UNIVERSITY OF CALICUT

(Abstract)

B.Sc Programme in Biotechnology – under Choice based Credit Semester System – Scheme and Syllabus – implemented with effect from 2009 admission onwards – approved - Orders issued.

GENERAL AND ACADEMIC BRANCH – I 'J' SECTION

No. GA. I/J1/4219/08 Dated, Calicut University. P.O., 26.06.2009

Read : 1. U.O. No. GAI/J2/3601/08 (Vol. II) dated 19.06.2009.
2. Minutes of meeting of Board of Studies in Biotechnology held on 27.02.2009
3. Item No.2(xiv) of the minutes of the meeting of the Faculty of Science held on 05.05.2009.
4. Item No.II A (15) of the minutes of meeting of the Academic Council held on 14.05.2009.

O R D E R

Choice based Credit Semester System and Grading has been introduced for UG Curriculum in the affiliated colleges under this University with effect from 2009 admission onwards and the regulation for the same implemented vide paper cited 1 above.

As per paper read as (2) above, the Board of Studies has resolved to approve the Syllabus of B Sc Programme in Biotechnology under Choice based Credit Semester System.

As per paper read as (3) and (4) above, the meeting of Faculty of Science held on 05.05.2009 endorsed the minutes of Board of Studies and the Academic Council held on 14.05.2009 approved the same.

Sanction has therefore been accorded to implement the scheme and syllabus of B.Sc programme in Biotechnology under Choice based Credit Semester System in this University with effect from 2009 admission onwards.

Orders are issued accordingly . Scheme & Syllabus appended.

Sd/-
DEPUTY REGISTRAR (G&A I)
For REGISTRAR

To
The Principals of all affiliated colleges -
offering B.Sc programme in Biotechnology.

Copy to:
Controller of Examination /EX I/EGI/DR B Sc/Enquiry/
System Administrator with a request to upload in the University website.
Tabulation Section/GA I 'F' Sections/SF/DF/FC.

Forwarded / By order
SECTION OFFICER

RESTRUCTURED COURSE CURRICULUM
(Syllabus)

For

B.Sc. BIOTECHNOLOGY
(alternate Pattern)
UNIVERSITY OF CALICUT
Academic year
2009 –'10 onwards

B.Sc. Biotechnology
COURSE STRUCTURE UNDER CCSS

I semester	Course Title		Instruc. Hrs/Week	Credit	Exam Hrs	Marks		Total Credit
						Int.	Ext.	
A 01	Common Course I	Communication skills in English	4	3	3hrs	25%	75%	16 credits
A 02	Common Course II	Critical reasoning , writing and presentation.	5	3				
A 07(3)	Common Course III	Communication skills for B Sc alternate pattern	5	4				
BT1B 01	Core Course I	Bioinforamatics	3	2				
BTIC 01	1st Complimentary course –1	Chemistry	2	2				
BTIC 02(P)	1st Complimentary course Practicals -1	Chemistry Practical	2					
BTIC 03	2nd Complimentary course-1	Environmental Biotechnology	2	2				
BTIC 04(P)	2nd Complimentary course Practicals – 1	Environmental Biotechnology	2 ------- 25	-- ---- 16				
I I semester								
A 03	Common course IV	Reading literature in English	4	4	3 hrs	25%	75%	20 credits
A 04	Common Course V .	Reading on Indian constitution secularism and sustainable environment	5	4				
A 09(3)	Common Course VI	Literature in …for B Sc alternate pattern	5	4				
BT2B 02	Core course II	General Microbiology	2	2				
BT2B 03	Core course Practical II	General Microbiology	1	2**				
BT2C 05	1st Complimentary Course II	Chemistry	2	2				
BT2C 06(P)	1st Complimentary Practical II	Chemistry practical	2	*				
BT2CO7	2nd Complimentary Course II	Environmental Biotechnology	2	2				
BT2CO8(P)	2nd Complimentary Course Practicals II	Environmental Biotechnology	2 ------ 25	* ----- 20				
III semester								
A 06	Common Course VII	History and Phylosophy of Science	5	4	3 hrs	25%	75%	17 credits
A 12	Common Course VIII	General Informatics	5	4				
BT3 BO4	Core Course III Biochemistry	Biochemistry	3	3				

BT3BO5(P)	Core Course Practical III	Biochemistry	2	2**				
BT3C 09	1st Complimentary course III	Chemistry	3	2				
BT3C10(P)	1st Complimentary Practical III	Chemistry	2	*				
BT3C11	2nd Complimentary Course III	Environmental Biotechnology	3	2				
BT3C12(P)	2nd Complimentary Practical III	Environmental Biotechnology	2	*				
			25	17				

IV semester								
A 13	Common Course IX	Basic numerical skills	5	4	3 hrs	25%	75%	25 credits
A 14	Common Course X	Entrepreneurship development	5	4				
BT4BO6	Core Course IV	Microbial genetics	3	3				
BT4C13	1st Complimentary Course IV	Chemistry	3	2				
BT4C14 (P)	1st Complimentary Practical IV	Chemistry practical	2	4				
BT4 C15	2nd Complimentary Course IV	Environmental Biotechnology	3	2				
BT4 C16 (P)	2nd Complimentary Practical IV	Environmental Biotechnology practiced	2	4				
BT4 B07 (P)	Core Practical IV	Microbial genetics practical	2 ------ 25	2** ----- 25				
V semester								
BT5B 08	Core Course V	Cell and Molecular Biology	4	3				21 credits
BT5BO9	Core Course VI	Immunology and Immuno-technology	4	3				
BT5B10	Core Course VII	Bioprocess Technology	4	3				
BT5B 11 (P)	Core Course Practical V	Cell and Molecular Biology Practical	4	3**				
BT5 B 12(P)	Core Course Practical VI	Immunology and Immuno-technology practical	4	3**				
BT5D 01	Open Course-1 (From other department)	Food Microbiology and Biotechnology	3	4				
BT5B13	Project Work/Industrial Visit		2 ------- 25	2** -------- 21				
VI semester								
BT6B14	Core course VIII	Plant Biotechnology	4	3				21 credits
BT6B15	Core Course IX	Animal Biotechnology	3	3				
BT6B16	Core Course X	Recombinant DNA Technology	3	3				

BT6 B17 (P)	Core Course VII Practical	Bioprocess Technology Practical	4	3				
BT6B18 (P)	Core Course VIII Practical	Plant Biotechnology Practical	4	3				
BT6 B19	Elective Course – (from same subject/ department)	Medical Biotechnology	3	2				
BT6 B20	Project	Combined Project of 5 students in each group	4 ------- 25	4 ------- 21				

(16+20+17+25+21+21=120)

- Combined project of 2 group with 5 students starts in the V Semester
- Industrial visit may be organised 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.....54

Credits for complimentary courses…… ...24

Credits for open course…….....04

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 minimise the work load on teachers.

- The VI Semester practical examination for the main course subjects shall be clustered in the form of 3 practicals.

Cluster I :	General Microbiology
	Microbial Genetics
	Biochemistry
Cluster II :	Cell and 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 with in 3 hrs for the B.Sc. Biotechnology course.
- Industrial visits may be organised in the V semester and report on the Industrial visit shall be submitted for evaluation in the VI semester.
- **The syllabus/Course offered by the University as per the recommendations of board of studies in chemistry for complimentary course (Chemistry) shall be followed for B.Sc. Biotechnology as the first complimentary course .**

BT1BO1. BIOINFORMATICS

I

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;

II

Phylogenetic analysis: Sequence based taxonomy, Neighbour joining method, Parsimony tree, Computer Tools for phylogenetic analysis- eg-PHYLIP

III

DNA sequence data bases, features of DNA sequence analysis, approaches of gene hunting, cDNA libraries, ESTs and EST analysis, general study of software packages, primary design for molecular biology.

References

1. Introduction to Bioinformatics: by T.K. Altwood, D.J. Parry-Smith and S. Phukan.
2. Bioinformatics: Sequence and Genome Analysis David. W. Mount.
3. Bioinformatics: Genes, Proteins, and Computers by C.A. Orengo, D.T. Jones and J.M. Thornton
4. Bioinformatics ,databases, tools and algorithms, Orpita Bosu, Simminder Kaur thukral.

