

Subject List

Page 1

Code Name

credit Ent Int p/v Tot Unit
Cell

Semester I

1101	Molecular Immunology (Th)	4	075	025	100	Unit
1102	Microbial Physiology and Development (Th)	4	075	025	100	Cell
1103	Bioenergetics and Molecular Enzymology (Th)	4	075	025	100	Cell
1104	Bioinstrumentation (Th)	4	075	025	100	Unit
1201	Molecular Immunology (Pr)	4		025	075	100 Unit
1202	Microbial Physiology and Development (Pr)	4		025	075	100 Cell
1203	Bioenergetics and Molecular Enzymology (Pr)	4		025	075	100 Cell
1204	Bioinstrumentation (Pr)	4		025	075	100 Unit

Semester II

2101	Advanced Clinical Virology (Th)	4	075	025	100	Unit
2102	Advanced Genetic Engineering (Th)	4	075	025	100	Cell
2103	Food and Dairy Microbiology (Th)	4	075	025	100	Unit
2104	Macromolecules and Molecular Enzymology (Th)	4	075	025	100	Cell
2201	Advanced Clinical Virology (Pr)	4		025	075	100 Unit
2202	Advanced Genetic Engineering (Pr)	4		025	075	100 Cell
2203	Food and Dairy Microbiology (Pr)	4		025	075	100 Unit
2204	Macromolecules and Molecular Enzymology (Pr)	4		025	075	100 Cell

Semester III

3101	Bioinformatics, Microbial Genetics and Proteomics (Th)	4	075	025	100	Cell
3102	Bioprocess Engineering and Technology (Th)	4	075	025	100	Cell
3103	Enzyme Technology (Th)	4	075	025	100	Unit
3104	Microbial Diversity (Th)	4	075	025	100	Unit
3201	Bioinformatics, Microbial Genetics and Proteomics (Pr)	4		025	075	100 Cell
3202	Bioprocess Engineering and Technology (Pr)	4		025	075	100 Cell
3203	Enzyme Technology (Pr)	4		025	075	100 Unit
3204	Microbial Diversity (Pr)	4		025	075	100 Unit

Semester IV

4101	Pharmaceutical Microbiology (Th)	4	075	025	100	Cell
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Subject List

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Code Name

Crs. Ext Int P/V Tot Unit/
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Semester IV

4102	Recombinant DNA Technology (Th)	4	075	025	100	Unit
4103	Industrial and Environmental Technology (Th)	4	075	025	100	Unit
4201	Pharmaceutical Microbiology (Pr)	4		025	075	100
4202	Recombinant DNA Technology (Pr)	4		025	075	100
4203	Industrial and Environmental Technology (Pr)	4		025	075	100
4204	Project	8			200	200

SEMESTER - IV (THEORY) (THEORY)

SEMESTER - IV (PRACTICE) (PRACTICE)

SEMESTER - IV (PRACTICE) (PRACTICE)

EXAMINATION DECEMBER - 2017

MASTER OF SCIENCE (M.Sc.) IN MICROBIOLOGY

SYLLABUS FOR

WOMEN'S UNIVERSITY
MUMBAI

SYLLABUS FORMAT

Course Name : - M.Sc. Microbiology

SCHEME :- Semester I

S.N.	Subject	L	P/T	TP	INTERNAL	P/V	T
1	Molecular Immunology (Th) ☆	4	—	80	20	—	100
2	Molecular Immunology (Pr) ☆	—	4	—	20	80	100
3	Microbial Physiology & Development (Th)	4	—	80	20	—	100
4	Microbial Physiology & Development (Pr)	—	4	—	20	80	100
5	Bioenergetics & Molecular Enzymology (Th)	4	—	80	20	—	100
6	Bioenergetics & Molecular Enzymology (Pr)	—	4	—	20	80	100
7	Bioinstrumentation (Th) ☆	4	—	80	20	—	100
8	Bioinstrumentation (Pr) ☆	—	4	—	20	80	100
TOTAL		16	16	320	160	320	800

SCHEME :- Semester II

S.N.	Subject	L	P/T	TP	INTERNAL	P/V	T
1	Advanced Clinical Virology (Th) ☆	4	—	80	20	—	100
2	Advanced Clinical Virology (Pr) ☆	—	4	—	20	80	100
3	Advanced Genetic Engineering (Th)	4	—	80	20	—	100
4	Advanced Genetic Engineering (Pr)	—	4	—	20	80	100
5	Food & Dairy Microbiology (Th) ☆	4	—	80	20	—	100
6	Food & Dairy Microbiology (Pr) ☆	—	4	—	20	80	100
7	Macromolecules & Molecular Enzymology (Th)	4	—	80	20	—	100
8	Macromolecules & Molecular Enzymology (Pr)	—	4	—	20	80	100
TOTAL		16	16	320	160	320	800

SCHEME :- Semester III

S.N.	Subject	L	P/T	TP	INTERNAL	P/V	T
1	Bioinformatics, Microbial Genetics & Proteomics (Th)	4	—	80	20	—	100
2	Bioinformatics, Microbial Genetics & Proteomics (Pr)	—	4	—	20	80	100
3	Bioprocess Engineering & Technology (Th)	4	—	80	20	—	100
4	Bioprocess Engineering & Technology (Pr)	—	4	—	20	80	100
5	Enzyme Technology (Th) ☆	4	—	80	20	—	100
6	Enzyme Technology (Pr) ☆	—	4	—	20	80	100
7	Microbial Diversity (Th) ☆	4	—	80	20	—	100
8	Microbial Diversity (Pr) ☆	—	4	—	20	80	100
TOTAL		16	16	320	160	320	800

SCHEME :- Semester IV

S.N.	Subject	L	P/T	TP	INTERNAL	P/V	T
1	Pharmaceutical Microbiology (Th)	4	—	80	20	—	100
2	Pharmaceutical Microbiology (Pr)	—	4	—	20	80	100
3	Recombinant DNA Technology (Th) ☆	4	—	80	20	—	100
4	Recombinant DNA Technology (Pr) ☆	—	4	—	20	80	100
5	Industrial & Environmental Technology (Th) ☆	4	—	80	20	—	100
6	Industrial & Environmental Technology (Pr) ☆	—	4	—	20	80	100
7	Project	—	—	—	—	—	200
TOTAL		12	12	240	120	240	800

L = No. of Lecturer / Week, P / T = Practical / Tutorial in hours, TP = Theory Paper - Marks,
P / V Practical / Viva Voce- Marks, T = Total

☆ Denotes - University Conducted Exam Papers

Examination Pattern for Theory & Practical

Examination Pattern for University Conducted & College Conducted Papers

1) For Theory Paper Exam Question Paper

- A) Question No. 1 - Long Question - 20 Marks
- B) Question No. 2 - Long Question - 20 Marks
- C) Question No. 3 - Short Question - 10 Marks
- D) Question No. 4 - Short Question - 10 Marks
- E) Question No. 5 - Short Notes (Any Five) 20 Marks

TOTAL - 100 Marks - 80 Marks External 20 Marks Internal

2) For Practical Exam Question Paper

- A) Long Question - 30 Marks
- B) Short Question - 20 Marks
- C) Journal (Record Book) - 15 Marks
- D) Viva Voce - 15 Marks
- External Marks - 80 Marks
- Internal Marks - 20 Marks
- Total Marks - 100 Marks

Semester- I
Theory Paper-I
Molecular Immunology

Marks: 100

Unit- I

Immune System

Organs and cells involved in immune system and immune response. Lymphocytes, their subpopulation, their properties and functions, membrane bound receptors of lymph cells, helper T cells suppression, lymphocyte trafficking.

