concept of Novelty in Biotechnological Inventions. Concept of Inventive Step in Biotechnological Inventions. Microorganisms as Biotechnological Inventions. Patenting biological inventions. Patenting microorganisms. Patenting other biological processes and products. Protection of new varieties of plants. Justification for Protection. Biotechnology and International Treaties such as Convention on Biological Diversity and TRIPs.

REFERENCES

1. T. M Murray, M.J. Mehlman. 2000. Encyclopaedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons.
2. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew.1985. Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA.
3. D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, 2002. Concepts in Biotechnology, University Press (Orient Longman Ltd.).
4. Bourgagaize, Jewell and Buiser. 2000. Biotechnology: Demystifying the Concepts, Wesley Longman, USA.
5. Ajit Parulekar, Sarita D' Souza. 2006. Indian Patents Law – Legal & Business Implications; Macmillan India,
6. B.L. Wadehra. 2000. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India
7. P. Narayanan. 2010. Law of Copyright and Industrial Designs; Eastern law House, Delhi.

8. N.S. Gopalakrishnan, T.G. Agitha. 2009. Principles of Intellectual Property. Eastern Book Company, Lucknow.
9. Dr. T. Ramakrishan (Ed.). 2003. Biotechnology and Intellectual Property Rights. CIPRA, NLSIU, Bangalore.
10 N.K. Acharya. 2012. Text Book on Intellectual Property Rights, 6th ed. Asia Law House, Hyderabad.
11 M. M. S. Karki. 2009. Intellectual Property Rights : Basic Concepts. Atlantic Publishers.
12 N. S. Sreenivasalu. 2007. Intellectual Property Rights. Neha Publishers & Distributors.
13 Pal P. 2008.Intellectual Property Rights in India : General Issues and Implications. Regal Publications

First semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

CELL BIOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Illustrate the mechanism of transport of materials across membranes
2. Explain the vesicular trafficking in cell
3. Describe the structure, types and functions of endoplasmic reticulum
4. Explain the structure of different components of cytoskeleton

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Distinguish prokaryotic and eukaryotic cell
6. What are the basic properties of cells
7. Describe Miller–Urey experiment
8. What is the chemical composition of biological membranes
9. How cells maintain membrane fluidity
10. What is the composition of extracellular matrix
11. Explain the chemical composition of various cell walls
12. What are the difference between prokaryotic and eukaryotic ribosome
13. Explain lysosomes maturation
14. Illustrate the mitochondrial oxidative phosphorylation
15. Explain the suture of chromatin
16. What are the functions of GPCR
17. Properties of cancer cells
18. Which are the events of meiosis

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are the different types of prokaryotic cells
20. Explain RNA world hypothesis
21. Briefly describe the structural organisation of flagella

22. Role of caspases in apoptosis

23. Cancer stem cells

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. Describe the contributions of Robert Hooke in cell biology

25. What are the different types of membrane proteins found in the plasma membrane

26. What are the properties of lipid rafts

27. What is the function of vacuoles in plant cells

28. What are the properties of hematopoietic stem cells

(5 x 2 = 10)

First semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

ENVIRONMENTAL BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain the role of microorganism in nitrogen cycle
2. What are the characteristics population
3. What are the effects of pollution on ecosystem
4. Explain different pollution control strategies

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Levels-of-Organization Hierarchy
6. Explain habitat and niche
7. What is population demography
8. Explain why ecological succession happens
9. Describe the importance of carbon cycle
10. What is the influence of human activities on sulphur cycle
11. Explain water cycle
12. What are the major causes of pollution
13. Explain the effect of acid precipitation on environment
14. What are the causes of greenhouse effect

15. What are CFCs

16. How biological pollution control methods support environment

17. What are the different pollution management strategies

18. How to preserve nonreplaceable resources

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are the components of abiotic environmental factors

20. What re the biological components of phosphorus cycle

21. Explain the role of Nitrosomonas and Nitrococcus in nitrogen cycle

22. What are the effects of global warming

23. Explain the methods used for remediation of polluted sites

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What is green manure

25. Assimilative sulfate reduction.

26. What are the causes of eutrophication

27. How nutrient availability affect ecosystem

28. What are the limitations of chemical waste treatment methods

(5 x 2 = 10)

Second semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

GENERAL MICROBIOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Morphological and physiological characters of fungi
2. Explain different methods used for sterilization
3. Illustrate the reproductive process of viruses
4. Explain the oxidative phosphorylation