BTIC02. ENVIRONMENTAL BIOTECHNOLOGY

(COMPLIMENTARY COURSE)

I. History of Environmental Biotechnology: Role of Environmental Biotechnology in Environment protection – Microbial interactions in the environment – Environment and Ecosystem processes – Origin of life, Chemistry of life and Organisation of life – Ecosystems. Pollution management: In process treatment, End of pipe treatment, Remediation of polluted sites, etc.

II. Microorganisms in biogeochemical cycles: carbon cycle, nitrogen cycle, phosphorus and sulphur cycle – Plant – microbe interaction

N_2 – fixation – symbiotic and non-symbiotic (12 hrs).

III. Water microbiology: Sources of microorganisms, *E. coli* as indicator, water purification methods; sedimentation, filtration and chlorination.

Bacteriological examination of water: Presumptive, confirmed and completed test (12 hrs).

IV. Vermitechnology: Role of earth worms in waste disposal and biomagnification of nutrients (10 hrs).

BTIC02 (P) PRACTICALS

1. Isolation of Nitrogen Fixing Bacteria from root nodule of Leguminous plants.
2. Standard plate count of Sewage water sample.
3. Presumptive and confirmed tests.
4. Indole test
5. Voger Pranokaur test
6. Citrate utilisation test
7. Methyl red test

References

1. Jogdand, G.N. 1995. EBT, Himalaya Publishing House.
2. EBT : Basic Concepts and Application: Indushekar Thakur (2006). I.K. International Publication.
3. Moo-Young, M. 1996. EBT: Principles & Applications, Kluver.
4. Pelczar, M.J. 1998. Microbiology: Concept & Applications, McGraw.

BT2BO1. GENERAL MICROBIOLOGY

I. History of Microbiology: Leeuvenhoek and h is 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)

BT2BO1 (P) PRACTICALS

1. A septic techniques.
2. Preparation of media and sterilization.
3. Isolation of microorganisms from airs, water, soil.
4. Pure culture techniques – Streak, spread, pores plate methods.
5. Enumeration of microorganisms Total Vs. Viable counts.

6. Staining methods.

7. Growth curve of bacteria.

8. Antibiotic sensitivity test.

9. Assessment of microbial growth wet weight, Packed Cell Volume.

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.

BT2CO2. ENVIRONMENTAL BIOTECHNOLOGY

(COMPLIMENTARY COURSE)

I. Microbiology and Biochemistry of waste water treatment. Water pollution: Primary, secondary and tertiary or Alternative treatment.

II. Municipal waste and industrial effluent treatment and disposal, mechanical treatment, biological treatment: activated sludge, biological filters, RBC, FBR, anaerobic treatment: contact digestors, packed column reactors, UASB. Medical solid waste.

(12 hrs).

III. Degradation of pesticide and other toxic chemicals by microorganisms, biotechnological application of thuringenesis toxin as a natural pesticide. Biofertilizers and Biopesticides. Composting.

(12 hrs)

IV. Bioenergy from waste: Biomass for energy production, sources of biomass, methane production, biogas from food processing industry, fuel-alcohol production – ethanol from biomass, lignocellulose residues. Biofuel and Biodiesel, Bio leaching, Types of bioleaching. (10 hrs)

BT2CO2 (P) PRACTICALS

1. Preparation of vermicompost

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

3. BOD & COD estimation of polluted water sample.

4. Production of biogas and methane from muncipal sewage & food waste.

References

1. Jogdand, G.N. 1995. EBT, Himalaya Publishers.

2. Indushekar Thakur: EBT, Concepts & Applications.

3. Moo-Young, M. 1996. EBT: Principles & Applications.

4. Pekzar, M.J. 1998. Microbiology.

BT3BO1. 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.

II **(2 hrs)**

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).

III **(8 hrs)**

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.

IV **(4 hrs)**

Proteins: Classification, structure and biological function.

V **(3 hrs)**

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

VI **(4 hrs)**

Nucleic acids: Structure of purines, pyramidines, different conformational forms of DNA, Types of DNA.

VII **(4 hrs)**

Enzyme: Classification, Nomenclature, Mechanism of enzyme action, derivation of Michaelis Menten equation, Enzyme inhibition, Factors affecting enzyme activity, Allorteric enzymes, Isoenzymes.

VIII **(4 hrs)**

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

IX **(4 hrs)**

Separation technique:

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

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

BT3BO1 (P) PRACTICALS

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.

BT3CO2. ENVIRONMENTAL BIOTECHNOLOGY

(COMPLIMENTARY COURSE)

I. Current status and novel trends in environmental biotechnology (4 hrs).

II. Bioremediation: Advantages of Bioremediation, types of bioremediation.

Monitoring the efficacy of Bioremediation.

Bioventing

Bioremediation for controlling oil spills.

Biosorption: Use of bacteria and fungi, Bioreaction for biosorption. (14 hrs)

III. Problems associated with disposal of xenobiotic compounds, Hazardous wastes.

Biodegradation of xenobiotics: Persistent compounds, Degradation mechanisms, naphthalene, benzene, phenol, PCB's, propanil (Herbicide), urea.

Biodegradation of petrochemical effluents. (14 hrs)

IV. Removal of nitrogen and phosphorus from waste water.

Global environment problems: The Green house effect, Ozone depletion, UV radiation, Acid rain.

Air pollution and its control: Control of gaseous emissions, control of pollutants from vehicles.

BT3CO2 (P) PRACTICALS (8)

1. Aerobic treatment of municipal sewage including sedimentation, filtration (sand filter), chlorination.
2. IMViC test : using river and tap water samples.
3. Spirulina production.
4. Deliguification of rice straw, rice husk using enzymes (white rot jungi, Pleurotus specis) and alkali.
5. Use of yeast as biosorbant to remove colour from coir retting waste water / industrial effluent.

References

1. Jodgand, G.N. 1995. EBT, HImalaya Publishers.
2. EBT. S.K. Agarwal (1998). A.P.H. Publishers.

3. Text book of EBT: Pradip Kumar Mohapatra (2006).

4. Moo-Young, M. (1996). EBT: Principles and Applications.

BT4BO1 MICROBIAL GENETICS

I. Genes mutation and mutagenesis

UV and chemical mutagenesis, Base analogue mutagens, mutagenesis by inter calating substances. Type of mutations; spontaneous mutation, frame shift mutation, suppression, missense mutation, Reversion, Isolation of mutants. Fluctuation test, Ames test for mutagenesis.

(8 hrs)

II. Bacterial genetic system

Transformation – competence, molecular mechanism of transformation conjugation; generalized transduction, specialized transduction plasmids; types of plasmids, purification, plasmids transfer, replication, Properties of bacterial plasmids.

Transposons; Insertion sequences (Is elements), composite transposons, Tn_3 elements, Transposition.

Brief account on Transposable elements in eukaryotes.

AC & DS elements in maize

Retrotransposons

(12 hrs)

III Viruses

Introduction to viruses, discovery, classification and structure of viruses, DNA & RNA viruses, replication of viruses eg: Herpes, pox, adenovirus, retrovirus, viroids, prions.

(08 hrs)

IV.

Viruses and their genetic system, phage and its lytic cycle. Genetics of phage T_4 and phage λ. Recombination, Circular map of T_4 & λ, life cycle of phage T_4 & λ.

(08 hrs)

BT4B 01(P) Practicals

1. Isolation of plasmid DNA

2. Phage titration

3. Induced Transformation in *E. coli*

4. Conjugation

5. Complementation experiment.

References

1. Microbial genetics: David Friefelder.

2. Principles of genetics: Snustad, Simmons, Jenkins.

3. Microbiology: sixth edition: Lan Sing, M. Prescott, John Harly & Donald. A. Klein.

BT4CO2. ENVIRONMENTAL BIOTECHNOLOGY

(COMPLIMENTARY COURSE)

I. Pesticide pollution problems and sources of pollution.

Biotechnological application for pesticide waste disposal with specific case studies using bacteria, fungi and immobilised enzymes. (14 hrs)

II. Single cell protein and biomass from waste

Biotechnological applications for distillary, tannery, pulp industry. Environmental impact of tanneny effluents. Process and production in distillery.