Unit II

Antigens and Immunoglobulin

Concept of haptens, determinants, conditions of antigenicity, antigens and immunogenicity, superantigen.

Immunoglobulins: Structure and properties of immunoglobulin classes. Theories of antibody formation, hybridoma technology for monoclonal antibodies and designer monoclonal antibodies. Multiple myelomas and structural basis of antibody diversity. Freund's adjuvants and its significance.

Unit -III

Antigen- Antibody reactions

Antigen - Antibody reaction by precipitation, agglutination and complements fixation.

Non-specific immune mechanism:- surface defenses, tissue defenses, opsonization, Inflammatory reaction, and hormone balance.

Tissue metabolites with bactericidal properties (Lysozyme, nuclein, histone, protamine, basic peptides of tissues- leukins, phagocytins, lecterins, haemocompounds)

Unit - IV

Expression and Regulation of Immune Response

Regulation of immune response : antigen processing and presentation, generation of humoral and cell mediated immune response, activation of B and T lymphocytes, cytokines and their role in immune regulation; T cell regulation, MHC registration, immunological tolerance. Cell mediated cytotoxicity: Mechanism of T cells and NK mediated lysis, antibody dependent cell mediated cytotoxicity, and macrophage mediated cytotoxicity.

Complement system classical, alternate, lectin pathway of complement activation. Regulation of complement activation.

Transplantation immunology. MHC, types of grafts, grafts rejection, GVH reactions, mechanism of graft rejection, and prevention of graft rejection.

Unit - V

Immunity and immunoassays

Defense against bacteria, viruses, fungi and parasites. Immunodiagnosis and immunotherapy in virology- serological methods for detection and quantitation of viruses including Hepatitis, Influenza, HIV and others.

Immuno-assays : SRID, ELISA, ELISA- PCR, RIA, Western Blotting Immunofluorescence and their application immune deficiencies and autoimmunity.

Practical Paper I

Marks -100

1. Diagnostic immunologic and methods

Precipitation methods

- Immunodiffusion
- Immuno electrophoresis

Agglutination method

- Widal test
- Haemagglutination
- ELISA method

2. Separation of serum protein by submerged agarose gel electrophoresis.

3. Purification of human immunoglobulins from serum and confirmation of its antigenicity

4. Identification of *S. typhi* by serotyping. (Purification of H and O antigens from *S. typhi*).

5. Clinical diagnosis of Rheumatoid arthritis by purifying immunoglobulins and albumins and confirmation by lattice agglutination test.

6. Estimation of Alkaline phosphate from patient's serum.

7. Demonstration of western blotting.

8. Detection of isozymes of Lactate dehydrogenase by PAGE

9. Clinical diagnosis of viral diseases by PCR, ELISA.

References:

1. Essentials of immunology by Riott I.M. 1998. E.J.B.S. Blackwell Scientific Publishers, London.
2. Immunology 2nd edition by Kuby J. 1994. W.H.Freeman and co. New York.
3. Immunology- Understanding of immune System by claus D. Elgert. 1996 Wiley-Liss, New York.
4. Fundamentals of Immunology by William Paul.
5. cellular and molecular immunology- 3rd Edition by Abbas.
6. Immunobiology The Immune System in Health and Disease . 3rd Edition by Travers.
7. Immunology. A short course. 2nd Edition by Benjamin.
8. Manual of Clinical Laboratory and Immunology 6th Edition 2000 by Noel R. Rose, Chief Editor. Robert G. Hamilton and Barbara Detrick (Eds.) ,ASM publications.

Microbial Physiology and Development

Unit-1 Bacterial Photosynthesis

Marks: 100

Photosynthetic Microorganisms, photosynthetic pigments and generation of reducing power by cyclic & noncyclic photophosphorylation, electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways.

Unit-2 Bacterial Respiration

Bacterial aerobic respiration, components of electron transport chain, free energy changes & electron transport, oxidative phosphorylation & theories of ATP generation, inhibition of electron transport chain. Electron transport chain in some heterotrophic & chemolithotrophic bacteria. Bacterial anaerobic respiration: Introduction, Nitrate carbonate & sulfate as electron acceptors. Electron transport chain in some anaerobic bacteria. Catalase, super oxide dismutase, mechanism of oxygen toxicity.

Unit-3 Bacterial Permeation

Structure & organization of membrane (Glyco-conjugants & proteins in membrane systems), fluid mosaic model of membrane. Methods of study diffusion of solutes in Bacteria, passive diffusion, facilitated diffusion, different mechanisms of active diffusion (proton Motive Force, PTS, role of permeases in transport, different permeases in E.coli. Transport of amino acids, & inorganic ions in microorganisms & their mechanisms.).

Unit-4 Bacterial Sporulation

Sporulating bacteria, molecular architecture of spores, induction & stages of sporulation, Influence of different factors on sporulation. Cytological & macromolecular changes during sporulation. Heat resistance & sporulation.

Unit-5 Bacterial Chemolithotrophs

Physiological groups of chemolithotrophs, ammonia oxidation by members of Genus Nitrosomonas, nitrite oxidation by Nitrospira group of genera. Oxidation of molecular hydrogen by Hydrogenomonas species. Ferrous & sulphur/sulfide by Thiobacillus species.

Practical Paper-II

Marks-100

1. Isolation of photosynthetic bacteria.
2. Glucose uptake by E. Coli/Saccharomyces cerevisiae (Active & passive diffusion)
3. Effect of UV, Gamma radiation, pH, disinfectants, chemicals & metal ions on spore germination of Bacillus sp.
4. Determination of Iron oxidation Rate of Thiobacillus ferrooxidans.
5. Determination of sulfur oxidation Rate of Thiobacillus ferrooxidans.
6. Microbial degradation, decolourization & adsorption of organic dyes (by free immobilized cells).
7. Estimation of calcium ions present in Sporulating bacteria by EDTA method.
8. Demonstration of utilization of sugar by oxidation & fermentation techniques.

Reference:

1. Microbial physiology & metabolism by Caldwell D.R. 19905 Brown publishers.
2. Microbial physiology by Moat A.G. & Foster J.W. 1999. Wiley
3. Prokaryotic Development by Brun. W.V. Shmukovits I.J. 2000 ASM. Press
4. Advances in Microbial physiology. Volumes. Edited by A.H. Rose. Academic Press, New York.
5. Applied Microbial physiology by Rhodes.
6. Biosynthesis by Smith.
7. The Bacteria. Volumes by I.C. Gunsalus & Rogeny Stainer, Academic press.
8. Microbial physiology by Benjamin.

