



**SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE
AND M.H. MEHTA SCIENCE COLLEGE, PALGHAR**

Department of Foundation Course

PROJECT REPORT

SYBSC-Biotechnology

Academic Year 2022-2023

Prepared by

**Department of Foundation Course
Sonopant Dandekar Arts, V.S. Apte Commerce and
M.H. Mehta Science College, Palghar**

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Sonopant Dandekar Shikshan Mandali's
Sonopant Dandekar Arts,
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Date : 31/01/2023

NOTICE

All S.Y.BSc .Biotechnology students are hereby informed that Assignments for **USBT 407: ENTERPRENUERSHIP DEVELOPMENT Semester 4** should be submitted on **25th February 2023** without fail to Asst. Prof. Ketki Rahalkar. The following assignment will be for 20 marks

The Roll nos. and the topics are distributed below:

Groups	Roll numbers	Topics for assignment
1	94001-94010	Organoveggies.Waste management industry, side foods
2	94011-94021	Organoveggies, Waste management industry, World of cosmetics
3	94022-94031	Sidefoods , Waste management industry, organoveggies
4	94032-94040	Sidefoods , Waste management industry, World of cosmetics

NOTE: ASSIGNMENTS ARE COMPULSORY FOR ALL S.Y. BIOTECHNOLOGY STUDENTS.

Shilpa P.

SIGNATURE

Head of the Department

BIOTECHNOLOGY DEPARTMENT

Academic Council:

Item No:

UNIVERSITY OF MUMBAI



Syllabus for S.Y.B.Sc.

(Restructured)

Programme: B.Sc.

Course: Biotechnology

with effect from the academic year

2017 – 2018

SEMESTER- III				
Course code	Course type	Course Title	Credits	Lectures/ Week
USBT301	Core Subject	Biophysics	2	3
USBT302	Core subject	Applied Chemistry- I	2	3
USBT303	Core Subject	Immunology	2	3
USBT304	Core Subject	Cell Biology and Cytogenetics	2	3
USBT305	Core Subject	Molecular Biology	2	3
USBT306	Skill enhancement elective	Bioprocess Technology	2	3
USBT307	General Elective	Research Methodology	2	3
USBTP301	Core subject Practicals	Practicals of USBT301 and USBT302	2	6
USBTP302	Core subject Practicals	Practicals of USBT303 and USBT304	2	6
USBTP303	Core Subject and Skill enhancement elective Practicals	Practicals of USBT305 and USBT306	2	6
SEMESTER-IV				
Course code	Course type	Course Title	Credits	Lectures/ Week
USBT401	Core Subject	Biochemistry	2	3
USBT402	Core subject	Applied Chemistry- II	2	3
USBT403	Core Subject	Medical Microbiology	2	3
USBT404	Core Subject	Environmental Biotechnology	2	3
USBT405	Core Subject	Biostatistics and Bioinformatics	2	3
USBT406	Skill enhancement elective	Molecular Diagnostics	2	3
USBT407	General Elective	Entrepreneurship Development	2	3
USBTP401	Core subject Practicals	Practicals of USBT401 and USBT402	2	6
USBTP402	Core subject Practicals	Practicals of USBT403 and USBT404	2	6
USBTP403	Core Subject and Skill enhancement elective Practicals	Practicals of USBT405 and USBT406	2	6

