

K.T.S.P. MANADAL'S
SAHEBRAOJI BUTTEPATUIL MAHAVIDYALAYA
RAJGURUNAGAR, PUNE 410 505

Department of Microbiology

A.Y.2025-26

Teaching plan-Semester II

MB 551 MJ Molecular Biology I

Sr.No	Month	Topic	Teacher name
1	Dec	1. Prokaryotic Genome organization, DNA replication, Mutagenesis and DNA repair. 2. Eukaryotic Genome organization, DNA replication and recombination, Chromatin remodeling, Histone modification and its effect on the function of chromatin, C value paradox, Rot and Cot concept, pseudogenes, 3. Transcription and Regulation in Prokaryotes and Eukaryotes: RNA polymerases, transcription unit, positive and negative regulation, role of attenuators, anti-termination	Prof.H.A.K
2	Jan	1. Prokaryotic and Eukaryotic translation: role of initiation factors, Shine-Dalgarno sequences, Kozak sequence, translocation of ribosomes, Role of elongation factors, termination codons and role of release factors, fidelity of translation, Puromycin translation assay.	Prof.H.A.K

		by Intron I and Intron II); rRNA processing; tRNA processing; RNA Editing, ii. Nuclear export of mRNA iii. Regulatory RNAs and noncoding RNAs: Si RNA, Micro RNA, RNA interference (RNAi) iv. CRISPER-cas system. 3. Molecular Techniques: yeast two and three hybrid assay, Activity gel assay, DNA helicase assay, Chromatin Immuno-precipitation (ChIP), Designing probe, Epitope tagging	
3	Feb	1. Enzymes used in Recombinant DNA technology; Restriction endonuclease, DNA ligase, T4 DNA polymerase, Terminal transcriptase, Alkaline phosphatase, polynucleotide kinase 2. Cohesive and blunt end ligation, linkers; adaptors; homopolymeric tailing labeling of DNA: 3. Nick translation, random priming, radioactive and nonradioactive probes 4. Hybridization techniques: Northern, Southern, south-western and far-western and colony hybridization, fluorescence in situ hybridization. 5. Vectors for cloning and gene expression: i. Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Blue script vectors, Baculovirus and Pichia vectors, plant-based vectors (Ti and Ri as vectors). Vectors for gene expression: types (pMal, GST, pET-based vectors), 6. Construction of genomic DNA and cDNA libraries; Human and <i>E.coli</i> genome project: introduction and applications. Concept of comparative genomics	Prof.H.A.K

4	March-April	Molecular diagnostics and applications 1. Introduction to Microarray and array techniques, the lab-on-a-chip concept 2. Use of array techniques detection of polygenic diseases and diseases-associated changes in gene expression 3. Detection of RNA signatures of 'Antibiotic Resistance' in bacteria 4. Detection of microRNA (mi RNA): A signature of cancer diagnostics	Prof.H.A.K
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Prof.H.A.Koli



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Teaching plan-Semester II

MB 522 MJ - Enzymology, Bioenergetics and Metabolism

Sr.No	Month	Topic	Teacher name
1	Dec	Enzymology 1. Overview: Purification of enzyme, purification chart 2. Overview: MM Equation and Kinetic Plots. 3. Kinetics of reversible inhibitions: Competitive, uncompetitive, non-competitive, mixed, substrate. Primary and secondary plots, Determination of K_i using secondary plots. Significance of inhibitors 4. King Altman approach to derive – two substrate enzyme catalyzed reactions 5. Concept of allosterism, positive and negative cooperativity, models of allosteric enzymes (Monod, Wyamann and Changeux and Koshland Nemethy and Filmer model), kinetics of allosteric enzymes, Hill plot, examples of allosteric enzymes and their significance in regulation.	Prof.KKG
2	Jan	Bioenergetics and Biosynthesis of Nitrogenous Compounds 1. Overview: Laws of thermodynamics, entropy, enthalpy, free energy, an equilibrium constant with reference to biological significance. 2. Gibbs free energy equation. 3. Determination of free energy of hydrolytic and biological oxidation reduction reactions under standard and non-standard conditions	Prof.KKG