Waste treatment using aquatic plants. (14 hrs)

III. Biotechnology for waste treatment of food and allied industries. General characteristics of dairy industry waste waters. Treatment of Dairy Effluent waste water. Biotreatment of Dye industry wastes. Sources and origin of Dyes. Treatment technologies of Dyes.

IV. Bioplastics: Biopols (PHB), Biolac (polylactic acid).

Economics of PHA production. Dark side of Bioplastics.

Bioscrubblers. (4 hrs)

BT4CO2 (P) PRACTICALS:

1. Isolation of pesticide degrading bacteria from rice field.

2. Microbial screening for phenol degrading organisms.

3. Removal of copper from waste water using *Trichoderma viridae*.

4. Production of cellulose and ethanol from lignocellulosic waste (biogas).

References

1. Jogdand, G.N. 1995. EBT: Himalaya Publishers.

2. S.K. Agarwal. 1998. EBT, APH Publishers.

3. Pradip Kumar Mohapatra: Textbook of EBT (2006).

4. Moo-Young, M. (1996). EBT: Principles and Applications.

BT5BO1. CELL AND MOLECULAR BIOLOGY

1. Introduction to the Cell: History of cell, Precellular Evolution, Cell as the basic unit of life, cell theory, Structural organisation of prokaryotes and eukaryotes. (3hrs)

2. Molecular archatecture of cell: Structure and junction of plasma membrane and cell organelles: cytosol, golgi, ER (rough & smooth), Ribosome, cytokeleton (microtubules, microfilments, intermediate filamens), Mitochondira (aerobic & anaerobic), Chloroplase (phtosynthesis, CAM plants, c3 & C4 pathway) Nucleus, Lysosome, Peroxisome, structure of cilia and flagella (20hrs)

3. Interactions between cell & environment: - Cell functions, cells adhesions, cell junction and extracellular matrix, cell signalling through G-protein linked receptors (9hrs)

4. Cellular regulation: (4 hrs)

    1. Brief account of cell cycle and its regulation.
    2. Mitosis and Meiosis.
    3. Brief overview of cancer.
    4. Cell apoptosis.

MOLECULAR BIOLOGY

I : Structure of Genetic material (4 hrs)

– Introduction – Nature of genetic materials; Discovery of DNA as genetic material (Griffith, Avery, Harshey Chase).

– Structure of nucleic acids – DNA – A, B, Z model.

– Super coiling and Topoisomerase.

– Types of RNA – structure and function.

II : Replication of DNA (5 hrs)

– Salient features of prokaryotic and eukaryote; DNA replication.

III : Molecular Mechanism of Recombination (8)

– Homologous recombination, site specific recombination; Models of recombination (Holliday Model, Double Strand break etc.)

IV : DNA repair mechanism (5)

– Excision mechanism – Nucleotide, Base.

– Post replication repair – Mismatch repair, Recombination repair, SOS repair.

V : Transposable elements (5)

– Transposable elements in prokaryotes – Is, Transposons.

– Mechanism of transposition in prokaryotes.

– Transposable elements in eukaryotes – AC – DS system in Maize, Drosophila – p elements, yeast, Ty elements.

– Retro transposons and Retroposons.

VI : Gene structure in prokaryotes and eukaryotes (4)

VII : Transcription of DNA processing (5)

– Central dogma.

– Transcription in prokaryotes. eg; lac, top operop.

– Transcription in eukaryotes.

– Post transcriptional modification and RNA processing.

– Gene regulation in prokaryotes and eukaryotes.

VIII : Genetic code and Translation (4)

– Salient features of venetic code.

– Translation in prokaryotes and eukaryotes.

– Post translational modification.

BT5BO1(P) PRACTICALS

1. Cell counting methods :
    a) Haemocytometer : WBS, RBC
    b) Differential counting using Leishmans
2. Micrometry : a) Calibration using occular micrometer

b) Finding out average cell size

3. Squash Preparation a) Study of mitotic stages

b) Measurement of Chromosome length.

4. Isolation of DNA from suitable materials (*E.coli.* Plant materials)

5. Agarose gel electrophoresis.

6. Induction of Lac Opeon using microorganisms (eg. *E. coli*).

7. Conjugation in *E. coli,.*

References:

1. De Robertis: Cell and Molecular Biology

2. Cell and Molecular Biology : Gerall Karp

3. Lodish, Baltimore: Molecular Cell Biology

4. The cell : Cooper (A Molecular Approach)

5. The Cell – Bruce Alberts.

6. Allyn Bregman, 1996. Labaratory investigation in cell and molecular biology. John Wiley & sons.

7. Freifelder, D. & Malacinski, G.M. 1998 (or latest edition)

8. Lewin, B. Genes VI, 1997, Oxford Univ. Press, Oxford, New York, Tokyo.

9. Cell and Molecular biollogy, Harvay Lodish, David Baltimore, Arnold Beek, Lawrence Zipursky, James Darnell.

10. Genetics – Peter J. Russel.

11. Principles of Genetics – Hartt & Jones.

BT5B02. 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)

BT5B02 (P) Practicals

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. Immnobiology: The immune system in Health and Diseases

   Charles A. Janeway, Paul Trawers

   Mark Walport and J. Donald Copra

BT5B03. BIOPROCESS TECHNOLOGY

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. (5)

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. (5 hours)

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. (6hours)

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.

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. (10hours)

Fermentation process operation: Inoculum preparation, scale-up of fermentations. Chemostat and turbidostat. Down stream 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 (8hours)

Typical fermentation processes: Antibiotics (Penicillins), organic acids (acetic acid), Microbial enzymes (Amylases and proteases) ethanol. Single cell proteins (SCP), Vatminas (Vti B 12). Use of microbes in solid and liquid waste disposal, aerobic and anaerobid biological waste treatment methods. Activated sludge, Rotating biological contactors, Trickling filters and anaerobic digestors. (8 hours)

Basic techniques in plant cell cultures. A brief account of primary and secondary metabolites. Large scale cultivation of plant cells in bioreactor. Bioreactors specific for plant cell cultures, hairy root cell cultures.

Case studies: Production of menthol, Vinblastine, Vanilline and capsicine by suspension cultures. (5 hours)

Animal cell culture. Anchorage dependent and independent cultures, monolayers, seeding density, microcarrier suspension, soft agar and perfusion cultures. Use of roller and spinner bottles, hollow fibre reactors. Case studies: production of interferon. Monoclonal antibodies and viral vaccine (rabies). (8 hours)

Enzyme technology: Basic concept of enzymes, sources of microbial enzymes, extraction and purification of enzymes. Control of microbial enzyme production imobilization of enzyme of adsorption, entrapment, crosslinking and encaosulation methods. (8 hours)

Application of enzymes in Medical/pharmaceutical, and in food industry. Industrial applications of amylasses and proteases. Production of amino acids and antibiotics by immbilised enzyems/cells. Use of microbial enzymes in leather, paper and dairy industry. (7 hours)

BT6B04 (P) Practicals

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. Detection of formed glucose by anthrone method,
5 .Separation of cells by flocculation. Use of alum as an flocculating agent to separate yeast from fermentation broth.
6. Anaerobic fermentations: Production of methane from Glucose.
7. Comparative study of surface culture (Mat culture of aspergillus niger/Pencillin), solid state fermentation (Mushrooms) and submerged cultures.
8. 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. FOOD MICROBIOLOGY AND BIOTECHNOLOGY

(Open Course –Elective from other department students)

I. Food as a substrate for microorganisms: pH, moisture content, redox potential, nutrient content and inhibitory substances (10 hrs)

II. Microorganisms important in food industry: Molds, identification of molds of industrial importance, yeasts & yeasts like fungi, yeasts of industrial importance, bacteria, morphological characteristics important in food bacteriology, Groups of bacteria important in food bacteriology. (11 hrs)

III. General principles underlying spoilage: Causes of spoilage, factors affecting kinds and members of microorganisms in food, factors affecting growth of microorganisms in food. Chemical changes caused by microorganisms. (11 hrs)

IV. Principles of food preservation: Methods of food preservation, Removal of microorganisms, Asepsis, Preservation by using high temperature and low temperatures.