PAPER-III

BIOENERGETICS AND MOLECULAR ENZYMOLOGY

Marks:-100

Unit-1 Carbohydrate catabolic pathways & microbial growth on CI Compounds

EMP, HMP, ED, phosphoketolase pathway, TCA cycle, methylglyoxal bypass. Anaplerotic sequences, catabolism of different carbohydrates, glycerol metabolism, regulation of carbohydrate metabolism, Pasteur effect, Substrate level phosphorylation. Microbial growth on CI compounds (Cyanide, Methane, Methanol, methylated amines and carbon monoxide).

Unit -2 Bacterial fermentations (biochemical aspects) and Biosynthesis

Alcohol, lactate, mixed acid, butyric acid, acetone-butanol, propionic acid, succinate, methane, and acetate fermentations. Fermentation of single nitrogenous compounds (amino acids)-alanine, glutamate and glycine. Biosynthesis of Purines, Pyrimidines and fatty acids.

Unit-3 Endogenous metabolism and degradation of aliphatic and aromatic compounds

Functions of endogenous metabolism, types of reserve materials, enzymatic synthesis, degradation and regulation of reserve materials – glycogen, polyphosphates and polyhydroxybutyrate (PHB), PHB production and its futuristic applications. Microbial degradation of aliphatic hydrocarbons (microorganisms involved, mon-terminal, bi-terminal oxidation of propane, decane, etc.) and aromatic hydrocarbons and aromatic compounds (via catechol, protocatechunate, meta-cleavage of catechol and protocatechunate, dissimilation of catechol and protocatechunate, homogentisate and related pathways).

Unit-4 Properties of Enzymes

Classification of enzymes into six major groups with suitable examples. Numerical classification of enzymes. Different structural conformation of enzyme proteins. Enzymes as biocatalysts, catalytic power, activation energy, substrate specificity, active site, theories of mechanisms of enzyme action. Mechanisms of action of lysozyme, chymotrypsin & ribonuclease. Monomeric, oligomeric & multienzyme complex, isozymes & allosteric enzymes. Extremozymes-thermostable, solventogenic & non-aqueous enzymes. Ribozymes & abzymes.

Unit-5 Enzyme kinetics

Importance of enzyme kinetics, factors affecting rates of enzyme mediated reactions (pH, temperature, substrate concentration & reaction time). Deviation of Michaelis-Menton equation & its significance in enzyme kinetic studies. Lineweaver-Burke plot, Haldane-Briggs relationship, sigmoidal kinetics steady state kinetics & transient phases of enzyme reaction.

PRACTICAL-III

BIOENERGETICS AND MOLECULAR ENZYMOLOGY

Marks-100

1. Isolation & Identification of Reserve food material (Glycogen / polyphosphatase, PHB) of B. megaterium & Azotobacter Sp
2. Quantitative estimation of amino acids by Rosen's method.
3. Quantitative estimation of sugars by Sumner's method.
4. Demonstration of endogenous metabolism in B. megaterium or E. coli. & their survival under starvation condition.
5. Quantitative estimation of proteins by Folin-Lowery / Biuret method.
6. Production of fungal α amylase using solid-state fermentation / production of proteases by bacterial species & confirmation by determining the achromic point.
7. Purification of fungal α amylase or bacterial proteases by fractionation, chromatographic techniques & electrophoretic separation.
8. Studies on enzyme kinetics of α amylase / Protease (Optimization of parameters viz., Substrate, enzyme-concentration, reaction pH, K_m , V_{max} & metal ions as activators & inhibitors).

References

1. Understanding enzymes by Trevor Palmer.
2. Enzyme kinetics by Paul Engel 1977. John Wiley & Sons, Inc. New York
3. Enzymes by Dixon & Webb, 3rd Edition 1979. Academic Press, New York.
4. Biochemistry by Stryer 5th edition WH Freeman 2001.
5. Laboratory techniques in Biochemistry & Molecular Biology by Work & Work.
6. Principles of Enzyme Kinetics. 1976 by Athel Cormish-Bowden. Butterworth & Co.
7. Biochemistry by Chatwal.
8. Biochemistry by Garret.
9. Biochemistry by Voet.
10. Methodes in Enzymology by Drolittle.
11. Methods of Biochemistry Analysis by David Glick, John Wiley & Sons, New York.

PAPER TH -IV BIOINSTRUMENTATION

Marks 100

Unit-1 Basic Laboratory Instruments

Principle and working of pH meter, Laminar-air flow. Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their application.

Unit - 2 Chromatographic Techniques

Theory, principles and applications of paper, thin layer, gel filtration, ion exchange, affinity, hydrophobic, gas liquid, high pressure/performance liquid chromatography (HPLC)

Unit- 3 Electrophoretic techniques

Basic principles of electrophoresis, theory and application of paper, starch gel agarose, native and denaturing PAGE, isoelectric focusing.

Unit- 4 Spectroscopy

Spectroscopic techniques, theory and applications of Uv, Visible, IR, NMR, Fluorescence, Atomic Absorption, CD, ORD, Mass, Raman Spectroscopy.

Unit - 5 Radioisotopic Techniques

Use of radioisotopic in life science, radioactive labeling, principle and applications of tracer techniques, detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger Muller and Scintillation counters, autoradiography and its applications. Dosimetry.

PRACTICAL

PAPER-IV

BIOINSTRUMENTATION

Marks 25

1. Studies on pH titration curves of amino acids/ acetic acid and determination of PKa values and Handerson Hassdeebach equation.
2. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC or paper chromatography.
3. Separation of serum protein by horizontal submerged gel electrophoresis.
4. Study of UV absorption spectra of macromolecules (protein, nucleic acid, bacterial pigments).
5. Quantitative estimation of hydrocarbons/pesticides/organic solvents/molecules by Gas chromatography.
6. Demonstration of PCR, DNA sequencer and Fermenter.
7. Separation of hemoglobin or dextrin by gel filtration.
8. Paper electrophoresis.
9. Friske dosimetry.

References

1. Instrumental Methods of analysis 6th Edition by H.H. Willard L.L. Merritt Jr. and others 1986 CBS Publishers and Distributors. ✓
2. Instrumental Methods of chemical Analysis 1989 by Chawal G and Anand S. Himalaya publishing House, Mumbai.
3. A Biologists Guide to principles and Techniques of practical Biochemistry 1975 by Willams B>I. and Wilson ,K.
4. Spectroscopy volume 1. Edited by B.B.straughan and S. Walker Chapman and Hill Ltd.
5. Gel Electrophoresis of proteins A practical approach by Hans.
6. Chromatography concepts and contrasts 1988 by James Miller. John Willey and sons. Inc. New York
7. Analytical Biochemistry by Holme.
8. Introduction to High performance Liquid chromatography by R.J. Hamilton and P.A. scwell.
9. Spectroscopy by B.P. Straughan and S. Walker
10. Practical aspects of Gas chromatography by Tibor Kermmery. Wiley publications
11. Isotopes and radiations in Biology by C.C. Thornburn Butterworth and Co. Ltd. London
12. The use of radioactive isotopes in the life span sciences by J.M. Chapman and G. Ayrey, George Allen Unwin Ltd. London.

SEMESTER-II

Theory Paper V Recent Trends In Virology

Marks: 100

Unit-I Classification and Morphology of Viruses

Cataloging the virus through virus classification schemes of ICTV/ICNV. Morphology and ultra- structure of viruses. Virus related agents, viroids and prions.