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Explain Koch's postulates

6. Describe the structure of bacterial cell wall
7. What is the cultural characteristics of viruses
8. Explain the structure of a prokaryotic cell
9. What are the shortcomings of antibiotics
10. Explain nutritional requirements for the laboratory culture of fungi
11. Describe the working of autoclave
12. Explain different methods to obtain pure cultures
13. Explain the principle behind turbidometric detection of bacterial growth
14. Describe the mechanism of group translocation
15. Illustrate the structure of bacteriophages
16. What are the sometimes of typhoid
17. Explain the pentose phosphate pathway
18. Illustrate the molecular mechanism of Human immunodeficiency virus infection

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is the advantages of immunoprophylaxis
20. Write a brief account of bacterial genetic system
21. What are the different methods used for the sterilization of culture media
22. Explain the symptoms of dermatomycosis
23. Describe lactic acid fermentation

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What is antisepsis
25. Properties of archaebacteria
26. Composition of corn steep liquor
27. What are the properties of thermophile organism
28. What are the methods used for counting viable microbes

(5 x 2 = 10)

Second semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

ENVIRONMENTAL BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What are the methods used for the bacteriological examination of water quality
2. Explain various types of activated sludge process and its advantages
3. What are the methods used for the removal of nitrogen from waste water and explain its significance
4. Explain different water purification methods

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What is BOD and how it is quantified
6. What are the biological properties of savage water
7. Explain the importance of indicator organism
8. Describe the sources of water pollution
9. What are the disadvantage of chemical treatment of waste water
10. What are the different methods used for the primary treatment of waste water
11. Explain the use of alternative waste water treatment methods
12. What are the methods used for sedimentation
13. Describe the working of trickling filters
14. Explain the phytoremediation with examples
15. How to remove phosphorous from waste water
16. What are the advantages and disadvantages of chlorination
17. Explain the working of depth filters
18. What is the use of ultraviolet light in water treatment

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is the principal behind COD determination
20. What are the physical properties of industrial water water
21. What are the advantages of RBC
22. Explain the applications of up flow anaerobic sludge blanket
23. What are membrane filters

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. How chemical properties of waste water affect waste water treatment process
25. What are water bone disease
26. What is the microbial load of waste water
27. What are the disadvantages of stabilization ponds
28. What are the methods for the purification of sea water

(5 x 2 = 10)

Third semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

BIOCHEMISTRY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain urea cycle
2. What are the different levels of protein structure
3. Explain the steps of fatty acid biosynthesis
4. Write an essay on enzyme inhibition

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Derive Henderson Harselbalch equation
6. Explain the properties of metallic bond
7. What is the significance of pentose phosphate pathway
8. What is the structural difference between starch and cellulose
9. Draw the structure of any 3 essential amino acids
10. Explain the metabolism of phenylalanine
11. How proteins are classified
12. Explain the structure of super secondary structures
13. Describe the oxidation of fatty acids
14. Explain Watson Crick base paring
15. Explain the systematic nomenclature of enzymes
16. What are the functions of auxin
17. What is the principle behind electrophoresis
18. Explain the importance of affinity chromatography

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is valence bond theory
20. Draw the structure of glucose
21. What are the properties of α helix
22. What are the signs of vitamin A deficiency
23. Explain SDS-PAGE

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What are zwitterions
25. What are non-standard amino acids
26. What are allorteric enzymes
27. What are the functions of vitamin C
28. What is vitamin toxicity

(5 x 2 = 10)

Third semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

ENVIRONMENTAL BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain the principle and application of composting
2. Describe the methods used for the medical solid waste management
3. How microbes degrade xenobiotic
4. Explain various biological methods for limiting air pollution

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What is the advantages of vermicomposting
6. Explain methanogenesis.
7. Explain the applications of landfill
8. What is the difference between ex situ and in situ Processes
9. Explain the importance of bioremediation

10. Explain the process of bioventing

11. What are advantages of bioaugmentation and explain its applications

12. How microbes degrade polychlorinated biphenyls

13. What is the general scheme of aromatic compounds degradation

14. Describe the mechanism of greenhouse effect

15. Who water vapour contribute to global warming

16. Explain the applications of biofilters for air treatment

17. How to control gaseous emissions from vehicles

18. Explain the process of acid rain

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is the composition of biogas

20. Explain the effect of herbicides on soil

21. What are the biological methods for controlling oil spills

22. How is isolate xenobiotic degrading microbes

23. Explain the point sources of air pollution

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What are the properties of domestic soil waste