Preservation by drying: Methods of drying. Factors in the control of drying. Preservation by food additives. (11 hrs)

V. Foods and enzymes produced by microorganisms – Bread, malted beverages, wines, distilled liquors, vinegar, fermented vegetables, fermented dairy products & oriental fermented goods.

Microorganism as food: single cell protein, fats and amino acids from microorganisms.

Production of microbial enzymes. (11 hrs)

References

1. Fraizier, Food Microbiology, 1978, McGraw Publishers.

2. Pelczar: Microbiology.

3. Prescott: Microbiology.

BT6BO1. 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)

BT6BO1 (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.

BT6BO2. 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.

BT6BO3. RECOMBINANT DNA TECHNOLOGY

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. (10 hrs)

3. Isolation and purification of total cell DNA (4 hrs)

4. 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. (15 hrs)

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

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

References

- 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.
- Old. R.W and Primerose, S.B. 1994. Principles of gene manipulation 0 An introduction to Genetic engineering.
- Gene cloning and DNA Analysis an Introduction T.A. Brown.
- Recombinant DNA - James D. Watson, Michael Gilman.

BT6B01. MEDICAL MICROBIOLOGY

(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. (7 hrs)

III. Staphyolococcus : General properties of bacteria.

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 (15 hrs)

V. Human Immunodeficiency Virus : AIDS

Normal Microflora of Human body

Acute diarrhoeal diseases

Antimicrobial therapy

Immunoprophylaxis & Immunotherapy

Nasocomial infections (7 hrs)

References

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

MODEL QUESTION PAPER

BT1CO3. ENVIRONMENTAL BIOTENCHNOLOGY

1. Enzyme involved in N_2 fixation.

   (Nitrogenates , oxidase, Urease de hydrogenase).

2. Which of the following is symbiotic bacteria

   (Rhizobium sps., Bacillus sps., Clostridium, Streptococeus.

3. The accepted MPN in terms of water quality is _____

4. Name two earth worms use for the production of vermicompost.

5. _____ is the major indicator of polluted water

   (*E. coli, Staphylococcus, Vibrio cholarae*, All)

6. Selective media used for confirmed test

7. _____ is sued as indicator in BGLB broth

   (Coomassie blue, Bromothymole blue, Methylene blue, Prussian blue).

8. Presumptive test is used in _____ microbiology

   (Food, Air, Water, Medical)

9. Name a genetically modified org to treat oil spills

10. Methane bacteria are obligate _____

    (Aerobes, Anaerobes, Facultative anaerobes, None)

11. Scientific name for tiger worm:

12. Expand NCST.

13. Ideal pH for compost bed.

14. Earthworm casts are a good source of _____ production.

15. Name a facultative bacteria.

16. _____test in presumptive is viewed as _____.

    (gas bubble formation, charring, colour change, all).

17. What is SRT?

18. Completed test determines _____ of the water sample

    (Mineral content, earbon, Content, Dissolved O_2, Coliform content).

19. _____ media is used to differentiate between *E. coli* and *E. aerogenes*

(Nutrient agar media).

20 _____ can remove uranium

(*Chloerella vulgaris, pseudomonas, E.coli, Streptococcus aureus)*

Short answers:

21. Role of symbiotic bacteria in N_2 fixation.
22. Phosphorus cycle.
23. Confirmed and Presumptive test.
24. ImVic test.
25. Plant-microbe interaction.
26. Sulphur cycle.

Short essay on

27. Vermitechnology
28. Biomagnification of nutrients.
29. Bacteriological examination of water.
30. N_2 fixation.

Long essay

31. Write in detail about biogeochemical cycles.
32. What are the different water purification methods for potable water?

BT2BO2. GENERAL MICROBIOLOGY

1. The word cell was first used by

   (a) Matthias Schleiden (b) Robert Hooke

   (c) Theodar Schwann (d) E.Hl. Haeckal

2. "Germ theory of disease" was postulated by

   (a) Louis Pasteur (b) Antony van Leenwenhoek

   (c) Robert Koch (d) Edward Jenner

3. _____ refers to the shortest period of time to kill a suspension of bacteria (or spore) at a prescribed temperature and under specific conditions:

   (a) Thermal death time (b) Decimal reduction time

   (d) Moist heat (e) Steam under pressure

4. Penicillin was discovered by

   (a) Rene Dubos (b) Alexander Fleming

   (c) Selman Waksman (d) W. Florey

5. The kind of movement that occurs in bacteria in which the flagella are present all over the bacterial surface or at one end are known as _____

   (a) Spirochaetal movement (b) Gliding movement

   (c) Flagellar movement (d) Pleomorphism

6. Exfoliate toxin is produced by

   (a) Staphylococcus aureus (b) Chostridium tetani

   (c) Bacillus anthracis (d) Ercherichia coli

7. When the male and female gametangia originate from the same vegetative body, the fungi is referred to as _____

   (a) Autogamous (b) Heterothallic

   (c) Pseudosepta (d) Homothallic

8. Among the following who is considered as father of microscope?

   (a) Louis Pasteur (b) Antony Van Leenweboek

   (c) Robert Koch (d) Theordore Schwann

9. Teichoid acid is present in the cell wall of _____

   (a) Gram +ve bacteria (b) Gram –ve bacteria

   (c) Blue green algae (d) All

10. The compound which gives heat resistant to endospore forming bacteria:

(a) Calcium DPA complex (b) Peptidoglycan

(c) Mycolic acid (d) None of the above.

11. The microscopy valuable for studying living and stained cells:

(a) Electron microscopy (b) Fluorescent microscopy

(c) Phase contrast microscopy (d) None of the above.

12. The name of a differential staining method is:

(a) Grams staining (b) Positive staining

(c) Negative staining (d) None of the above.

13. The acid fast bacterial cell was consists of:

(a) Calcium carbonate (b) Mycolic acid

(c) Polysaccharides (d) Polypeptides

14. The microorganism called as an indicator organism:

(a) Pseudomonas fluorscens (b) E. coli

(c) Vibriocholerae (d) None of the above

15. An example for double stranded RNA viruses is:

(a) Reovirus (b) Vaccinia virus

(c) TMV (d) Small pox virus

16. Aflatoxin is produced by the species:

(a) Aspergillus flavus (b) Aspergilus niger

(c) Penicillium notatum (d) None of the above.

17. The process by which energy from electron transport is used to make ATP is called:

(a) Oxidative phosphorylation (b) Substrate level phosphorylation

(c) TCA cycle (d) None of the above.

18. An antibiotic which inhibits the peptidiglycan biosynthesis:

(a) Penticillin (b) Streptomycin

(c) Polymyxins (d) None

19. Potato dextrose agar used to culture

(a) Bacteria (b) Fungi

(c) Virus (d) Protozoa

20. The plasmids which give degradative capacity are:

(a) TOL plasmids (b) Col plasmids

(c) R plasmids (d) None

Short Answers:

21. Define episome.
22. Define cold sterilization.
23. Define sanitization.
24. What are virions?
25. Define parsive diffusion.
26. Note on homofermentors.

Short Essays

27. Write a note on pentose phosphate pathway.
28. Brief note on Streptococcal disease.
29. Differentiate eukaryotic and prokaryotic bacteria.
30. Short note on selective media.

Long Essays

31. Explain the morphology of bacteria.
32. Explain the factors effecting the growth of bacteria and also mention the methods to measure the growth of bacteria.

BT2CO7. ENVIRONMENTAL BIOTENCHNOLOGY

1. Biogas is mixture of CH_4 and _____

   (a) CO_2 (b) H_2 (c) CO (d) NO_2

2. Expand CASP.

3. RBC are used in

   (a) aerobic treatment (b) anaerobic treatment (c) nitrogen removal (d) none

4. *T. viridae* used to remove _____.

