

The Kelkar Education Trust's V. G. Vaze College of Arts, Science and Commerce (Autonomous) Affiliated to University of Mumbai (Re Accredited by NAAC with Grade A)

Revised Syllabus for SYBSc Biotechnology Semester III & IV Based on NEP-2020 Guidelines

> Implemented From Academic Year 2024-25

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SYBT Sem III

MAJOR	VBCB200	CELL BIOLOGY
MAJOR	VBPR201	PRACTICALS OF CELL BIOLOGY
MAJOR	VBMB202	MOLECULAR BIOLOGY
MAJOR	VBPR203	PRACTICALS OF MOLECULAR BIOLOGY
MINOR	VBIM204	IMMUNOLOGY
MINOR	VBPR205	PRACTICALS OF IMMUNOLOGY
Open Electives	VBES206	ENVIRONMENTAL STUDIES- I
VSEC	VBBT207	BIOPROCESS TECHNOLOGY
ABILITY ENHANCEMENT COURSE	VFWS237	Writing skills in Marathi I
ABILITY ENHANCEMENT COURSE	VFWS238	Writing skills in Hindi I
FP	VBFP210	FIELD PROJECT
CC	VCA141	Community Engagement Activities
CC	VCE142	Cultural Activities
CC	VNS143	National Service Scheme (NSS)
CC	VSA144	Sports Activities
CC	VYG145	Yoga
CC	VKB146	Rhythmic Narratives: History & Foundation of Kathak and Bollywood Dance
CC	VSS147	Sangeet Sadhana

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SYBT Sem IV

MAJOR	VBB250	BIOCHEMISTRY
MAJOR	VBPR251	PRACTICALS OF BIOCHEMISTRY
MAJOR	VBMB252	MEDICAL BIOTECHNOLOGY
MAJOR	VBPR253	PRACTICALS OF MEDICAL BIOTECHNOLOGY
MINOD		INTRODUCTION TO BIOINFORMATICS &
WIINOR	VBBN254	NANOTECHNOLOGY
MINOD		PRACTICALS OF BIOINFORMATICS &
WIINOR	VBPR255	NANOTECHNOLOGY
Open Electives	VBES256	ENVIRONMENTAL STUDIES- II
VSEC	VBED257	ENTREPRENEURSHIP DEVELOPMENT
ABILITY		
ENHANCEMENT		
COURSE	VFWS289	Writing skills in Marathi II
ABILITY		
ENHANCEMENT		
COURSE	VFWS290	Writing skills in Hindi II
COMMUNITY	VBBT260	COMMUNITY ENGAGEMENT
ENGAGEMENT		
CC	VCA141	Community Engagement Activities
CC	VCE142	Cultural Activities
CC	VNS143	National Service Scheme (NSS)
CC	VSA144	Sports Activities
CC	VYG145	Yoga
CC	VKB146	Rhythmic Narratives: History & Foundation of
		Kathak and Bollywood Dance
CC	VSS147	Sangeet Sadhana

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Course Code	Title	Credits	No. of lectures
	CELL BIOLOGY AND CYTOGENETICS	2	
UNIT I Cytoskeleton	Cytoskeleton : Overview of the Major Functions of Cytoskeleton. Microtubules: Structure and Composition. MAPs: Functions- Role in Mitosis, Structural Support and Cytoskeleton Intracellular Motility. Motor Proteins: Kinesins, Dynein; MTOCs. Dynamic Properties of Microtubules. Microtubules in Cilia and Flagella. Microfilaments: Structure, Composition, Assembly and Disassembly.		15
UNIT II Cell Membrane & Cytogenetics	 Cell Membrane : Uptake of Nutrients by Prokaryotic Cells; Cell Permeability. Principles of Membrane Transport- Transporters and Channels; Active Transport, Passive Transport; Types of Transporters; Types of ATP Driven Pumps - Na+ K+ Pump. Cell Junctions; Cell Adhesion and Extracellular Material Microvilli; Tight Junctions, Gap Junctions; Cell Coat and Cell Recognition. Cellular Interactions. Cytogenetics : Structure of Chromosome - Heterochromatin, Euchromatin, Polytene Chromosomes. Variation in Chromosomal Structure and Number : Deletion, Duplication, Inversion, Translocation, Aneuploidy, Euploidy and Polyploidy and Syndromes- Klinefelter, Turner, Cri-du-Chat, Trisomy -21, Trisomy 18 and Trisomy 13. 		15