SEMESTER III

Course Code	Title	Credits	No. of Lectures	Notional hours
USBT301	BIOPHYSICS	2		
<p>Course objectives:- The objective of this course is to have a firm foundation in the fundamentals and applications of current biophysical theories.</p> <p>Learning outcomes:- By the end of the course the student will:</p> <ul style="list-style-type: none"> develop an understanding of the different aspects of classical physics. be able to relate principles of physics to applications and techniques in the field of biology such as microscopy, spectroscopy and electrophoresis. 				
<p>UNIT I Optics and Electromagnetic Radiations</p>	<p>Introduction to Optics and Lasers: <i>Optics :</i> Properties of Light - Reflection, Refraction, Dispersion, Interference. <i>Lasers :</i> Properties of Lasers, Stimulated Emissions, Laser Action; Applications of Laser. Electromagnetic Radiations: Introduction to Electromagnetic Radiation. Spectroscopy : Types and Properties of Spectra; Basic Laws of Light Absorption. Spectrophotometer:-Principle, Instrumentation and Applications; UV-Vis Spectrophotometer, Single and Dual Beam Spectrophotometer. Microscopy: Types of Microscopy; Electron Optics; Electron Microscopy- Preparation of Specimen, SEM, TEM and Immuno-Electron Microscopy. Fluorescence Microscopy.</p>		15	
<p>UNIT II Heat, Sound, Magnetism and Fluid Dynamics</p>	<p>Heat: Concept of Temperature; Modes of Heat Transfer; Measuring Temperature; Platinum Resistance Thermometer; Thermocouple and Thermistors. Sound: Types of Sound Waves - Audible, Ultrasonic and Infrasonic Waves; Doppler Effect; Applications of Ultrasonic Waves. Magnetism: Magnetic Field; Magnetism of Earth; Paramagnetism, Diamagnetism, Ferromagnetism. Nuclear Magnetism and Biomagnetism.</p>		15	

	<p>Fluid Dynamics :</p> <p>Viscosity: Definition Flow of Liquids through Capillaries; Stokes' Law; Terminal Velocity. Determination of 'η' by Falling Sphere Method; Viscosity Estimation by Oswald's Viscometer.</p> <p>Surface Tension: Definition - Surface Tension and Surface Energy; Capillary Action; Angle of Contact; Wettability; Temperature Dependence of Surface Tension. Applications in Biology.</p>			
UNIT III Electrophoretic Techniques	<p>Electrophoresis: Migration of Ions in an applied electric field; Factors affecting Electrophoretic Mobility; Moving Boundary Electrophoresis; Principle of Electrophoresis; Supporting Matrix; Paper electrophoresis; AGE; Native and SDS PAGE (reducing and non-reducing, continuous and discontinuous); IEF and 2D PAGE. Staining and Detection methods; Gel-Documentation. Applications in Biology.</p>		15	

Course Code	Title	Credits	No. of Lectures	Notional hours
USBT302	APPLIED CHEMISTRY –I	2		
<p>Course objectives:- The objective of this course is to have a firm foundation in the fundamentals and applications of organic and green chemistry.</p> <p>Learning outcomes:- By the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • develop an understanding of the different aspects of organic and green chemistry. • discuss role of organic compounds in biology and synthesis of organic compounds. • discuss role of green chemistry and its application in industry. 				
UNIT I Organic Chemistry	<p>Introduction to Types of Organic Reactions : Addition, Elimination and Substitution Reactions. Essential and Non-essential Elements in Biological Systems. Role of Metal Ions in Biological Systems.</p> <p>Metal Coordination in Biological Systems : Enzymes, Apoenzymes and Coenzymes. Biological Role of Metalloenzymes wrt Myoglobins, Haemoglobin. Biological Role of Carboxypeptidases, Catalases and Peroxidases.</p>		15	

	Structure and Function : Dioxygen Binding, Transfer and Utilization; Metal Complexes in Medicines.			
UNIT II Synthesis of Organic Compounds	Synthesis of Organic Compounds : Criteria for Ideal Synthesis; Selectivity and Yield. Linear and Convergent Synthesis and Multicomponent Reactions. Microwave Assisted Organic Synthesis, Ultrasound in Synthesis and Polymer supported Synthesis. Retrosynthesis.		15	
UNIT III Green Chemistry and Synthesis	Green Chemistry and Synthesis: Introduction to Green Chemistry; Need and Relevance of Green Chemistry; Principles of Green Chemistry. Green Synthesis in Industry: Green Materials, Green Reagents, Green Solvents and Green Catalysts.		15	