Unit-II Cultivation and assay of viruses

Cultivation of viruses using embryonated eggs, experimental animals and cell cultures (cell lines, cell strains and transgenic systems) Purification of viruses by adsorption, precipitation, enzymes, serological methods –haeme agglutination and ELISA.
Assay of viruses- physical and chemical methods (Electron Microscopy and protein and Nucleic acid studies)
Infectivity assays (plaque and end-point)
Genetic analysis of viruses by classical genetic methods.

Unit-III Viral Multiplication

Mechanism of virus adsorption & entry into host cell including genome replication & mRNA production by animal viruses, mechanism of RNA synthesis, mechanism of DNA synthesis & post transcriptional processing. Translation of Viral Proteins, assembly, exit & maturation of progeny virions, multiplication of bacteriophages.

Unit-IV Pathogenesis of Viruses

Host & Virus factors involved in pathogenesis, patterns of infection, pathogenesis of animal viruses Adenovirus, Herpes virus, Hepatitis Virus, Picorna Virus, Poxvirus & Orthomyxovirus, pathogenesis of plant (TMV) & insect virus (NPV). Host cell transformation by viruses & oncogenesis of DNA & RNA viruses.

Unit-V Control of viruses & Emerging viruses

Control of viral infections through vaccines, Interferons & chemotherapeutic agents.
Structure, genomic organization, pathogenesis, & control of Human immunodeficiency virus. Emerging viruses.

Practical paper-V

Marks-100

1. One step growth curve for determination of virus titre
2. Phage typing of E.coli. bacteriophages.
3. Induction of lambda lysogen by UV radiations.
4. Studies on specialized transduction.
5. Isolation of lambda DNA & their characterization.
6. Amplification of lambda DNA by PCR.
7. Cultivation & assay of viruses using Embryonated eggs & Tissue culture Technique.
8. Isolation of coliphage from sewage.
9. Enumeration of phage particles in given suspension.

Reference-

1. Medical virology 10th Edition by Morag C & Timbury MC 1994 Churchill Livingstone, London.
2. Introduction to Modern Virology 4th Edition by Dimmock N.J. Primrose S.B. 1994. Blackwell scientific publications. Oxford.
3. Principles of virology. 2000 by Edward Arnold.
4. Prion disease by Gaschup, M.H.
5. Text book on principles of Bacteriology, Virology & Immunology by Topley & Wilsons 1995.
6. Applied virology. 1984. Edited by Edward Kurstak. Academic press inc.
7. Introduction to Modern Virology by Dimmock.
8. Clinical virology Manual by Steven, S., Adink, R.L. Young S.A.
9. Molecular Biology, pathogenesis & Control by S.J. Flint & others. ASM. Press. Washington, D.C.

PAPER-VI

ADVANCED GENETIC ENGINEERING

Marks-100

Unit-1 Recombination

Recombination Between heteroduplex DNA, Holiday intermediate, proteins involved in recombination, role of recA, recBCD, pathway in E.coli., single strand assimilation in bacteria. Conjugation in bacteria, replication & transfer of DNA, Transduction generalized & specialized mechanisms, recombinations hot spots, gene conversions. Transposomes insertions sequences & composite transposones, phages as transposomes, replicative, non-replicative, conservative transpositions. Mutations i.e. deletions, inversions & frame shift due to transpositions. Mechanisms of transpositions, Controlling elements of maize-autonomous, non autonomous elements, P-elements in drosophila, retro viruses as retroposons.

Unit-II Gene Expressions

Prokaryote:

Operon Concept, coordinated control structural genes, lac, trp, ara operons, repressor proteins & their functions. Operations & other DNA elements of regulation, positive & negative control of an operon, catabolic repression, stringent response, attenuation as control mechanism.

Eukaryotic:

Transcriptional activators as positive regulators of gene expressions, coordinated control of expressions by different factors, independent domains of protein bind to DNA to activate transcription, obstream factors, response elements, identifying gene under common regulations. Zn fingers, leucine zippers, homeodomain, helix loop are different domains present in transcription factors activating domains of transcriptional activators, gene expressions & methylation repression by inhibition of TAF binding, blocking of activation silencing, translational control.

Unit-III Isolation, Identification & Characterization of DNA organisms

Restriction endonucleases, type I, II, III, Recognition sequences, properties, nomenclature of classification of type II endonucleases, their activities, restriction mapping RFLP, RAPD, AFLP

DNA ligase, properties & specificity, Enzymes used in genetic engineering, S1 nucleases, Bal-31 nuclease, DNA polymerase, polynucleotide kinase, phosphatase, reverse transcription its activity & mode of action, chemical synthesis of DNA. DNA sequencing: Deoxy method Automated sequencing.

Unit-IV Cloning vectors in E coli

Plasmids: Properties Incompletely, Transformations techniques plasmid vectors & their properties PBR33-its construction and derivatives single stranded plasmid, promoter probe vectors runaway plasmid vectors.

Bacteriophage as "Essential features organization of genome general structure, rationale for vector construction improved vectors, get series EMBL vectors, invitro packaging cosmid plasmid filamentous phage vectors, zap blue vectors,

Cloning strategies: Genomics DNA libraries Chromosomes walking and jumping cDNA libraries, shot gun cloning, directed cloning phage display.

Unit - V Cloning and expression in other organisms

E coli expression vectors: promoters (B gal.T7,), codon selection maximizing expression hybrid promoters, manipulation of cloned genes to achieve expression, stability of protein, fusion proteins and their application

Bacillus: Transformation techniques plasmid and vectors, expression vectors, excretion vectors and shuttle vectors.

Streptomyces: Transformation, plasmid and vectors, expression vectors and phage vectors.

Yeast: Genetic markers and selection system, yeast integrating, replication, episomal vectors, yeast artificial chromosomes, expression vectors.

Practical

Marks-100

1. Study of conjugation in E coli and score for marker
2. Generalized transduction in E coli using P λ phage
3. Transition of in family and insertional inactivation in E coli.
4. Phage titration with P1 & phage.
5. Phage induced recombination
6. Gene expression in E coli & yeast
7. Isolation of plasmid from E coli, Bacillus
8. Restriction fragment analysis
9. Transformation of E coli
10. Transformation of Bacillus
11. Transfection with phage DN & isolation of lysogenic.
12. Isolation of RNA from Eukaryotic cells
13. Shot gun Cloning in E coli
14. Isolation of genomic DNA
15. Electrophoresis to purify the DNA Fragments

References

1. Benjamin Lewin - gene - VI gene - VII Oxford university press.
2. David Frieder - Essentials of molecular biology
3. J. Kendrew - Encyclopedia of molecular biology Blackwell Pub.
4. Weaver Molecular biology
5. J D Watson, N H Hopkins, J W Roberts, Molecular biology of the gene
6. J D Darnell - Molecular biology of the cell (2nd Edition) Garland Pub. Inc.
7. Moyers R A - Molecular biology and Biotechnology VCH Pub. NY Inc
8. Elberts B Molecular biology of the cell Garland Pub. Inc
9. Watson J D Recombinant DNA
10. Jynner - Gene targeting practical approach
11. Robertson Manipulation and expression of recombinant DNA
12. Nicoll : Genetic Engineering
13. Brown D A Genetics : Molecular approach
14. Primrose Molecular biotechnology
15. Berry Yeast Biotechnology
16. Griffith Anthony, Miller J F - An Introduction to Genetic Analysis
17. Nancy Craig Martin allan - Mobile DNA II
18. Helen Kreuzer Recombinant DNA and Biotechnology
19. Winnaker - From genes to clones
20. Old and Primrose Principles of gene manipulation

Theory Paper-VII Food and Dairy Microbiology

Marks: 100

Unit – I Industrial Food Fermentations

Starter cultures, their biochemical activities, production and preservation of the following fermented foods.