   (a) Fe (b) Cu (c) Ni (d) None

5. Gibberella used in commercial scale to break down _____.

6. *F. solani* to degrade _____

   (a) propane (b) DDT (c) parathione (d) none

7. Vitox system is a _____.

   (a) aerobic system (b) anaerobic system (c) mixture of both (d) None

8. *P. crysoporium* degrades _____

9. Waste water contribute organic and inorganic material to river water is called _____.

10. _____ is an ethanol producing bacteria.

11. Expand IFBBR.

12. Cauriers used in CASP include _____.

    (a) Powdered activated charcoal (b) Iron particles (c) fibres (d) None

13. _____ organism degrades 2,4,5-T

    (a) Pseudomonas fluorescence (b) E. coli (c) Pseudomonas cepacia

    (d) Flavobacterium

14. Organism which produces H_2 from waste is _____

    (a) *Clostridium butyrium* (b) *Pseudomonas fluorescence*

    (c) *Vibriocholerae* (d) None

15. Support media in FBR includes _____

    (a) Plastics (b) Glass (c) None (d) Iron particles

16. Expand NCST

17. Camphor is degraded to _____

    (a) Lactonic acid (b) CO_2+H_2O (c) acetic acid + formic acid (d) None

18. Benzaldehyde is degraded to _____

19. Phenol at meta-cleavage degradation yields _____

20. Trichloroethylene is degraded by _____.

Short answers

21. Mechanical treatment option for waste water.

22. Activated study process.

23. Trickling filters.

24. Rotating biological contactors.

25. Fluidised bed reactors.

26. Contact digestors.

Short Essay

27. Use of microbes in pesticide waste disposal.

28. Role of *B.t.* as a biopesticide.

29. Ethanol production from biomass and lignocellulosic residues.

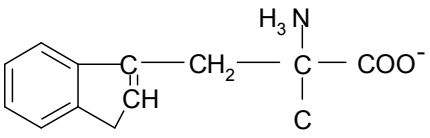
30. Biogas production from distillery waste.

Long essay

31. What are the various biological treatment methods for purification of municipal sewage of industrial effluents.

32. Write an essay on production of bioenergy from waste stressing on various sources of industrial and biomass waste.

BT3B04. BIOCHEMISTRY

1.  represents the structure of

a) Phenylalanine
b) Methionine
c) Iryptophan
d) Tyrosine

2. Fatty acids are:

a) hydrophobic
b) hydrophilic
c) amphipathic
d) none of the above.

3. An example for a cofactor is

a) Zn^{2+}
b) Biotin
c) NAD^{+}
d) Pyridoxal phosphate

4. Glycogen is a

a) structural polysaccharide
b) storage polysaccharide
c) dissacharide
d) monosaccharide

5. Molecular sewing is also called

a) Affinity chromatography
b) Adsorption chromatography
c) Electrophoresis
d) Gel filtration chromatography

6. SDS-PAGE is a method of separation of:

a) Proteins
b) DNA
c) RNA
d) Carbohydrates

6. Phosphodiester bonds are present in:

a) Carbohydrates
b) Nucleic acids
c) Proteins
d) Lipids

7. Ethidium bromide is a stain used to visualise

a) Protein
b) RNA
c) DNA
d) None of the above

8. Sucrose is composed of

a) Glucose and fructose
b) Galactose and glucose
c) Glucose and glucose
d) Fructose and galactose

9. Lock & Key hypothesis was proposed by:

a) Kuhne
b) Emil Fischer
c) Miachelis-Menten
d) Buchner

10. Example of a polar amino acid

a) Glycine
b) Thereonine
c) Aspartic acid
d) Serine

11. Pairs of stereoisomer that are not mirror images of each other are called

a) diasteroisomers b) enatiomers
c) geometric isomers d) cis-trans isomers

12. _____ proteins have polypeptide chains that are arranged in long strands or sheets:

a) globular b) fibrous
c) pleated sheet d) β-tuan

13. Adipocytes and germinating seeds contain _____ enzyme that catalyse the hydrolysis of triacylglycerols

a) Ligase b) Lipase
c) Kinase d) Protease

14. Ceramide is the structural parent of

a) Schingolipids b) Phospholipids
c) Steroids d) None of the above

15. Write down the function of an oxido-reductase enzyme.

16. What are domains?

17. What is meant by an anomer?

18. Give the structure of any aromatic amino acid.

19. What are reducing sugars? Give example.

20. Give structures of all the pyramidines found in nucleic acids.

II. Short Answers

21. What is meant by a 'zwilter ion'?

22. Write down Henderson-Hasselbalch equation.

23. List out the essential fatty acids found in nature.

24. What are allosteric enzymes?

25. What is the basis for separation in ion-exchange chromatography?

26. What is a buffer? Give example.

III. Short essay:

27. Write the reaction of α-amino acids with ninhydrin.

28. Briefly outline the classification of carbohydrates.

29. What is meant by non-comparative inhibition?

30. Write a short note on compound lipids.

IV. Long essay:

31. Derive Michaelis-Menten equation.

32. Explain the four levels of organisation in proteins.

BT3CO11. ENVIRONMENTAL BIOTECHNOLOGY

1. Metabolism independent binding of heavy metals to living or dead cells are referred to as _____

   (a) Fusarium solani (b) Aspergillus niger (c) Chlorella vulgaris

   (d) Zooglea ramigeron

2. Organism which can remove uranium?
3. Organism which can remove silver from solution:
4. Organism which can remove cadmium.
5. Bisorbent-M involved in removal of _____.
6. Polyanionic heteropolysaccharides produced by *Acinetobacter calcoa*
7. Organism ..... degrades propanol
8. Organism .... degrades baphthalene
9. Organism ....degrades benzene.
10. In activated slude method, activated sludge is mixed .....
11. Organism .. degrade phenol
12. Parathion hydrolase is isolated from
13. Expand CASP
14. Support media in FBR includes _____.
15. F. solani degrades _____.
16. *P. crysosperium* degrades _____.
17. Biogas is a mixture of CH_4 and _____.
18. Carriers used in CASP include _____.
19. *E. coli* is _____ bacteria
20. _____ is an ethanol producing bacteria.

Short Answers

21. Biodegradation of naphthalene.
22. Problems associated with disposal of xenobiotic compounds.
23. Bioremediation for controlling oil spills.
24. Cyanide degradation using fungi.

25. Use of biosorption in leather industry.

26. Advantages of bioremediation.

Short Essay

27. Current status of EBT.

28. Bioventing

29. Biodegradation of petrochemical effluents.

30. Biosorption involving bacteria and fungi.

Long Essay

31. Write essay regarding biodegradation of embiotic compounds.

32. Types and advantages of bioremediation.

BT4BO6. MICROBIAL GENETICS

1. Enzyme which reverts UV DNA damage.

   a) AP endonuclease b) Photolyase

   c) Exonuclease d) Photo convertase

2. Which of the following is not alkylating agent

   a) EMS (eltyl methane sulphonate)

   b) Methyl methane sulphonate

   c) Dimeltyl sulphate

   d) Diethyl amino ethane

3. Who discovered transduction

   a) Zinder & Tatum b) F. Griffith

   c) Lederberg & Tatum d) Zinder & Laderberg

4. Which are the following RNA viruses replicates through DNA intermediate.

   a) ϕx174 b) N13 c) Hiv d) Hooper views

5. What was the experimental system of Barbara Mc. Clintok

   a) Rice b) Wheat c) Tornato d) Maize

6. Transposons integrates itself in the host genome through

   a) Homologous recombination

   b) Site specific recombination

   c) Illegitimate recombination

   d) None of the above

7. What will be the state of F cells after conjugation with Hfr

   a) F^- b) F^+ c) Hfr d) F^1

8. Which one of the following method is used for polasmid isolation

   a) Hot phenol method b) Acidic phenol method

   c) Alkaline lysis method d) All of the above

9) Identity the type of miltation in following sequence.