25. What are the different types of heap process

26. Point out the different methods used for monitoring the efficacy of bioremediation.

27. What is the composition of petrochemical effluents

28. What is the impacts of global warming on ecosystem

(5 x 2 = 10)

Fourth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

GENETICS

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain various non-Mendelian Inheritance

2. Illustrate the structure and organisation of eukaryotic chromosome

3. Explain the gene transfer methods in bacteria

4. Explain Hardy–Weinberg equilibrium

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Explain the inheritance of chloroplast
6. Explain codominance with an example
7. What are the applications of pedigree analysis
8. Explain linkage mapping
9. Explain the chromosomal variations associated with Down syndrome
10. Explain the karyotyping
11. How sex-linked characteristics are inherited
12. What are the feathers of lampbrush chromosomes
13. What are the different types of chromatin in eukaryotes
14. What is the peculiarity of viral genome
15. What are the virus mediated gene transfer methods in bacteria
16. Explain polygenic Inheritance
17. How skin colour is inherited
18. What is the rationale behind the phylogenetic tree construction

(7 x 5 = 35)

Section C

Answer all questions in about 300 words. Each question carry 3 marks

19. How human blood groups are inherited
20. What is aneuploidy
21. What are the karyotypic variations associated with Klinefelter syndrome
22. How to test mutation
23. Explain genetic drift

(5 x 3 = 15)

Section D

Answer all questions in about 200 words. Each question carry 2 marks

24. What is One-Gene-One-Enzyme Hypothesis
25. Give an example of epigenetic inheritance
26. What is Human genome project
27. What is C-Value paradox
28. How the partitioning of variance occurs

(5 x 2 = 10)

Fourth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

ENVIRONMENTAL BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain the advantages and environmental effects of biofuels
2. Describe the production of bioplastics
3. What are the methods used for Bio leaching
4. What are the effect of genetically modified organisms in environment

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Explain biosorption with example
6. What are the applications of thuringenesis toxin
7. Explain Azolla-Anabena symbiosis
8. What are the applications of bioventing
9. How to produce biodiesel
10. What are energy crops
11. What are the advantages of biopower
12. What are the environmental concerns associated with genetically modified bioplastics
13. Explain the advantages of single cell proteins
14. What is the IUPAC definition for bioplastic
15. What are the methods used for the production of biomass from waste
16. What are health effects of genetically modified organisms
17. How genetically modified organisms promote emergence of secondary pests
18. What re the advantages of Bio leaching

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. How Bt cotton prevent pest attack
20. What is mean by E15 fuel
21. Why bacteria is not generally used a single cell protein for humans
22. How genetically modified organisms effect biodiversity

23. What are the methods used for bio leaching of gold

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. How Bacillus subtilis prevent pest attack
25. What is biopower
26. What are the advantages of fuel ethanol
27. What are super weeds
28. What is the principle behind the bio leaching of cooper

(5 x 2 = 10)

Fifth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

MOLECULAR BIOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Illustrate genome structure of eukaryotes
2. Explain various processes in the central dogma of molecular biology
3. Write an essay of transcription in eukaryotes
4. What is the chemistry and mechanism of protein synthesis

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Explain the semiconservative model of DNA replication
6. Describe the various types of RNA and their function
7. Draw the clover-leaf structure of tRNA
8. What are the properties of histone proteins
9. How pseudogenes are originated
10. What are LINEs
11. Explain the components in noncoding DNA
12. What are the various types of mutation
13. How eukaryotic tRNA is modified after transcription
14. Explain spliceosome mediated splicing
15. Describe the effect of phosphorylation on protein function

16. How lac operon is regulated according to metabolic needs

17. Explain the role of mediator complex in transcription

18. How chromatin structure is regulated

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is the secondary structure of DNA

20. What are the functions of noncoding DNA

21. What is the structure of type I intron

22. Explain the significance of alternative splicing

23. What are the non-universal genetic codes

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What is linking number

25. What is Chargaff's rules

26. What are the functions of DnaA

27. Define open reading frame

28. What are the functions of chaperones

(5 x 2 = 10)

Fifth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

IMMUNOLOGY AND IMMUNOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What is the role of various lymphoid organs in providing immunity

2. Explain the fine structure of Antibodies

3. What are the applications of antigen antibody interactions

4. What are the diseases associated with autoimmunity

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What are the components of innate immunity