- a) Soya sauce fermentation by Moulds
- b) Fermented Vegetables- Saurkraut.
- c) Fermented meat – sausages
- d) Production and application of Baker's Yeast
- e) Application of microbial enzymes I food industries
- f)

Unit II Quality Assurance in Foods

Food borne infections and intoxication : bacterial with examples of infective and toxic types.

Clostridium, Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria.

Mycotoxins in food with references to Aspergillus species.

Quality assurance: Microbiological Quality Standards of Food

Government regulatory practices and policies. FDA, EPA, HACCP, ISI

Unit – III Food Preservation Methods

Radiation- UV, Gamma and microwave .

Temperature

Chemical and naturally occurring antimicrobials.

Biosensors in Food industry.

Unit- IV Microbiology of cheese and beverage fermentation

Microbiology of fermented milk products (Acidophilus milk, Yoghurt)

Role of microorganisms in beverages – tea and coffee fermentations. Vinegar fermentation

Unit- V Advanced Food Microbiology

Genetically modified food , biosensors in food, applications of microbial enzymes in dairy industries (Protease, Lipases)

Utilization and disposal of dairy by – product- Whey.

Practical paper-VII

Marks-100

1. Production & estimation of Lactic acid by Lactobacillus species or Streptococcus species.
2. Extraction & estimation of diacetyl.
3. Sauerkraut fermentation.
4. Isolation of food poisoning bacteria from contaminated foods, dairy products.

5. Extraction & detection of aflatoxin for infected foods.
6. Preservation of potato/onion by UV radiation.
7. Production of fermented milk by *Lactobacillus acidophilus*.
8. Rapid analytical techniques in food quality control using microbial biosensors.

References-

1. Food microbiology II edition by Adams.
2. Basic food microbiology by Banwart George J.
3. Food microbiology: Fundamentals & frontiers by Dolle
4. Biotechnology : Food fermentation microbiology, Biochemistry & Technology. Volumell by Joshi.
5. Fundamentals of Dairy microbiology by Prajapati.
6. Essentials of Food microbiology edited by John Garbult: Arnold International Students Edition.
7. Microbiology of Fermented food volumes I & II by Brian J. Wood Elsevier Applied Science Publication.
8. Microbiology of food by John C. Ayres. J. Orwin Mundt. William E. Sandinee. W. H. Freeman & Co.
9. Dairy microbiology by Robinson Volume II & I.
10. Food microbiology: Fundamentals & Frontiers. II Edition by Michael P. Doyle, Larry R. Beuchat & Thomas I. Montville (Eds), ASM Publications.
11. Advances in Applied microbiology by D. Pearlman Academic Press.

PAPER-VIII MACROMOLECULES & MOLECULAR ENZYMOLOGY

Marks-100

Unit-I Proteins

Classification, structure, General reactions of amino acids, on-proteins amino acids, Primary, Secondary, Tertiary & Quantitative, structure of Proteins, Sequencing of Proteins, Proteins folding, methods of purification (brief), allosteric proteins, metabolism, Biosynthesis, regulation & metabolic disorders of amino acids. Sources of organic Nitrogen, Flow of Nitrogen into the catabolism of amino acid, Urea cycle & excretion of Nitrogen.

Unit-II Nucleic Acid

Biosynthesis & regulation of nucleic acids, purines & pyrimidins by denovo & salvage pathways, structure of DNA & RNA, Different form of DNA (A, B, Z, etc), Structure of rRNA, tRNA & ribosomes.

Unit-III Enzymology an Introduction

Classification & Nomenclature of enzymes, enzymes as biocatalysts, Theories & Mechanisms of enzyme action, Specificity of enzyme action, activation energy, allosteric enzymes, multi enzyme complex, isozymes.

Unit-IV Activity of enzymes

Enzyme induction, active site determination, enzyme kinetics, enzyme inhibitors, enzyme parameters, Factors affecting enzyme activity & enzyme immobilization by different methods & their applications.

Unit-V Applied Enzymology

Use of enzymes in industries, textile, leather, food industries. Applications of immobilized enzymes in the industries, Use of purified enzymes in biosensors, Enzymes sensors for clinical diagnosis, environmental analysis & other applications of biosensors.

Practical

Marks-100

1. Estimation of proteins by Folin Lowry & Biuret method.
2. Determination of isoelectric pH of proteins & amino acids.
3. Estimation of DNA.
4. Determination of T_m of DNA.
5. Denaturation & Renaturation of DNA.
6. Estimation of RNA.
7. Isolation of proteins-Casein from milk, Haemoglobin from RBC.
8. Enzyme production from microbes & seeds
9. Enzyme purification by salting out followed by a chromatographic technique.
10. Enzyme kinetic analysis.
11. Effect of inhibitors on enzyme activity.
12. Immobilization of enzyme.
13. Assembly of Biosensor & determination of its activity.

References-

1. Cohn & Stump-Outline of Biochemistry, Wiley Eastern Ltd.
2. Harpers review of Biochemistry-Prentice Hall.
3. Plummer-Practical Biochemistry.
4. J. Jayaman- Practical Biochemistry.
5. Lubert Stryer- Biochemistry.
6. Zubay- Biochemistry 4th edition
7. Voet- Biochemistry
8. Boyer- Concepts in Biochemistry
9. Adams- Biochemistry of Nucleic acids.
10. Voet-Fundamentals of Biochemistry with CD.

PAPER TH-IX BIOINFORMATICS, MICROBIAL GENOMICS & PROTEOMICS.

Marks-100

Unit-I Bioinformatics & its applications

Database types, Pairwise & multiple alignments. Structure-function relationship. Sequence assembling using computers. Computer applications in molecular biology. Protein Domains & human genome analysis Programs (BLAST, FASTA, GCC etc) Search & retrieval of biological information & database sequence, databank, (PDB & gene bank), accessing information (Network expasy, EMB Net, ICGEB Net).

Unit-2

Whole genome analysis.

Preparation of ordered cosmid libraries, Bacterial artificial chromosomal libraries, shotgun libraries & sequencing, Conventional sequencing (Sanger, Maxam & Gilbert Method), Automated Sequencing.

Unit-3

Sequence analysis

Computational methods, homology algorithm (BLAST) for proteins and nucleic acids, open reading frames, annotations of genes, conserved protein motifs related structure /function (PROSITE, PFAME, profile scan). DNA analysis for repeats (direct and inverted), palindromes folding program's. Use of internet, public domains databases for nucleic acids and proteins sequences (EMBL, genebank), database for proteins structure (PDB).

Unit-4

DNA Microarray.