   AUG AUC UVV UGA $\rightarrow$ AUG AUC UUA UGA

   1) Missense mutation 2) Nonsense mutation

   3) Silent mutation 4) Suppressor mutation

10) Termination suppressor mutation occurs in

1) mRNA 2) DNA c) rRNA c) tRNA

11) Natural competence occures in

1) H. influenzae 2) E-coli 3) Corny bacterium

4) Clostridium

12) Copia elements are

1) Eukaryotic transposons 2) Viral transporous

3) Prokaryotic transposous 4) Plasmid vectors

13) A Plasmid said to be relaxed because

a) It is linear b) It has high copy number

c) It will not have super coiling d) None of the above

14) Acrydine orange is

a) Methylating agent b) Agent causing point nutation

c) DNA intercalating agent d) Translational inhibitors agent

15) Creutafeidt - Jakoh disease is due to

a) Virus b) Prions c) Bacteria d) Viroids

16) ϕ x 174 replicates through

a) O mode b) Rolling circle

c) Both d) None of the above

17) Which one of the following has double stranded DNA

a) Human papillona virus b) Parvovirus

c) Rotavirus d) Corona virus

18) Lytic condition is triggered due to

a) UV exposure b) Abundant nutrients

c) λ repressor d) None of the above

19) What is the size of F plasmid

a) 200 kb b) 50 kb c) 5 kb d) 100 kb

20) Through which receptor λ phage injects E-coli

a) Glucose receptor b) Maltose receptor

c) Galactose receptor d) Lactose receptor

Short answer

1) Hfr

2) Prions

3) Reversion

4) Missense mutation

5) AC/DC elements

Short answer

1) Explain Aemes test and its significances

2) Explain generalized transduction

3) Classification of virus

4) Give an account of different types of plasmid and its purification

5) Explain the molecular mechanism of transformation

6) Give an account of T_4 phage life cycle.

Long essay

1) Explain different types of mutation and also give an account on chemical mutagenesis.

2) Explain different types of gene transfer in bacteria.

BT4CO15. ENVIRONMENTAL BIOTECHNOLOGY

1. Curing and preservation in tannery uses _____ & _____.

   (a) NaCl + Pentachlorophenyl (b) Alkyl phenyl + phenol

   (c) Acetate + CO_2 (d) None

2. Degreasing is done with help of _____ enzyme.

   (a) Lipase (b) pectinase (c) lysozyme (d) None

3. Microorganism which can leach olet chromium

   (a) Aspergillus oryzae (b) Aspergillus flavus (c) Penicillium (d) None

4. 'Ecopulpl x 200' is produced from fungus _____.

5. Microbial desulfonation is used for _____.

6. Pineapple wastes are used for SCP production using _____

   (a) ethanol (b) methanol (c) H_2 (d) None

7. Org: c' growth on waste water of soybean and curd.

8. Organism which degrades trichloroethylene.

9. Degraded end pelts of VOC's are _____, _____ & _____.

10. Aerobic degradation of mercaptoethanol by _____.

11. Aerobic degradation of butyraldehyde by _____.

12. Aerobic degradation of methyl chloride by _____.

13. Degradation product of camphor

14. Degradation product of Benzaldehyde

15. Degradation product of phenol at ortho-cleavage

16. Degradation product of dimethylamines mediated by _____ enzyme.

17. Organism which degrades propanol.

18. Cadmium is removed by _____ organism.

19. Expand IFBBR.

20. 2,4,5-T is degraded by

Short answers

21. Biotechnological application in tannery industry.

22. Biotechnological application in pulp industry.

23. Biotechnological application in distillery industry.

24. Use of immobilised enzymes for pesticide degradation.

25. Use of fungi for pesticide degradation.

26. Use of bacteria for pesticide degradation.

Short essay

27. Bioscrubbers

28. SCP from biomass.

29. Biopols

30. Biolac.

Long essay

31. Biotechnological application for pesticide waste disposal with specific case studies using bacteria and fungi.

32. Biotechnological applications in distillary, tannery and pulp industry.

BT5B08. CELL AND MOLECULAR BIOLOGY

1. Which class of topoisomerase is DNA gyrase?

(Type I, Type II, Type III, Type IV)

2. Which phosphoglyceride in plasma membrane has no net electric change?

   (a) cholesterol (b) phosphatidyl choline

   (c) sphingolipid (d) phosphatidyl inositol

3. Which type of cell junction mediates attachment of cells and their cytoskeleton to their neighbours or ECM?

   (a) Occluding (b) Gap

   (c) Ahdering (d) None of the above.

4. Absorbance max of nitrogenous bases in nucleic acid is _____

   (< 200 nm, 260 nm, 560 nm, 700 <)

5. Which enzyme mediates base excision repair

   (Methylane, pectivase, Amylase, DNA glycolyase)

6. Which conformation is called the "wet" form of DNA?

   (A-DNA, B-DNA, C-DNA, Z-DNA).

7. σ70 subunits binds to which promotor region?

   (-20, -10, -50, -100)

8. Microtubular motors are:

   (a) kinesin (b) dyenin

   (c) both a & b (d) only a

9. Diameter of microfilaments:

   (a) 8 nm (b) 0.1 – 1 nm

   (c) 2-5 nm (d) 11 – 20 nm

10. Lagging strand is synthesised in which direction?

    (a) 5' $\rightarrow$ 3' (b) 3' $\rightarrow$ 5' (c) None of the above (d) both a and b

11. Another name for C_4 pathway

    (a) Hatch Slack (b) Calvin

    (d) EMB pathway (c) Krebs

12. Porins are : _____

13. Action of DMS on dsDNA?

    (Acylation, hydroxylation, methylation, none)

14. Proteins are synthesised from _____ terminal to _____ terminal

    ($-NH_2$, COO^-; COO^-, NH_2; CO_2, NH_4^+; None)

15. Satellite DNA contain short sequences of _____ repeat in vast number?

(5-100 bp, 100-1000 bp, 1000-5000 bp, 5000 above).

16. Reaction centres of PS I & PS II are respectively

(a) P680 & P700 (b) P700 & P680

(c) P500 & P680 (d) P680 & P750

17. The 3C intermediate identified in C_3 pathway:

(a) 3-phosplhoglyceraste (b) 1,3-bisphosphoglycerate

(c) Fructose-3-PO_4 (d) Fructose-6-PO_4

18. Who got Nobel prize for 'gene expression'?

19. Pribnow box.

20. Which is the splice site?

[GATC, GUAG, TATA, TAAT]

Short Answer

21. Which are the enzymes coded by lac operon?

22. What is syncytium?

23. Spliceosoma complex.

24. Amber Mutation.

25. Explain prometaphase.

26. What are MAPs?

Short Essay

27. Explain Holiday model of recombination

28. Explain SNARE hypothesis.

29. Mode of action of G-linked proteins.

30. Explain splicing mechanisms.

Long Essay

31. Comment on molecular aspects of cell cycle.

32. Explain the semi conservative model of DNA replication.

BT5BO9. IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. A patient with Grave disease produce auto-antibodies against

a. Receptor for TSH b. Acetyl choline receptor

c. RBC d. IgG

2. Asthma related Hyper sensitivity is

a. Type I b. Type 2

c. Type 3 d. Type 4

3. Which of the following is a secondary lymphoid organ

a. Bonemarrow b. Thymus

c. Spleen d. Thyroid

4. The term epitope denotes the part of

a. Antigen b. Antibody

c. Lymphoid organs d. antigen + Antibody

5. An example for pentamer antibody is

a. IgG b. IgA c. IgD d. IgM

6. Western blotting technique is used to analyse

a. DNA b. Protein c. RNA d. Lipids

7. Paractine action of cytokines on Immune cells refers to

a. Self activation

b. Activation of distant cells

c. Activation of cells in close proximity

d. High activation

8. T cells originates from

a. Bone marrow b. Thymus

c. Spleen d. Lymph node

9. Hyper variable regions are located in

a. Only Heavy chain b. Only light chain

c. Heavy and light chain d. Fc region

10. Immunoglobulin with 4 constant region domain in its heavy chain.

a. IgM b. IgA c. IgG d. IgD

11. Agglutinins are

a. Antibodies b. Antigen c. Glycolipids d. RBC's

12. DNA vaccines cannot be used to deliver

a. Protein Antigen b. Polysaccharide antigen

c. Cytokines d. Visual proteins

13. Idio typic determinants arise from

a. Variable region b. Constant region

c. Hinge region d. Light chain constant region

14. Avidity is higher for

a. IgG b. IgM c. IgD d. IgE

15. The first line of defence against infection is

a. Innate immunity b. Acquired immunity

c. Humoral immunity d. Vaccination

16. Antibodies are produced by

a. T-cells b. Macrophages

c. Plasma cells d. Dendrite cells

17. The cell that play an important role in allergic reaction is

a. Mast cell b. RBC

c. CD8 cells d. NK cells

18. Eosinophills are distinguished by

a. Acid stain b. Basic stain

c. Both acid and basic stains d. None of the above

19. Administration of antivenom is a type of

a. Active immunization b. Passive immunization

c. Attenuated vaccine d. Killed vaccines

20. Proto oncogenes are

a. Normal genes b. Cancerous gene

c. Viral genes d. Over expressed genes

21. Write short note son ADCC

22. Anaphylatic shock

23. Phagosome

24. Complementarity determining region

25. Superantigens

26. Tolerance

Short essay

27. Discuss the principle of ELISA technique and its application.

28. Give an account on anto immune disease

29. Give an account of oncogenes and cancer induction

30. Describe the principle of Monoclonal antibody production.

Long essay

31. Explain the detailed structure of Immunoglobulin IgG

32 . Discuss the strategy of production of recombinant vector vaccines.