		4. Overview of High Energy Compounds 5. Coupled reactions 6. Determination of feasibility of reactions 7. Problems based on 2, 3 and 6. 8. Atkinson's energy charge. 9. Biosynthesis of five families of amino acids and histidine, 10. Biosynthesis of purine and pyrimidine bases	
3	Feb	Lipid and Carbohydrate Metabolism 1. Synthesis of lipids: Phospholipids and triacylglycerols, 2. Synthesis of membrane lipids: Glycerophospholipids, sphingolipids, sterols 3. Degradation of fatty acids (alpha, beta and Omega oxidation and unsaturated fatty acids) 4. Lipids as signal molecules (eg. phosphatidylinositol, eicosanoids). 5. Overview of Glycolysis and gluconeogenesis 6. Regulation of glycolysis and gluconeogenesis 7. Synthesis of microbial exopolysaccharides (alginate) 8. Cellulose synthesis and breakdown 9. Regulation of Glycogen synthesis & breakdown, 10. Metabolic flux and its regulation by various metabolic intermediates, 11. TCA cycle- regulation, role in energy generation, Role in generati biosynthetic intermediates and glyoxylate cycle	Prof.KKG
4	March-April	Micronutrients and Hormones A. Structure, function of following micronutrients in metabolism: 1. Water soluble vitamins and their coenzyme forms (Niacin, Riboflavin, Pantothenic acid, Thiamine, Pyridoxal, Vitamin B₁₂, Folic acid, Glutathione) 2. Fat soluble vitamins (A, D, E, and K) 3. Minerals as vitamins (Iron, Manganese, Magnesium, Cobalt, Molybdenum, Copper, Zinc, Nickel)	Prof.KKG



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Prof. K. K. Gaur

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DEPARTMENT OF MICROBIOLOGY

Teaching Plan (A.Y.2025-26)

M.Sc. (Microbiology) Part-I NEP 2020 (Sem II)

Subject- MB 553 MJ: Laboratory Techniques and Instrumentation

Sr No.	Month	Topics	Teacher
1	December	Introduction to laboratory techniques and instrumentation; Sample preparation techniques – Dialysis, Ultrafiltration, Centrifugal vacuum concentration	SRP
2	January	Chromatography – Principles; Partition coefficient; Selectivity; Resolution; Column efficiency; Van Deemter equation; Instrumentation and applications of Gel filtration, Ion exchange, Affinity chromatography	SRP
3	February	Advanced chromatography techniques – HPLC, FPLC, Supercritical fluid chromatography, Reversed phase chromatography, Gas chromatography; Interpretation of chromatograms Electrophoresis methods Agarose gel electrophoresis, Native PAGE, SDS-PAGE, Pulse field gel electrophoresis,	SRP
4	March	Capillary electrophoresis, Isoelectric focusing, 2-D electrophoresis, Immunoelectrophoresis Spectroscopy – Electromagnetic spectrum;	SRP

		UV-Visible spectroscopy (Instrumentation, Beer-Lambert law); Fluorescence spectroscopy	
5	April (From 15 December to 5 April)	Infrared spectroscopy (FTIR); Mass spectroscopy (Ionization, Fragmentation, Mass analysers); Flow cytometry and FACS	

Prof. S.R. Patil

Prof.S.R.Patil
Teacher Incharge



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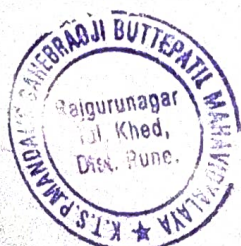
Teaching Plan (A.Y.2025-2026)

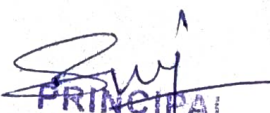
M.sc I

Sem II

MB 526 MJ -Nitrogen Metabolism, Respiration and Photosynthesis
Group II Major Elective Theory