6. Explain the characteristics of adaptive immunity

7. Explain the process of haematopoiesis
8. Describe MALT
9. What is the use of adjuvants in immunisation
10. Explain the properties of epitopes
11. What are the effector functions mediated by antibodies
12. Explain the structure and functions of Immunoglobulin A
13. Explain the principle and application of ELISA
14. What is ATOPY
15. What is the pathophysiology of Goodpasture's syndrome
16. Explain the production of monoclonal antibodies
17. What is the application of passive immunisation
18. How to treat hypersensitivity

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are the contributions of Louis Pasteur to immunology
20. Describe the structure of mononuclear Phagocytes
21. Distinguish between immunogenicity and antigenicity
22. What is DTH
23. What are TSTAs

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What is Variolation
25. What are APCs
26. Explain the applications of estern blotting
27. What are LATS antibodies
28. Multivalent subunit vaccines

(5 x 2 = 10)

Fifth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

BIOPROCESS TECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What are the methods used for the isolation of industrially important microbes
2. What is the composition of a typical industrial fermentation media and how it is differ from laboratory media
3. What are the different types of bioreactors used for fermentation
4. Explain a fermentation process for the production of penicillin

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. Draw a flow chart of typical industrial fermentation process
6. How rDNA technology improve industrial fermentation process
7. What are the different methods used for the preservation of industrial strains
8. How biotechnology helps to improve the strains to increase yield
9. Explain different methods used for protoplast fusion
10. How to sterilize industrial fermentation media
11. Explain the oxygen requirement of various fermentations
12. What are the methods used to control industrial fermentation
13. What is the importance of inoculum preparation
14. How to stabilize biological products before packing
15. Explain methods used to isolate intercellular molecules from cell
16. What is the importance of fuel ethanol production
17. How crosslinking helps to immobilize enzymes
18. How to induce the production of enzyme from microbes

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What is lyophilisation
20. How intercalating agents induce mutation
21. How to sterilize air for fermentation
22. What are the advantages of trickling filters

23. How to entrap enzymes

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What are low volume - high value
25. What is the applications of PEG
26. What is sparging
27. What are the methods used for the separation of cells from medium
28. What are the advantages of SCP

(5 x 2 = 10)

Fifth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)- OPEN COURSE

INTRODUCTION TO BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 40

Section A

Answer Any one out of two Questions in about 1500 words. Each question carry 10 marks

1. What are the applications of biotechnology in improving human wellbeing
2. Explain the production of red and white wine

(1x 10 = 10)

Section B

Answer Any four out of 8 Questions in about 750 words. Each question carry 5 marks

3. How to use cells for the production of useful compounds
4. What is the use of yeast in fermentation
5. How to produce bread
6. Explain the principle of fermentation
7. What are the advantages of fermentation
8. Explain the production of fermented Indian foods
9. How to produce single cell proteins
10. What are the methods for producing mushrooms

(4 x 5 = 20)

Section C

Answer All Questions in about 200 words. Each question carry 2 marks

11. Define biotechnology
12. What is a cell
13. What is fermentation

14. What are the applications of *Saccharomyces cerevisiae*

15. Give examples of 4 genetically modified foods

(5 x 2 = 10)

Sixth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

PLANT BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What are the methods and applications of micropropagation
2. Discuss the importance of organ culture in crop improvement
3. Explain the methods and application of protoplast function in crop improvement
4. What are the application of Ti plasmid derived vectors

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What is the composition of MS medium
6. Explain the importance of plant growth regulators in tissue culture medium
7. How to sterilize plant tissue culture media
8. What are the methods used for organogenesis
9. How to induce and select somaclonal variants
10. What is the composition of the medium for callus induction
11. How to produce haploid plants using tissue culture
12. What are the method used to induce polyembryony
13. What are the chemical methods of protoplast fusion
14. What is the significance of horticulture in crop improvement
15. How to produce pharmaceuticals using plant cell culture
16. What are the methods used for the culture of plant protoplast
17. what are the methods used for cryopreservation
18. Advantages of genetically modified crops

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are the organic supplements used in plant tissue culture media

20. How to create virus-free plants using tissue culture

21. How to maintain plant cells in suspension culture

22. Explain hairy root culture

23. What are the environment impact of genetically modified plants

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. How to subculture plant tissue culture

25. What are the advantages of synthetic seeds

26. Application of immobilized plant cell cultures

27. How to produce plant leaf culture

28. What is somatic fusion

(5 x 2 = 10)