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	Title	Credits	No. of Lectures
	MOLECULAR BIOLOGY	2	
UNIT I Gene Expression- Transcription	 Gene Expression- an Overview. Transcription Process in Prokaryotes : RNA Synthesis; Promoters and Enhancers; Initiation of Transcription at Promoters; Elongation and Termination of an RNA Chain. Transcription in Eukaryotes : Eukaryotic RNA Polymerases; Eukaryotic Promoters; Transcription of Protein Coding Genes by RNA Polymerase; Eukaryotic mRNA's; Transcription of other genes; Spliceosomes; RNA editing. 		15
UNIT II Gene Expression- Translation & Operons	Nature of Genetic Code. Wobble Hypothesis. Translation : Process of Protein Synthesis (Initiation, Elongation, Translocation, Termination); Post Translation Modifications. Protein sorting. In Bacteria : lac Operon of E.coli; trp Operon of E.coli. In Viruses : Lytic / Lysogenic Regulation		15

Course Code	Title	Credits	No. of lectures
	IMMUNOLOGY	2	
UNIT I Effectors of Immune Response	 Haematopoiesis; Cells of the Immune System; Primary and Secondary Lymphoid Organs. Complement System- Classical, Alternate and Lectin; Regulation and Biological Effects of Complement System; Deficiencies of Complement System T-cell Receptor Complex : Structure and Activation. MHC Classes - General Organization and Inheritance; Structures and Peptide Interactions; Class I and II Diversity and Polymorphism; Antigen Presentation - Endocytic and Exocytic Pathways; MHC Restriction. B-cell Receptor : Structure, Maturation and Activation B-T Cell Interaction (B-T cell Cooperation). 		15
UNIT II Immuno- Techniques	Precipitation Reactions : Immunoprecipitation, Immunoelectrophoresis, CIEP, Rocket Electrophoresis and 2-D Immunoelectrophoresis. Agglutination Reactions : Passive, Reverse Passive, Agglutination Inhibition. Coomb's Test; Complement Fixation Tests, RIA, ELISA, ELISPOT, Chemiluminescence, Western Blot, Immunofluorescence, Flow Cytometry.		15

Course Code	Title	Credits	No. of Lectures
	BIOPROCESS TECHNOLOGY	2	
UNIT I Microorganisms	Types of Microorganisms used in Industrial Processes:		15
in Industrial	Bacteria, Actinomycetes, Fungi and Algae.		
Processes	Screening and Maintenance of Strains:		
	Primary Screening and Secondary Screening; Cultivation; Preservation of Industrially Important Microbial Strains.		
	Inoculum development.		
	Bioavailability and Bioequivalence Studies		
UNIT II	Design of a fermenter:		15
Fermenter and Fermentation	Stirred Tank Fermenter- Basic Design; Parts of a Typical Industrial Fermenter.		
Processes	Fermentation Media:		
	Components; Design and Optimization.		
	Sterilization:		
	Sterilization of Fermenter and Fermentation Media. Process Parameters:		
	<i>pH</i> , Temperature, Aeration, Agitation, Foam, etc.		
	Types of Fermentation:		
	Surface and Submerged; Batch and Continuous, Aerobic and Anaerobic.		
	Product Isolation and Purification.		
	Study of Representative Fermentation Processes:		
	Outline of Penicillin and Ethanol Production by Fermentation along with a <i>flow-diagram</i> .		