Sr. No	Month	Topics	Teacher
1	DEC	Nitrogen fixation and amino acid degradation: 1. Biochemistry of biological nitrogen fixation, properties of nitrogenase and its regulation	RSK
2	JAN	2. Ammonia assimilation, glutamine synthetase, glutamate dehydrogenase, glutamate synthetase, their properties and regulation 3. Protein turnover and amino acid degradation	RSK
3	FEB	Respiration and photosynthesis: 1. Respiration: Respiration in chemolithotrophs, sulphur oxidisers, nitrate reducers with respect to electron transport chain and energy generation, Biochemistry of methanogens.	RSK
4	MAR	2. Photosynthesis: i. Overview: Plant Photosynthesis. ii. Bacterial photosynthesis: photolithotrophs, scope, photosystems, iii. Bacterial (cyclic, noncyclic) photophosphorylation in various groups of phototrophic bacteria (photoautotrophs and photoheterotrophs)	RSK
5	APR	iv. Electron donors other than water in anoxygenic photosynthetic bacteria	RSK




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Prof. R.S.KOKANE

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DEPARTMENT OF MICROBIOLOGY
Teaching Plan (A.Y.2025-26), Term II
M.Sc. (Microbiology) Part-II (NEP 2020,Pattern 2023)
MB 621 MJ: Pharmaceutical Microbiology

Sr. No.	Month	Topic	Teacher
1.	December (From 17 December)	Credit I : Introduction A. Definition and Explanation of Medicinal Chemistry Terms: HITS, lead compound, toxicity studies, high throughput screening B. Nomenclature of Drugs: 1. Introduction to IUPAC 2. Generic system 3. International non-proprietary names and trade names C. Historical perspectives: 1. Overview of development in medicinal chemistry in 20th and 21st century 2. Significance of medicinal chemistry	KSG
2.	January	D. Introduction to Modern Drug Discovery: 1. Rational drug design 2. Molecular modeling 3. Use of gene and DNA technology in chemotherapy E. Classification of Drugs Based on: 1. Therapeutic classes 2. Drug targets 3. Drug mechanisms of action.	KSG
3.	February	Credit II : Drug Development A. Lead Optimization: 1. Lead likeness, drug likeness 2. Determination of biological and biochemical properties of drug 3. Pharmacovigilance	KSG

		B. Drug Designing: 1. CADD, LBDD, SBDD (protein crystallography; molecular docking) C. Drug Development: 1. Preclinical development 2. Toxicity testing – acute, sub acute, chronic D. Clinical Development: 1. Clinical trials (aims, objectives and conduct) 2. Clinical trial phases (0, I, II, III and IV)	
4.	March	Credit III : Biopharmaceuticals A. Regulations of Biopharmaceuticals: 1. Regulations and Sources 2. Regulatory authorities and their role: Food and Drug Administration (FDA), World Health Organisation (WHO) and Clinical and Laboratory Standards Institute (CLSI) 3. Ministry of AYUSH in biopharmaceuticals (introduction, role and guidelines) B. Pharmacopeia: 1. Introduction to pharmacopeia: IP, USP and BP (vision, mission, policy role and objectives) 2. Significance of IP with any one example in detail	KSG
5.	April (up to 10 April)	Credit IV : ADME (Pharmacodynamics and Pharmacokinetics) A. Passage of Molecules through Biological Barriers: 1. Membrane transport (paracellular, transcellular) B. Drug Absorption: 1. Drug dosages 2. Gastric emptying to gastric permeability to drug 3. First pass effect 4. Bioavailability C. Drug Distribution: 1. Drug-plasma/serum binding 2. Blood brain barrier	KSG

C. Drug Distribution:

1. Drug-plasma/serum binding
2. Blood brain barrier
3. Accumulations in various organs and tissues

D. Drug Metabolism and Elimination:

1. Biotransformation reactions
2. Functionalization
3. Conjugation reaction
4. Reactions leading to toxic metabolites.


Prof. Gujar K.S.
Teacher Incharge




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Department of Microbiology**Teaching Plan (A.Y.2025–2026)****M.Sc-II****MB 622 MJ: Bioprocess Technology**