BT5B10. BIOPROCESS TECHNOLOGY

1. Which one is an organic acid:

   a) Butanol b) Vinegar

   c) Ethanol d) Vitamin B 12.

2. Low volume high value product

   a) Ethanol b) Bakers yeast

   c) Acetic acid d) Vaccines

3. Which one is a down stream processing technique

   a) Media optimisation b) Strain improvement

   c) Sterlization d) drying

4. Antifungal antibiotic

   a) Pencillin b) Nystatin

   c) Streptomycin d) Tetracycline

5. Protein component in the medium is usually responsible for production of _____ in the fermentor (ans : joam)

6. Leather industry uses _____ enzyme (ans: protease)

7. Ethanol is a _____ metabolite (ans: primary)

8. Giant colony inhibition spectrum used as a _____ screening technique

   (ans: secondary)

9. Spiral heat exchanges are _____ heat exchanger (ans: indirect)

10. The core group in pencillin is _____ group (ans: β-lactose)

11. Capsicin is a _____ plant metabolite (ans: secondary)

12. Roller bottles is used for _____ cell culture (ans: animal)

13. Baffle is used for prevention of _____ in fermentors (ans: Vortex)

14. Invertase enzyme is used to convert sucrose to glucose and _____ (ans: fructose)

15. UV is used as a mutating agent since it induces _____ DNA

    (ans: thymine dimers)

16. Sulfite waste liquor is a byproduct of _____ industry (ans: paper)

17. Soybean meal is used as a _____ source in industrial fermentation

    (ans: nitrogen)

18. Streptokinase is an enzyme used for removing _____ in a patient

(ans: blood clots)

19. Viblastine is extracted from _____ (vinca, rosea)

20. Air-left fermentors are more suitable for _____ organisms

(ans: filamentous)

Short answer

21. Methods of cell disruption

22. Immobilisation of enzymes

23. Fed batch fermentation

24. Batch sterlisation of media

25. Inoculum preparation

26. Protoplast fusion for strain improvement

Short essay

27. What are the different methods of cells separation.

28. Aerobic waste water treatment

29. Various methods of drying of biologicals

30. Media preparation for large scale fermentation process.

Long essay

31. Synthesis of Penicillin

32. Various strategies employed in microbial screening.

BT5D01.FOOD MICROBIOLOGY AND BIOTECHNOLOGY

1. Meat spoilage causes change in pH towards _____ from neutral pH.
2. Sodium benzoate is used as a _____.
3. Rennet is used in production of _____.

   (milk, cheese, butter, curd)
4. Pectinase is used in _____ beer industry.
5. _____ is a malted beverage

   (beer, wine, alcohol, cocoa)
6. _____ is a oriental food

   (vanilla, soy sauce, green olives, pickles).
7. _____ is used as flavour enhances ... is a derivative of glutamic acid

   (Ajinamotto, Sucrase, Mable syrup, None)
8. *A. niger* is used in production of _____

   (lactic acid, citric aci, butyric acid, alcohol).
9. Glucose oxidase is produced by _____.
10. Citric acid is a:

    (a) antibiotic (b) vitamin

    (c) organic acid (d) alcoholic beverage
11. Sodium propionate is used as a _____.
12. Ethylene oxide is used as a _____.
13. Bread mold is _____. (Rhizoplus, Mucosa, Absidia, Oomycetos)
14. Botulism is caused by _____

    (E. coli, Clostridium boutili, Salmonella typhi, None)
15. Temperature of a refrigerator is usually between 0 and _____.

    (25, 10, 50, 100)
16. Name a mold of industrial importance

    (E. coli, Aspergillus, Streptococci, Mycobacterium).
17. Source of dextransucrase.
18. Flash method of sterilisation is _____

    (High time low temp., High temp low time, Equal time & temp., None)

19. Simmering is _____.

20. Pressurized packed food uses the gases _____.

Short Answers:

21. Single cell protein.

22. Redox potential.

23. Inhibitory substances in food.

24. Identification of molds of industrial importance.

25. Chemical changes caused by microorganisms in food.

26. Preservation of foods using high temperature.

Short Essay

27. Production of microbial enzymes.

28. Production of fats and amino acids from micro organism.

29. Fermented dairy products.

30. Fermented vegetables.

Long Essay

31. General principles underlying spoilage of food. What are the factors affecting growth of micro organism in food.

32. Essay on fermented foods.

BT6B14. PLANT BIOTECHNOLOGY

1. Name the person whose is aptly regarded as the father of plant tissue culture.

   (a) Gottlieb Huberlandt (b) Charles Darwin

   (c) Skoog (d) Miller

2. Name the person who demonstrated the possibility of raising haploid plants from pollen grains of Datura innoxia

   (a) Zenkteler (b) Guhas and Maeshwari

   (c) Carlson (d) None of the above

3. Most commonly word media for plant tissue culture is

   (a) Murachige and Skoog Media (b) White media

   (c) B_5 Media (d)WPM media

4. Most commonly used carbon source

   (a) Mannitol (b) Sorbitol

   (c) Sucrose (d) None of the above

5. The hormone most commonly used to induce rooting under in vitro conditions

   (a) IBA (b) BAP

   (c) 2,4-D (d) None of above

6. The culture technique used for obtaining virus free plants

   (a) Anther culture (b) Callus culture

   (c) Meristem culture (d) Pollen culture

7. The viability staining technique used to stain dead cells is

   (a) FXA method (b) Evan's blue staining

   (c) Gram's staining (d) None of these

8. The embryos found from unfertilized eggs are known as

   (a) Somatic embryo (b) Parthenogentic embryo

   (c) Zygotic embryo (d) Androgentic embryos

9. Triploid production includes the invitro culture of

   (a) Anther (b) embryo

   (c) Endosperm (d) Apical bud

10. In Planta transformation was done in the plant species

    (a) Datura innoxia (b) Arabidopsis thaliana

(d) Popular tremuloides (d) Rianus communis

11. Name the chemical used as a fusogen

(a) IBA (b) $CaNO_3$

(c) PEN (d) Sucrose

12. The phenomenon of browning of medium can be reduced by

(a) ABA (b) PVP

(c) Na_2EDTA (d) KInetin

13. An organism or cell line resulting from a cross between parents that are genetically unlike is _____ (Hybrid)

14. The name adopted for an apparatus designed for the semi continuous chemostat culture of plant cells is _____ (phytostat)

15. The deletion of genes governing auxin and cytokinin production from T-DNA of a Tiplaonlid is known as _____ (disarming)