Course Code	Title	Credits	No. of Lectures
SBT401	BIOCHEMISTRY	2	
UNIT I	Carbohydrate Metabolism:		15
Carbohydrate Metabolism, ETS and Energy Rich Compounds	Glycolytic Pathway and its Regulation, Homolactic Fermentation; Alcoholic Fermentation; Energetics of Fermentation; Citric Acid Cycle and its Regulation; Gluconeogenesis; Pentose Phosphate Pathway; Glyoxalate Pathway; Reductive TCA. (Sequence of Reactions, Regulation, Energy Yield and Metabolic Disorders of the above Pathways) Electron Transport System: Electron Transport and Oxidative Phosphorylation. Inhibitors of ETS. Energy Rich Compounds: ATP as Energy Currency, Structure of ATP, Hydrolysis, Other Energy Rich Compounds other than ATP like PEP, Creatine Phosphate, etc.		
UNIT II Metabolism of Aminoacids, Lipids & Nucleotides	 Amino Acid Breakdown: Deamination, Transamination, Urea Cycle, Breakdown of Glucogenic and Ketogenic Amino Acids. Lipid Metabolism: Mobilization, Transport of Fatty Acids. Beta, Alpha and Omega Oxidation of Saturated Fatty Acids; Oxidation of Unsaturated Fatty Acids; Oxidation of Odd Chain Fatty Acids. Nucleotide Metabolism: Degradation of Purines and Pyrimidines. 		15

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Course Code	Title	Credits	No. of lectures
	MEDICAL BIOTECHNOLOGY	2	
UNIT I	Host Parasite Relationship:		15
Infectious Diseases	Normal Flora; Factors Affecting the Course of Infection and Disease; Mechanisms of Infection and Virulence Factors.		
	Infection:		
	Patterns of Infection; Types of Infections; Signs and Symptoms; Epidemiology and Epidemiological Markers.		
	Diseases:		
	Origin of Pathogens; Vectors; Acquisition of Infection; Koch's Postulates.		
	Skin:		
	S. aureus.		
	Respiratory Tract Infections:		
	M. tuberculosis Urinary Tract Infections:		
	E.coli		
	GI Tract Infections:		
	Salmonella and Shigella spps		
	Sexually Transmitted Diseases:		
	Syphilis and Gonorrhoea.		
	Nosocomial Infections:		
	Ps. Aeruginosa		4 5
UNIT II	Introduction to Molecular Diagnostics:		15
Basics of Molecular Diagnostics	Overview of Molecular Diagnostics; History of Molecular Diagnostics; Molecular Diagnostics in Post Genomic Era; Areas used in Molecular Diagnostics; Future Prospects - Commercialising Molecular Diagnostics, Personalized Medicine, Theranostics.		
	Characterisation and analysis of Nucleic – Acids and Proteins:		
	Extraction, Isolation and Detection of DNA, RNA and Proteins; Restriction Endonucleases and Restriction Enzyme Mapping.		
	Hybridisation Techniques:		
	Southern, Northern, Western and FISH; Markers, Probes and its Clinical Applications		
	PCR : General Principle; Components of a Typical PCR Reaction; Experimental Design.		

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Course Code	Title	Credits	No. of Lectures
	BIOINFORMATICS and NANOTECHNOLOGY	2	
UNIT I	Computer Basics :		15
Introduction to Computers and Biological Databases	Organization of a Computer; I/O Units; Computer Memory; Processor; Binary Arithmetic; Logic Circuit; Architecture; Operating System.		
	Internet Basics :		
	Connecting to the Internet, E-mail, FTP, www, Difference between www and Internet.		
	Biological Databases :		
	Classification of Databases - Raw and Processed Databases; Primary (NCBI), Secondary (PIR) and Tertiary or Composite (KEGG) Databases; Structure and Sequence Databases. Specialized Databases - Protein Pattern		
	Classification Databases (CATH/SCOP).		
	Genome Information Resources:		
	DNA Sequence Databases Specialized Genomic Resources. Protein Databases based on Composition,		
	Motifs and Patterns.		
	Protein Structure Visualization Software.		1.7
UNIT II Nanotochnolo	Introduction to Nanomaterials.		15
Nanotechnology	Forms of Nanomaterials : Nanoparticles, Nanofilms and		
	Nanotubes Synthesis and Characterization of Nanomaterials.		
	Applications of Nanomaterials.		