Printing or oligonucleotides and PCR products on glass slides, nitrocellulose paper. Whole genome analysis for global patterns of gene expression using fluorescent-labelled cDNA or end labeled RNA probes. Analyses of single nucleotide polymorphism using DNA chips.

Unit-5

Proteome analysis

Two dimensional separation of total cellular proteins, isolation and sequence analysis of individual protein spots by mass spectroscopy. protein microarray advantages and disadvantages of DNA and protein microarray.

Practical- BIOINFORMATICS, MICROBIAL GENOMICS & PROTEOMICS.

Marks-100

1. Use of Internet or software for sequence analysis of nucleotides & proteins.
2. Studies of public domain database for nucleic acid & protein sequence.
3. Determination of protein structure (PDB).
4. Genome sequence analysis.

References-

1. Bioinformatics. 1998 by Baxevanis
2. Bioinformatics 2000 by Higgins & Taylor OUP
3. Nucleic acid research 2001 Jan. Genome database issue.
4. The internet & the new biology. Tools for Genomics & Molecular Research by Peruski Jr. Peruski (ASM) 1997.
5. DNA microarrays: A practical research edited by Mark Schena (OUP).
6. Bioinformatics: Sequence structure & Data bank: A Practical approach by Higgins.
7. Bioinformatics-from Genome to drug 2 volumes by Lenganer.
8. Introduction to Bioinformatics by Attwood.
9. Computer analysis of sequence data by Colte.
10. Genomics: The science & Technology behind human project.

11. Protein Engineering Principles & Practice by Cleland.
12. Bioinformatics methods & protocols - Misner.
13. Protein Biotechnology: Edited by Felix Franks. Human Press, Totowa, New Jersey.

PAPER-X

BIOPROCESS ENGINEERING & TECHNOLOGY

MARKS-100

Unit-1 Bioreactors

Design of basic Fermentors, Bioreactor configuration, design features, individual parts, baffles, imperials, foam separators, spargers, culture vessel, cooling & heating device, Probes for online monitoring computer control of fermentation processes, measurement & control of processes.

Reactors for specialized application: tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors, trickle flow reactors, their basic constructions & types for distribution of gases.

Unit-2 Mass Transfer in Reactors

Transport phenomenon, fermentation: gas liquid exchange & mass transfer. O_2 transfer, Critical oxygen concentration, Determination of $K_L a$, heat transfer, aeration/agitation, its importance.

Sterilization of Bioreactors, Nutrients, air Supply, Products & effluent.

Process variables & control scale of bioreactors.

Unit-3 Fermentation Processes

Growth of culture in the fermenters: Kinetics of growth in batch culture continuous culture, w.r.t. substrate utilization, specific growth rate, steady state chemostat, fed batch fermentations, yield of biomass, products calculations of productivity, substrate utilization kinetics.

Fermentation processes - inoculum development, storage of culture for repairs, fermentations.

Scaling up of processes from shake flask to industrial fermentations.

Unit-4 Down stream Processing

Biomass separation by centrifugation, separation, flocculation & other research developments, self disintegration: physical chemical & enzymatic methods.

Extraction: Solvent, two phase, liquid extraction, whole broth aqueous multiphase extraction.

Purification by different method.

Concentration by precipitation, ultra-filtration, reverse osmosis.

Drying & crystallization.

Unit-5 Isolation, selection & Improvement of culture

Screening & isolation of micro-organisms, Primary & secondary metabolites, enrichment, specific screening for the desired products.

Strain improvements for the selected organisms-mutation & screening of improved cultures, random & strategic screening methods of strain improvements for primary, secondary metabolites with relevant examples. Use of recombinant DNA technology

Protoplast fusion techniques for strain improvements of primary & secondary metabolites, Production of Recombinant molecules in heterologous system, problems associated with SIP, improvements of characters other than products & its application on the industry, Importance of media in fermentation, media balancing after improvements, Preservation of cultures after SIP

Practical-

Marks-100

1. Isolation of industrially important organisms from the environments.
2. Determination of TDP & TDT of micro organisms for a design of sterilizer.
3. Determination of growth curve of a organisms & compute substrate degradation profile, Specific growth rate & growth yield.
4. Screening & enrichment for a Primary/secondary metabolites from the environment.
5. Strain improvements for highest yield of the products.
6. Random & strategic screening for a metabolite.
7. Media balancing experiments
8. alcohol fermentation using different substrate its down stream process.

References

1. Bailly & Ollis Biochemical Engineering fundamentals, Tata McGraw Hills, New York.
2. Stanberry & Whittaker principles of fermentation technology, Pergamon press Oxford.
3. Creuger & Creuger Biotechnology, A text book of Industrial Biotechnology industrial microbiology
4. L.E. Cassida Industrial microbiology Wiley Eastern
5. Applied microbiology series
6. Doran Bioprocesses Engineering Principles Academic press London.
7. Nelson J Villadsen Bioreaction Engineering principle Pl, en & Press, New York

Th -paper -XI

ENZYME TECHNOLOGY

MARKS-100

Unit-1 Extraction and purification of microbial enzymes

Importance of enzymes purification, different sources of enzymes. Extracellular and intracellular enzymes. Physical and chemical methods used for cell disintegration. Enzyme fractionation by precipitation (using temperature, salt, solvent, pH, etc.), liquid-liquid extraction, ionic exchange, gel electrophoresis, affinity chromatography and other special purification methods. Enzyme crystallization techniques. Criteria of purity of enzymes. Pitfalls in working with pure enzymes.

Unit-2 Enzyme kinetics and Enzyme inhibition

Enzyme kinetics; steady state kinetics, Briggs Haldane equation, Michaelis Menten equation; Lineweaver Burke equation, Eadie Hoffstee equation. Irreversible, reversible, competitive, non competitive and uncompetitive inhibition with suitable examples and their kinetic studies.

Allosteric inhibition, types of allosteric inhibition and their significance in metabolic regulation and their kinetic study. Study on vitamins and co-enzymes; structure and functions with suitable examples. Metalloenzymes and Metal ion as co-factors and enzyme activators.

Unit-3 Immobilization of microbial enzymes

Methods viz. adsorption, covalent bonding, entrapment and membrane confinement. Analytical, therapeutic and industrial applications. Properties of immobilized enzymes

Unit-4 Enzyme Engineering

Chemical modification & Site-directed mutagenesis to study the Structure function relationship of industrially important enzymes.

Unit-5 Applications of microbial Enzymes

Microbial enzymes in textiles, leather, wood industries & detergents. Enzymes in clinical diagnostics.

Enzyme sensors for clinical processes & environmental analysis. Enzymes as therapeutic agents.

Practical paper-XI

Marks-100

1. Microbial production, Extraction, Purification & Confirmation of alpha amylase/Lipases.
2. Determination of efficiency of enzyme purification by measuring specific activity at various stages viz., Salt precipitation, dialysis, electrophoresis etc.
3. Studies on enzyme activation & inhibition of extracted alpha amylase/Lipase. Effect of heavy metal ions, Chelating agents activators & inhibitors.
4. Immobilization of cells & enzyme using Sodium alginate & egg albumin & measurement of enzyme activity (amylase/Lipase)
5. Studies on impact of Immobilization of enzyme activity in terms of temperature tolerance & V_{max} & K_m using various forms of alpha amylase/Lipase
6. Determination of molecular weight of enzymes using PAGE techniques.
7. Preparation of biosensors of urease & determination of its activity.