16. Transgeic formation have been produced whcih contain antisense construct of gene encoding _____ (Polyglactwonace)

17. The bacterial used to induce hairy roots in plant cells in

(a) Agrobacterium rhizogenes (b) B.thuringiensis

(c) Agrobactericine (d) None of these

18. The heat labile compounds are sterilised by

(a) Dry heat sterilization (b) Moist heat sterilization

(c) Filter sterlization (d) None of these

19. The most commonly used cryoprotectant is

(a) Ethanol (b) DMSO

(c) PEG (d) PVP

20. The most commonly used plant virus vector is

(a) CaMV (b) Sv 40

(c) Retrovirus (d) None of the above

II. Short Answer

21. Define cybrids

22. Most commonly used surface sterilizing agent used in plant tissue culture is _____.

23. What do you mean by synthetic seed?

24. Name a method adopted for production of raplids.

25. Define somadonal variation.

26. Define explant.

III. Short Essay

27. Explain protoplast fusion techniques.

28. Differentiate between somatic embryo and zygotic embryo.

29. Explain Biolistic method of gene transfer.

30. Detailed note on gene sanctories.

IV. Long Essay

31. Explain somatic embryogenesis. Add a note on the applications is plant tissue culture.

32. Explain Micropropagation including stage and applications is plant tissue culture.

BT6B15. ANIMAL BIOTECHNOLOGY

1. An example for animal tissue culture medium
   (MS, B5, DME, Whites).
2. HAT medium is used for _____ isolation
   (Mouse cells, Hybrid cell, Tumor cell).
3. A chemical used for somatic cell fusion
   ($CaCl_2$, PEG, Sucrose, Now).
4. Culture vessel used for monolayer culture
   (Air life fermenter, Rourbottle, Stirrer bioreactor, None)
5. An example for cryoprotectant
   (H_2S, H_2O, liq. N_2, None)
6. Interleukins are produced from _____
   (B-cell, T-cell, Mast cells, None)
7. Animal virus vector _____
   (Gemini, CMC, SV40, Now)
8. Heat labile substances are sterilized by _____
   (Hot air oven, Boiling, Filtration, None)
9. Dead cells absorb _____
   (Acetocarmine, Evan's blue, Co-marsibrilliant blue, Methylene blue)
10. Enzyme used for disaagregation of explant
    (pectinae, collagenase, amylase, none)
11. Electrofusion method was developed by _____

12. In short ..... method, on which particle T-DNA is coated?
13. An example for tissue engineering.
14. FACS.
15. Expand ATCC.
16. p53 gene is _____.
17. SCID is caused due to _____ mutation.
18. Molecules which absorbs light of one wave length and emit light at a longer wave length. They are _____.
19. Substrates used for ATC are _____ charged.
20. Expand HGPRT.
21. Principle of electroporation.
22. What do you meant by bioforming?
23. Differentiate between ancorage dependent and independent.
24. Hormones and growth factors in animal tissue culture.
25. pH meter.
26. Culture vessel used in ATC.
27. Methods of cryopreservation and its stages.
28. Laboratory organization for animal tissue culture.
29. Media components for animal tissue culture.
30. Use of hemocytomatics in animal tissue culture. Describe its components.
31. Write a short note on transgenic animals.
32. Types of animal viral vectors.

BT6B16.. RECOMBINANT DNA TECHNOLOGY

1. Which of the following is a shuttle vector

   a) ρBR322 b) YEP

   c) ρuc18 d) YIP

2. A single stranded filamentors phage vector

   a) ϕλ B) M^{13}

   c) pGV 3850 d) None of these

3. A recombinant clone selected on X-Gal IPTG medium shows ____ colonies

   a) Blue b) White

   c) Red d) None of the above

4. Transfer of RNA from agarose gel to nitrocellulose membrane can be performed by

   a) Southern blotting b) Northern blotting

   c) Western blotting d) None of the above

5. Taw polymerase used in polymerase chain reaction is a type of _____

   a) DNA polymerase I b) DNA polymerase III

   c) RNA polymerase d) None of the above

6. A hexameric cutter

   a) ECORI b) San 3A

   c) Taq I(d) Hal III

7. Modified DNA polymerase I devoid of nuclease activity is called as

   a) Klenow fragment b) Okazaki fragment

   c) Reverse transcriptase d) None of these

8. A plast DNA viral vector

   a) Sv40, b) Gemini virus vectors

   c) Retroviral vector d) Baeuloviral vector

9. Oneogenicity of T1 plasmic in Agrobacterium tremefacium is due to the presence of _____

   a) Vir genes b) T DNA

   c) border sequences d) None of the above

10. An enzyme that produces negative super coils in covalently closed circular DNA

a) Endonuclease b) Topoisomerase

c) liguse d) Alkaline phosphatase

11. Process of introduction of recombinant phase molecules in competent *E. coli* cells is known as

a) Transformation b) conjugation

c) Tranfection d) None of the above

12. _____ is an enzyme used in non-radioactive hybridization probing.

a) horse radish perodidase b) alkalinem phosphatase

c) polynucleolic kinase d) Topiosomerase

13. Insecticidal crystalline protiens in B.thuringiensis

a) β-endotoxin b) δ endotoxin

c) δ exotoxin d) α endotoxin

14. The nucleolide sequence upstream of a gene that acts as a signal for RNA polymerase binding.

a) Primer a) Promoter

c) Probe d) Linker

15. A synthetic double stranded oligonucleotide used to attach sticky ends to a blunt ended molcule.

a) Adaptor b) Marker

c) Kelnow fragment d) None of the above

16. A technique used to construct a cline contg. by identifying overlapping fragments of cloud DNA.

a) PCR b) Chromosome walking

c) RAPD d) None of the above

17. TOL plasmid of *Pseudomonas putida* is a

a) Resistance plasmid b) Virulance plasmid

c) Degradative plasmid d) Col plasmic

18. A spi –ve $\lambda\phi$ grows on

a) Rec –ve host b) Rec +ve host

c) Both A & B d) None of the above

19. Denaturation temperature in polymerase chain reaction

a) 60^0 b) 94^0

c) 76^0 d) None of the above

20. A plasmid capable integrating into host cells chromosome

a) Episome
b) Transposon
c) Clone
d) None of the above

Short Answers

21. 2μm plasmids
22. Polylinkers
23. Cosmids
24. What are phagemids
25. Homopolymeric toiling.
26. Insertional inactivation

Short Essays

27. Sanger['s method of DNA sequencing
28. Types of restriction endonucleasis.
29. Eukaryotic gene cloning vector
30. What are complementary DNA's ? Exlaing the construciton of a. CDNA library.

Long Essays

31. Explain the cloning of a Prokaryote gene in a eukaryotic system.
32. Explain the application of recombinant DNA technology in agriculture and medicinie?

BT6B16. MEDICAL MICROBIOLOGY

(Elective course)

1. _____ cells produce Antibodies
   (B-cells, T-cells, Lymphocytes, None of the above).
2. Clostridium is a strict _____ bacteria.
   (aerobic, anaerobic, facultative, none)
3. Vibrio causes _____
   (cholera, typhoid, diphtheria, rabies)
4. Hepatitis causes _____ damage.
5. AIDS virus contain _____ as the genetic material
   (RNA, DNA, SSRNA, dsRNA)
6. Rhabdo viruses are _____ shaped
   (linear, bullet, supracoiled, round)
7. WIDAL test is used for diagnosis of _____
   (typhoid, cholera, rabies, HIV)
8. Negri bodies is indication of _____.
9. β-propiolactone is used as a _____.
10. Papilonia virus is a _____ virus.
11. Herpes virus is a _____ virus (DNA, RNA, ssRNA, dsRNA)
12. Expand HTLB
13. HSV2 causes _____.
14. V-Src is a _____.
15. GP-120 protein is found in _____.
16. Confirmatory test for HIV is _____.
    (EUSA, Western blot, Karpa's test, Northean blot)
17. Thymus is located behind _____
    (sternum, larynx, medulla, spleen)
18. Largest lymphoid organ is _____
    (olymphanode, spleen, thymus, bone marrow)
19. Expand MHC.
20. Expand CMI.

Short Answer

21. Nasocomial infection
22. Antimicrobial therapy
23. AIDS
24. Immunoprophylaxis
25. Immunotherapy
26. Hepatitis

Short Essay

27. Cholera
28. Tuberculosis
29. Glomerular nephritis
30. Diseases caused by Staphylococcus.

Long Essay

31. Write an essay regarding identification procedures for various pathogenic bacteria and fungi.
32. Write a detailed essay regarding structure of function of immune system.