Course Code	Title	Credits	No. of lectures	Notional hours
USBT303	IMMUNOLOGY	2		
<p>Course objectives:- The objective of this course is to familiarize students with the immune effector mechanisms and various immunotechniques.</p> <p>Learning outcomes:- By the end of the course the student will be able to:</p> <ul style="list-style-type: none"> understand the role of different types of cells, effector molecules and effector mechanisms in immunology. understand the principles underlying various immunotechniques. 				
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		15	
UNIT II Cell Receptors	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 III Immuno- Techniques	<p>Precipitation Reactions : Immunoprecipitation, Immunoelectrophoresis, CIEP, Rocket Electrophoresis and 2-D Immunoelectrophoresis.</p> <p>Agglutination Reactions : Passive, Reverse Passive, Agglutination Inhibition. Coomb's Test; Complement Fixation Tests, RIA, ELISA, ELISPOT, Chemiluminescence, Western Blot, Immunofluorescence, Flow Cytometry.</p> <p>Alternatives to Antigen-Antibody Reactions.</p>		15	
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Course Code	Title	Credits	No. of lectures	Notional hours
USBT304	CELL BIOLOGY AND CYTOGENETICS	2		

Course objectives:-

The objective of this course is to have a firm foundation in the fundamentals of cell biology and cytogenetics.

Learning outcomes:- By the end of the course the student will be able to:

- develop an understanding of the cytoskeleton and cell membrane.
- discuss the structure of chromosomes and types of chromosomal aberrations.
- discuss the principles underlying sex determination, linkage and mapping.

UNIT I Cytoskeleton	<p>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. Motor Protein: Myosin. Muscle Contractility: Sliding Filament Model. Actin Binding Proteins : Examples of Non-Muscle Motility. Intermediate Filaments :Structure and Composition; Assembly and Disassembly; Types and Functions.</p>		15	
UNIT II Cell Membrane	<p>Cell Membrane : Uptake of Nutrients by Prokaryotic Cells; Cell Permeability. Principles of Membrane Transport-Transporters and Channels; Active Transport,</p>		15	

	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.			
UNIT III Cytogenetics	<p>Cytogenetics : Structure of Chromosome - Heterochromatin, Euchromatin, Polytene Chromosomes.</p> <p>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.</p> <p>Sex Determination and Sex Linkage : Mechanisms of Sex Determination (XX-XY, ZZ-ZW, XX-XO) Dosage Compensation and Barr Body.</p> <p>Genetic Linkage, Crossing Over and Chromosomal Mapping : Tetrad Analysis; Two-point Cross; Three-point Cross; Pedigree Analysis.</p>		15	

Course Code	Title	Credits	No. of Lectures	Notional hours
USBT305	MOLECULAR BIOLOGY	2		
<p>Course objectives:- The objective of this course is to have an insight into mechanism of gene expression and regulation.</p> <p>Learning outcomes:- By the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • discuss the mechanisms associated with gene expression at the level of transcription and translation. • discuss the mechanisms associated with regulation of gene expression in prokaryotes and eukaryotes 				
UNIT I Gene Expression- Transcription	<p>Gene Expression- an Overview.</p> <p>Transcription Process in Prokaryotes : RNA Synthesis; Promoters and Enhancers; Initiation of Transcription at Promoters; Elongation and Termination of an RNA Chain.</p> <p>Transcription in Eukaryotes : Eukaryotic RNA Polymerases; Eukaryotic Promoters; Transcription of Protein Coding Genes by RNA Polymerase; Eukaryotic mRNA's; Transcription of other genes;</p>		15	

	Spliceosomes; RNA editing.			
UNIT II Gene Expression- Translation	Nature of Genetic Code. Wobble Hypothesis. Translation : Process of Protein Synthesis (Initiation, Elongation, Translocation, Termination); Post Translation Modifications. Protein sorting.		15	
UNIT III Regulation of Gene Expression	In Prokaryotes: In Bacteria : <i>lac</i> Operon of <i>E.coli</i> ; <i>trp</i> Operon of <i>E.coli</i> . In Viruses : Lytic / Lysogenic Regulation In Eukaryotes : Operons in Eukaryotes; Control of Transcriptional Initiation; Gene Silencing and Genomic Imprinting; Post-Transcriptional Control; RNA Interference.		15	