Reference:

1. Methods in Enzymology. Volume 22-Enzyme purification & related technique. Edited by William B. Jakoby. Academic Press, New York.
2. Allosteric enzymes-Kinetic Behaviour. 1982. by B.I. Kurganov. John Wiley & Sons Inc., New York
3. Hand book of enzyme technology by Wiseman.
4. Enzymes as drugs edited by John S. Holenberg & Joseph Roberts, John Wiley & Sons New York.
5. Methods in Enzymology by W.A. Wood, academic press.
6. Advances in enzymology by Alton Meister, Interscience publishers.
7. Topics in enzymes & fermentation biotechnology by L.N. Weisman, John Wiley & Sons.

PAPER-XII
MICROBIAL DIVERSITY & EXTREMOPHILES
MARKS-100

Unit-1 Biodiversity

Introduction to microbial biodiversity, -distribution, abundance, ecological niche. Types- Bacterial Archaeal & Eucaryal.

Unit-2 Characteristics & classification of Archaeobacteria

Thermophiles: Classification Hyperthermophiles, habitats & ecological aspects. Extremely Thermophilic Archaeobacteria, Thermophily, Commercial aspects of thermophiles. Applications of thermozymes.
Methanogenes: Classification, Habitats, applications.

Unit-3 Alkalophiles & Acidophiles

Classification, Alkaline environment, soda lakes & deserts, Calcium alkalophily Applications.
Acidophiles: Classification, Life at low pH, acidotolerance, applications.

Unit-4 Halophiles & Barrophiles

Classification, Dead sea, Discovery basin, Cell wall & membranes -purple membrane, Compatible solutes. Osmoadaptation/halotolerance. applications of halophiles & their extremozymes.
Barrophiles: Classification, High -pressure habitats, life under pressure, barrophily, death under pressure.

Unit-5 Space Microbiology

Aims & objectives of space research, Life detection method a) Evidence of metabolism (Gulliver) b) Evidence of Photosynthesis (Autotrophic & Heterotrophic) c) ATP production d) phosphate uptake e) Sulphur uptake, Martian environment (atmosphere, climate, & other details)
Antarctica as a model for Mars. Search for life on Mars, Viking mission, Viking landers and Biology box experiment. Gas Monitoring of astronauts microbial flora: Alterations in the load of medically important microorganisms, changes in mycological autoflora, and changes in bacterial autoflora.

Practical

1. Isolation of Thermophiles from Hot water spring (Study at least one enzyme)
2. Studies on halophiles isolated from seawater (Pigmentation & Salt tolerance)
3. Studies on alkaliphiles isolated from lonar water/sea water. (Study at least one enzymes)
4. Biogenic methane production using different wastes.
5. Isolation of thibacillus ferrooxidans & Thibacillus thiooxidans cultures from metal sulfides, rock, coal & acid mine waters.

References:

1. Extremophiles by Johri B.N. 2000. Springer Verlag, New York
2. Microbial Diversity by Colwell D 1999, Academic Press.
3. Microbial life in extreme environments Edited by Clive Edward Open University Press Milton Keynes.
4. Microbiology of Extreme Environments Edited & its potential for Biotechnology Edited by N.S. Da Costa, J.C. Duarata, R.A.D. Williams. Elsevier Applied Science, London.
5. Extreme Environment Mechanism of Microbial Adaptation Edited by Milton R. Heinrich Academic Press.
6. Microbiology of Extreme Environments Edited by Clive Edward Open University Press. Milton Keynes
7. Thermophiles General, Molecular and Applied Microbiology Edited by Thoms D. Brock. Willey Intersciences Publication.
8. Microbiology: Dynamics and Diversity by Perry.
9. Microbial Ecology Fundamentals and Applications by Ronald M. Atlas and Richard Bart. II and IV Edition The Benjamin Cummins Publication Co, Inc.
10. Microbial Ecology II Edition by R. Campbell Blackwell Scientific Publication
11. Brock's Biology of Microorganisms VII Edition. (International Edition -1997) by Michael T. Madigan John M. Martinko. Jack Parker. Prentice Hall International Inc.
12. Bart Advances in Applied Microbiology .Vol.X. Edited by Wayne W. Umbreit and D. Pearlman Academic Press.

PAPER-XIII
PHARMACEUTICAL MICROBIOLOGY

MARKS-100

Unit-1 Antibiotics & Synthetic antimicrobial agents

Antibiotics & Synthetic antimicrobial agents.
(Aminoglycosides, Beta lactams, Tetracyclines, ansamycines, Macroiid antibiotics)
Antifungal antibiotics, Antitumour substances,
Peptide antibiotics, Cholramphenicol, Sulphonamides, & Quinoline antimicrobial agents.
Chemical disinfectants, antiseptics & preservatives.

Unit-2 Mechanism of action of antibiotics

Mechanism of action of antibiotics, (Inhibitors of cell wall synthesis, nucleic acid & protein synthesis.)
Molecular principles of drug targeting.
Drug delivery system in gene therapy.
Bacterial resistance to antibiotics.
Mode of action of bacterial killing by quinolones.
bacterial resistance to quinolones
Mode of action of non-antibiotic antimicrobial agents.
Penetrating defences-How antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system & drug diffusion)

Unit-3 Microbial production & spoilage of pharmaceutical products.

Microbial production & spoilage of pharmaceutical products. (Sterile injectables, noninjectables, ophthalmic preparation & implants) & their sterilization. Manufacturing procedures & inprocess control of pharmaceuticals.
Other pharmaceuticals produced by microbial fermentations (Streptokinase)
New vaccines technology, DNA vaccines, Synthetic peptides vaccines, multivalent subunit vaccines. Vaccine clinical trials.

Unit-4 Regulatory practices, Biosensors & applications in Pharmaceuticals.

Financing R & dD capital & market outlook, IP, BP, USP,
Government regulatory practices & policies, FDA perspective.
Reimbursement of drugs biologiss, legislative perspective.
Rational drug design.
Immobilization procedures for Pharmaceutical applications (liposomes)
Macromolecular, Cellular & Synthetic drug carriers.
Biosensors in pharmaceuticals.
Applications of microbial enzymes in Pharmaceuticals.

Unit-5 Quality Assurance & Validation

Good manufacturing Practices (GMP) & Good Laboratory Practices (GLP) in Pharmaceutical industry.

Regulatory aspect of quality control

Quality assurance & quality management in pharmaceuticals ISO, WHO, & US certification.

Sterilization control & sterility testing (heat sterilization, D value, Z value, Survival curve, Radiation gases & Filter Sterilization)

Chemical & Biological indicators.

Design & layout of sterile product manufacturing unit.