Course Code	Title	Credits	No. of Lectures
SBT407	ENTERPRENEURSHIP DEVELOPMENT	2	
UNIT I Introduction to Entrepreneurship Development	Concept of Entrepreneur; Entrepreneurship; Need and Importance; Factors Influencing Entrepreneurship; Essentials of a Successful Entrepreneur; Location of Enterprise; Financial Planning; Role of Government and Financial Institutions in Entrepreneurship Development		15
UNIT II Setting-up of an Enterprise and Planning	Project Planning and Formulation; Project Feasibility Assessment; Preparation of a Business Plan, Market Research, Marketing Plan for an Entrepreneur		15

Internal EvaluationSubmission and Presentation of Business Proposal for any Biotechnological Product/ Enterprise		
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PRACTICALS

	SEMESTER III	
Course code	Title	Credits
(PRACTICALS Based on Cell biology)	 Extraction of plant genomic DNA and Separation by Agarose Gel Electrophoresis. Determination of Purity of DNA using UV Spectrophotometry. Study of Chromosomal Aberrations- Deletion, Duplication, Inversion, Translocation and Syndromes- Trisomy 21 Trisomy 13 Trisomy 18, Klinefelter, Turner and Cri-du-Chat. Induction of Polyploidy by PDB Treatment using Suitable Plant Material. Study of Polytene Chromosomes. Mapping based on Tetrad Analysis and Three Point Cross. Pedigree Analysis- Autosomal and Sex-Linked. 	2
Course code	Title	Credits
(PRACTICALS based on Molecular Biology)	 Study of <i>E.coli</i> Diauxic Growth Curve- (Lactose and Glucose). Study of <i>lac</i> Gene Expression using Blue-White Selection. Expression of β-galactosidase and Measurement of Activity. Characterization of expressed protein using SDS-PAGE. Isolation of RNA from yeast. Isolation of coliphages from sewage. 	2

Course code	Title	Credits
(PRACTICALS based on Immunology & Bioprocess Technology)	1. Complement Fixation Test (CFT).	2+2
	2. Passive Agglutination- RA Factor Test.	
	3. Immunoelectrophoresis.	
	4. Ouchterlony test.	
	5. DOT-ELISA.	
	6. Flow Cytometry - Lab Visit.	
	7. Screening for an Antibiotic Producing Strain of Microorganism.	
	8. Screening for an Alcohol Producing Strain of Microorganism.	
	9. Lab Scale Production of Ethanol.	
	10. Purification of Ethanol from Broth Culture of <i>Saccharomyces spp</i> . by Distillation.	
	11. Estimation of <i>Penicillin</i> from Recovered Broth by Biological	

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(Bioassay) Method.	
12. Estimation of Alcohol from Recovered Broth by Dichromate	
Method.	