Sr. No	Month	Topics	Teacher
1	DEC	Bioreactor Design and Operation A. Basic Components, Design and Scale-up of Fermentors: 1. Designing of bioreactors: a. Design aspects CSTRs b. Dimensional ratios of the outer shell c. Operational aspects such as working volume, baffles and impellers 2. Configuration (placement) of impellers in a vessel and different types of impellers (types of turbines and propellers and their combinations) 3. Immobilized cell reactors and air-lift reactors: Design and operation 4. Batch, fed-batch and continuous fermentors: Applications, advantages and limitations of each type	ADD
2	JAN	Process Variables and Monitoring A. Process Variables: 1. Aeration theory of oxygen transfer in bubble aeration; Oxygen transfer kinetics (Oxygen Uptake Rate - OUR, Oxygen Transfer Rate OTR, Ccrit), determination of KLa value. 2. Agitation; Functions of agitation; Flow patterns with different types of impellers; Effect of agitation and microbial biomass on KLa value a. Fermentation broth rheology and power requirements for agitation - Concept of Newtonian and non Newtonian fluids b. Effect of broth rheology on heat, nutrient and oxygen transfer c. Reynold' s number, power number, aeration number: solving examples using different software programs B. Monitoring of Process Variables: 1. Use of various types of sensors and biosensors for monitoring environmental	ADD

		parameters (pressure, pH, temperature, DO and DCO ₂) 2. Basic principles of operation, types of biosensors	
3	FEB	Applications of Bioprocess Technology A. Upstream and Downstream Processing for the Following Microbial Metabolites: 1. Antibiotics (Rifamycin) 2. Microbial enzymes (Chitinase) 3. Exopolysaccharides (Pullulan & Xanthan) 4. Immobilized cells/enzymes for bioconversion 5. Fungi in agriculture and environmental applications 6. Bio-mining: Microbial extraction of Cu, Au, and U from ore and their biorecovery 7. Probiotics and prebiotics: Fundamental aspects and health benefits	ADD
4	MAR	Concepts of IPR, ISO Certification, SOP Preparation, Validation and Entrepreneurship A. Intellectual Property Rights (IPR): 1. Basic concepts of IPR 2. Introduction to forms of IPR - Patents and Designs 3. Patents: Concepts and principles of patenting 4. Procedure of obtaining patents B. Concept of ISO Certification C. Preparation of SOPs D. Validation protocols for methods (as per WHO norms) in: 1. Quality Control 2. Process validation	ADD
5	APR	E. Exercises on preparation of SOPs, operation and validation for analytical methods F. Entrepreneurship 1. Concept of entrepreneurship; Scope for entrepreneurship in Microbiology/Life sciences 2. Concept of incubation centre 3. Challenges and considerations for startups and small scale industry	ADD

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Prof.A.D.Daundkar



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A.Y.2025-26

Teaching plan-Semester II

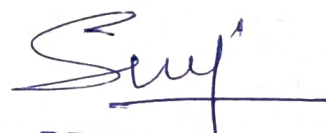
**MB 624 MJ: Quality Assurance and Validation in the Pharmaceutical Industry
and Development of Anti-infectives from Plants**

Sr.No	Month	Topic	Teacher name
1	Dec	Quality Assurance and Validation in the Pharmaceutical Industry A. Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in the Pharmaceutical Industry B. Quality Assurance and Quality Management in Pharmaceuticals: ISO, WHO, and US certification C. Safety in the Microbiology Laboratory	Prof.H.A.K
2	Jan	D. Safety Profile of Drugs: a. Sterility Testing b. Pyrogenicity testing c. Mutagenicity and carcinogenicity testing d. Teratogenicity testing	Prof.H.A.K
3	Feb	Development of Anti-infectives A. Definitions: Therapeutic ratio, MIC and MBC B. Overview of Susceptibility Testing: 1. Use of liquid and solid media 2. Factors affecting susceptibility testing, CLSI guidelines	Prof.H.A.K

		3. Diffusion methods – agar dilution technique, gradient plate techniques, Etest, Kirby Bauer method, Stokes method	
4	March-April	C. Susceptibility Testing for Following Agents: 1. Anti-mycobacterial agents 2. Anti-fungal agents 3. Anti-protozoal agents 4. Anti-viral agents	Prof.H.A.K


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