(Designing of Microbiology laboratory)

Safety in Microbiology laboratory

Practical

Marks-100

1. Sterility testing for *Bacillus stearothermophilus*.
2. Determination antimicrobial activity of a chemical compound (Phenol, resorcinol, thymol, formaldehyde) to that of phenol under Standardised experimental conditions.
3. Spectrophotometric/Microbiological methods for determination of Griesofulvin.
4. Bioassay of chloramphenicol by plate assay method or turbidometric assay method.
5. Treatment of bacterial cells with cetrimide, phenol & detection of substances such as potassium ions, amino acids, purines, pyrimidines & pentoses due to cytoplasmic membrane damage.
6. To determine MIC, LD50 of Beta lactum/aminoglycoside/tetracycline/ansamycines
7. Sampling of pharmaceuticals for microbial contamination & load (syrups, suspensions, creams & ointments, ophthalmic preparations.)
8. Determination of D value Z value for heat sterilization in pharmaceuticals.

References

1. Pharmaceutical microbiology-Edited by W.B.Hugo & A.D.Russell 6th edition. Blackwell scientific publications.
2. Analytical microbiology- Edited by Frederick Kavangh volume I & II Academic press New York.
3. Quinolone antimicrobial agents-edited by David C. Hooper, John S. Wolfson. ASM Washington DC.
4. Quality control in Pharmaceutical industry-edited by Murrar S. Cooper Vol II Academic press New York.
5. Pharmaceutical Biotechnology by S.P.Vyas & V.K.Dixit, CBS Publishers & distributors, New Delhi.
6. Good manufacturing Practices for Pharmaceutical 2nd edition, by Sidney H. Willig, Murray M. Tuckman
7. Quality assurance in microbiology by Rajesh Bhatia, Rattan Lal Ithpungani. CBS Publishers & Distributors, New Delhi

RECOMBINANT DNA TECHNOLOGY

Marks-100

Unit-1 Techniques & enzymes in Genetic Recombination

Core techniques & essential enzymes used in recombination: Restriction endonucleases, type I, II, III, Recognition sequences, properties, nomenclature, classification of type II endonucleases, their activity. DNA ligase: Properties & Specificities, S1 nuclease, Bal 31 nuclease, DNA polymerase, polynucleotide kinase, phosphatase, Reverse transcriptase & its activity & mode of action. Chemical synthesis of DNA. Restriction digestion, ligation & transformation.

Unit-2 Vectors

Properties, incompatibility, isolation & purification Technique, Plasmid vectors & their properties, PBR322-its construction & derivatives, single stranded plasmid, promoter probe vectors, runaway plasmid vectors.

Bacteriophages lambda as a vectors: Essential features, organization of lambda genome, general structure, rational for vector construction, Improved lambda vectors, Lambda gt series, lambda EMBL vectors, in-vitro packaging, cosmids, phasmids, filamentous phage vectors, lambda zap, lambda blue print vectors.

Unit-3 Specialised cloning strategies.

Expression vectors, promoter probe vectors, vectors for library construction, genomic DNA libraries, Chromosome walking & jumping, cDNA libraries, Shotgun sequencing, directed cloning, phage display. Recombinant DNA technology with reference to cloning production & production of interferon & insulin. Miscellaneous applications of Genetically engineered microorganisms (GEMS)/Genetically modified organisms (GMO's).

Unit-4 PCR methods & Applications

Pcr methods & applications, DNA Sequencing methods, Dideoxy & chemical method, Sequence assembly, Automated sequencing.

Unit-5 Molecular mapping of genome

Genetic & Physical maps, Physical mapping & map-based cloning, choice of mapping population, Simple sequence repeat loci, southern & fluorescence in situ hybridization for genome analysis: RFLP, RAPD & AFLP analysis, molecular markers linked to disease resistant genes, applications of RFLP in forensic, Disease prognosis, genetic counseling, pedigree, varietal etc. Animal trafficking & poaching: germplasm maintenance, taxonomy & biodiversity.

Practical

Marks-100

1. Isolation of genomic DNA & its confirmation by southern blotting.
2. Isolation of plasmid DNA & its restriction digestion.
3. DNA sequencing by Sangers method/other method.
4. DNA cloning using plasmid vectors and expression vectors.
5. RFLP analysis.
6. Isolation of poly-A+RNA
7. Amplification of DNA by PCR

References

1. Principles of gene manipulation 1994 by Old & Primrose Blackwell Scientific publications.
2. DNA cloning A practical approach by D.M. Glover & B.D. Hames, IRL Press, Oxford 1995.
3. Molecular biotechnology II edition by S.B. Primrose. Blackwell scientific publications Oxford 1994.
4. PCR technology-Principals & applications for DNA Amplifications by Henry A. Erlich (Ed) Stockton press 1989
5. Biotechnology: A Guide to Genetic Engineering by Peteres
6. Genetic Engineering-2000 by Nicholl
7. From genes to clones by Winnakar.
8. Gene targeting-A practical approach by Joyner

Paper XV Industrial & Environmental Biotechnology

Unit I : Industrial Fermentation & Production

General methods of production, SIP, purification & application of organic acids: citric acid, lactic acid.

Amino acid: Glutamic acid,

Antibodies: Classification, antibiotic research, isolation of new antibodies, hybrid antibodies, Lactum, Aminoglycosides, peptide, ansamycines, quinones

Unit I I: Industrial Fermentation & Production

Methods of production, SIP, purification & application of enzymes: amylases, polysaccharides-alginate, dextran, xanthan, pullan, lipids-pHB, PHA

Biomass: SCP & SCO.

Solvents: ethanol, acetone.

Unit I V: Environmental Biotechnology

Water, air pollution & its control by biotechnological means biotechnology & waste management, aerobic & anaerobic treatments degradation of Xenobiotics from the environments bioremediation.

Effluent treatment: types microbes used of ETP plants

Microbial, biochips, bioplastics

Bioinsecticides & biofertilizers

Microbial flavor, dyes, surfactants, bio terrorism.

Unit V: Intellectual Property & Ethical Issues:

Intellectual property rights, (IPR), patents, trademarks, copy right, secrets, IPR & plant genetics resources (PGR), patenting of biological materials, international conventions, International cooperation, obligations with patent application, implication of patenting current issue, hybridomes technology, etc patenting of higher plant & animal, transgenic organism and isolated genes, patenting of genes & DNA sequences, plant breeders right & farmers right.

Practical:

Marks-100

1. Production of organic acids by fermentation
2. Production of Amino acids by fermentation
3. Antibiotic fermentation, Penicillin, rifamycin, tetracycline etc.
4. Microbial enzyme production & its characterization.
5. Microbial polysaccharide production
6. Lipid productions from microbes
7. Biomass SCP from microbes
8. Organic solvent production
9. Biotransformation
10. Bioinsecticide isolation purification & assay
11. Biofertilizers production
12. Microbial leaching
13. Effluent treatment- Physical, chemical, & biological treatments.

References:

1. Baily & Ollis Biochemical engineering Fundamentals, Tata McGraw Hills New York.
2. L.E. Casida Industrial microbiology, Wiley Eastern.
3. Applied microbiology series.
4. Stanbury & Whittekar principles of Fermentation technology, Pergamon.
5. H.J. Rehm G Biotechnology: A comprehensive treatise, VCH
6. Creugure & Creugure Biotechnology A textbook of industrial microbiology, Sinauer Associates.
7. Alexander M Biodegradation & Bioremediation Academic press San Diego
8. Atkinsons B Biochemical reactors pion ltd, London.

PAPER-XVI PROJECT

Marks-200