Sixth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

ANIMAL BIOTECHNOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What are the physicochemical properties of animal cell culture media
2. Explain the methods used for producing primary culture
3. How to create and characterize continues cell line
4. Explain various methods used for cytotoxicity study

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. How to maintain sterility during the handling of animal tissue culture
6. What are the different classes of LAF used in cell culture
7. Explain the role of serum in the media
8. What are the methods used for the sterilization of culture media
9. Explain the functions of balanced salt solutions
10. What is primary explant culture
11. What are the national requirements for primary cell culture
12. Explain the advantages of enzymatic disintegration methods

13. Describe the role of Epstein-Barr virus in immortalization of cell lines

14. How SV. 40 virus induce cell culture transformation

15. What are the genetic changes associated with cell transformation

16. What are the methods used for the cryopreservation of cells

17. Immortalisation fibroblast

18. Explain MTT assay

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are the functions of antibiotics in media

20. What is the composition of serum

21. What is the importance of CO2 in animal tissue culture

22. Explain cold trypsin treatment method

23. How to revive cryopreserved cells

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What is the use of inverted microscope

25. What are the applications of Hemocytometer

26. What is the use of HEPES

27. What are the cell disaggregation methods

28. What are the criteria for subculture

(5 x 2 = 10)

Sixth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

RECOMBINANT DNA TECHNOLOGY AND BIOINFORMATICS

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. Explain various DNA sequencing methods
2. What are the different hybridization techniques? Explain its applications
3. Explain different methods used for gene transfer to animal cells
4. Write an essay about biological databases

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What are the different types of DNA ligases
6. Explain the use of alkaline phosphatase in rDNA technology
7. Illustrate the use of adaptors and linkers
8. Explain the principle and application of RAPD
9. What is the components of PCR
10. Describe the forensic applications of DNA figure printing
11. What are the advantages of M13 based vectors
12. What is the principle and advantages of electroporation
13. What are the methods used for the selection of recombinants
14. How to produce recombinant therapeutics
15. How to produce transgenic bioreactors
16. Explain rDAN induced insect-resistance in plants
17. Describe the properties of primary and secondary sequence databases
18. Explain the methods of sequence alignment

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. What are isoschizomers
20. Describe Lambda ZAP
21. How Calcium Phosphate helps transformation
22. Describe the features of BLAST
23. What are composite protein sequence databases

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. Draw the restriction sequence of EcoRI
25. What are the properties of ddNTPs
26. Describe the importance of ColE1 plasmid
27. What is IPTG
28. What is the principle behind gene augmentation therapy

(5 x 2 = 10)

Sixth semester B. Sc. Biotechnology Degree Examination, LPR pattern

(CPSS)

MEDICAL BIOTECHOLOGY

Time : Three Hours Maximum Marks : 80

Section A

Answer Any Two out of Four Questions in about 1500 words. Each question carry 10 marks

1. What are the methods used for the identification of pathogenic microorganism
2. Explain the characteristics of Enterobacteriacea members. Explain its role in various diseases
3. Explain the replication of virus and its cultural characters
4. Explain the methods used in antimicrobial therapy. What are its advantages and disadvantages

(2 x 10 = 20)

Section B

Answer Any Seven out of Fourteen Questions in about 750 words. Each question carry 5 marks

5. What are the principle of general sterilization methods
6. Explain immunoenzymatic assays
7. What are the methods used for the genetic identification of pathogens
8. Explain the role of complement system
9. Describe the role of WBCs in immune system
10. What are the main feathers of staphylococcal infection
11. Explain the significance of *Clostridium botulinum* in food industry
12. Comment on Shigella infections
13. Explain the pathogenesis of viral diseases
14. Describe the replication of pox viruses
15. How retroviruses replicate their genome
16. What is the principle of vaccination
17. How normal biota helps to prevent diseases
18. Explain passive immunisation

(7 x 5 = 35)

Section C

Answer All Questions in about 300 words. Each question carry 3 marks

19. How microarray analysis helps to identify microbes
20. What are the general features of fungal infection
21. What are the morphological features of spirochetes
22. Explain Virus-Host interactions.

23. What are the disadvantages of chemotherapy

(5 x 3 = 15)

Section D

Answer All Questions in about 200 words. Each question carry 2 marks

24. What are the symptoms of Nosocomial infection

25. What is the cause of rheumatic fever

26. Give some examples of Exotoxins

27. What are the general features of Herpesviruses

28. What is Multiple drug resistance

(5 x 2 = 10)