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PRACTICALS

		SEMESTER IV	
Course code		Title	Credits
(PRACTICALS Based on	1.	Determination of Lactate Dehydrogenase (LDH) Activity in Blood Serum.	2
Biochemistry)	2.	Determination of Total, LDL and HDL Cholesterol in Serum.	
	3.	Organ Function Tests: Liver (SGPT, SGOT); Kidney (Urea from Serum).	
	4.	Estimation of Uric Acid in Urine.	
	5.	Estimation of Creatinine in Urine	
	6.	Qualitative Detection of Ketone Body in Urine.	
	7.	Isolation of Mitochondria and Demonstration of ETC using a Marker Enzyme.	
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Course code		Title	Credits
(PRACTICALS	1.	Title Identification of S.aureus-Isolation, Catalase, Coagulase Test.	Credits 2
(PRACTICALS based on	1. 2.	Title Identification of S.aureus-Isolation, Catalase, Coagulase Test. Identification of E.coli-Isolation, Sugar Fermentations, IMViC.	Credits 2
(PRACTICALS based on Medical Biotechnolog	1. 2. 3.	Identification of S.aureus-Isolation, Catalase, Coagulase Test. Identification of E.coli-Isolation, Sugar Fermentations, IMViC. Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4.	TitleIdentification of S.aureus-Isolation, Catalase, Coagulase Test.Identification of E.coli-Isolation, Sugar Fermentations, IMViC.Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant.	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5.	Title Identification of S.aureus-Isolation, Catalase, Coagulase Test. Identification of E.coli-Isolation, Sugar Fermentations, IMViC. Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant. Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant. RPR Test (Kit Based).	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5. 6.	Identification of S.aureus-Isolation, Catalase, Coagulase Test. Identification of E.coli-Isolation, Sugar Fermentations, IMViC. Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant. Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant. RPR Test (Kit Based). Permanent Slide- Mycobacterium.	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5. 6. 7.	TitleIdentification of S.aureus-Isolation, Catalase, Coagulase Test.Identification of E.coli-Isolation, Sugar Fermentations, IMViC.Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant.RPR Test (Kit Based).Permanent Slide- Mycobacterium.Isolation, Quantitative Analysis and AGE of Genomic DNA from Bacteria.	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5. 6. 7. 8.	TitleIdentification of S.aureus-Isolation, Catalase, Coagulase Test.Identification of E.coli-Isolation, Sugar Fermentations, IMViC.Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant.RPR Test (Kit Based).Permanent Slide- Mycobacterium.Isolation, Quantitative Analysis and AGE of Genomic DNA from Bacteria.Restriction Enzyme Digestion.	2 2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5. 6. 7. 8. 9.	TitleIdentification of S.aureus-Isolation, Catalase, Coagulase Test.Identification of E.coli-Isolation, Sugar Fermentations, IMViC.Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant.RPR Test (Kit Based).Permanent Slide- Mycobacterium.Isolation, Quantitative Analysis and AGE of Genomic DNA from Bacteria.Restriction Enzyme Digestion.Restriction Mapping.	2
(PRACTICALS based on Medical Biotechnolog y)	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	TitleIdentification of S.aureus-Isolation, Catalase, Coagulase Test.Identification of E.coli-Isolation, Sugar Fermentations, IMViC.Identification of Salmonella- Isolation, Sugar Fermentations, TSI Slant.Identification of Shigella- Isolation, Sugar Fermentations, TSI Slant.RPR Test (Kit Based).Permanent Slide- Mycobacterium.Isolation, Quantitative Analysis and AGE of Genomic DNA from Bacteria.Restriction Enzyme Digestion.Restriction Mapping.Primer Designing through Open Online Source NCBI- BLAST.	2 2

Course code	Title	Credits
(PRACTICALS		2
based on	1. Familiarization with NCBI, EMBL, DDBJ, PIR, KEGG Databases.	
Bioinformatic	2. Use of NCBI BLAST Tool.	
s & Nanotechnolo	3. Pairwise and Multiple Sequence Alignment and Phylogeny.	
gy)	4. Classification of Proteins using CATH/SCOP.	
	5. Visualization PDB Molecules using Rasmol/Raswin.	

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6. Chemical Synthesis of Silver Nanoparticles.
7. Biological Synthesis of Silver Nanoparticles.
8. Characterisation of Silver Nanoparticles by UV- VIS Spectrophotometer.

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Course code	Title	Credits	
SBTP303	1. Study of <i>E.coli</i> Diauxic Growth Curve- (Lactose and Glucose).	2	
	2. Study of <i>lac</i> Gene Expression using Blue-White Selection.		
	3. Expression of β -galactosidase and Measurement of Activity.		
	4. Screening for an Antibiotic Producing Strain of Microorganism.		
	5. Screening for an Alcohol Producing Strain of Microorganism.		
	6. Lab Scale Production of Penicillin (Static and Shaker).		
	7. Purification of <i>Penicillin</i> from Broth Culture of <i>Penicillium spp.</i> by Solvent Extraction.		
	8. Lab Scale Production of Ethanol.		
	9. Purification of Ethanol from Broth Culture of <i>Saccharomyces spp.</i> by Distillation.		
	10. Estimation of <i>Penicillin</i> from Recovered Broth by Chemical (Iodometric) Method.		
	11. Estimation of <i>Penicillin</i> from Recovered Broth by Biological (Bioassay) Method.		
	12. Estimation of Alcohol from Recovered Broth by Dichromate Method.		