Course Code	Title	Credits	No. of Lectures	Notional hours
USBT306	BIOPROCESS TECHNOLOGY	2		
Course objectives:- The objective of this course is to understand the basics skills applied in fermentation technology and build a foundation for more advanced studies in bioprocess technology. Learning outcomes:- By the end of the course the student will be able to:				
<ul style="list-style-type: none"> • develop an understanding of the various aspects of bioprocess technology. • develop skills associated with screening of industrially important strains. • understand principles underlying design of fermentor and fermentation process. 				
UNIT I Microorganisms in Industrial Processes	Types of Microorganisms used in Industrial Processes : Bacteria, Actinomycetes, Fungi and Algae. Screening and maintenance of strains: Primary Screening and Secondary Screening; Cultivation; Preservation of Industrially Important Microbial Strains.		15	
UNIT II Fermentor and Fermentation Processes	Design of a fermentor : Stirred Tank Fermentor- Basic Design; Parts of a Typical Industrial Fermentor. Fermentation Media : Components; Design and Optimization. Sterilization : Sterilization of Fermentor and Fermentation Media.		15	

	<p>Process Parameters : pH, Temperature, Aeration, Agitation, Foam, etc.</p> <p>Types of Fermentation : Surface and Submerged; Batch and Continuous, Aerobic and Anaerobic.</p> <p>Product Isolation and Purification.</p> <p>Study of representative fermentation processes : Outline of Penicillin and Ethanol Production by fermentation along with a flow-diagram.</p>			
<p>UNIT III <i>In-vivo and In-vitro</i> Assay of Industrial Products</p>	<p>Assay of Industrial Products: Chemical and Biological; Types and Subtypes; Kinetics. Advantages and Disadvantages. Half-Life Determination of Pharmacological Products. Bioavailability and Bioequivalence Studies</p>		15	

Course Code	Title	Credits	No. of Lectures	Notional hours
USBT307	RESEARCH METHODOLOGY	2		
<p>Course objectives:- The objective of this course is to develop research aptitude, logical thinking and reasoning. Learning outcomes:- By the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • understand basic principles of research methodology and identify a research problem. • understand a general definition of research design. • identify the overall process of designing a research study from its inception to its report. 				
<p>UNIT I Introduction to Research Methodology and Research Problem</p>	<p>Meaning of Research; Objectives of Research; Motivation in Research; Types of Research; Research Approaches; Significance of Research; Research Methods versus Methodology; Research Process; Criteria of Good Research; Problems Encountered by Researchers in India; What is a Research Problem? Selecting the Problem; Necessity of Defining the Problem; Technique Involved in Defining a Problem</p>		15	
<p>UNIT II Research Design and Data Collection</p>	<p>Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design; Different Research Designs; Basic Principles of Experimental Designs; Developing a Research Plan- Collection of Primary Data; Observation Method; Interview Method; Collection of Data through Questionnaires; Collection of Data through Schedules; Other Methods of Data Collection, Collection of Secondary Data,</p>		15	

	Selection of Appropriate Method for Data Collection, Case Study Method			
UNIT III Interpretation and Report Writing	Meaning of Interpretation, Why Interpretation?, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.		15	
Internal Evaluation	Submission of Research Report/ Project/ Case Study/ Assignment			

PRACTICALS

SEMESTER III		
Course code	Title	Credits
USBTP301 (PRACTICALS based on USBT301 and USBT302)	<ol style="list-style-type: none"> 1. Study of Absorption Spectra of Coloured Compounds (CuSO₄, CoCl₂, KMnO₄). 2. Verification of Beer-Lambert's Law. 3. Extraction of Plasmid DNA and Separation by Agarose Gel Electrophoresis. 4. Determination of Purity of Plasmid DNA using UV Spectrophotometry. 5. Study of the Structure and Function of an Electron Microscope (Visit / Video Demonstration - including Sample Preparation and Staining). 6. Demonstration of Structure and Working of a Fluorescence Microscope (Stained Preparation). 7. Electrophoresis of Proteins by PAGE and SDS-PAGE. 8. Purification of any TWO Organic Compounds by Recrystallization Selecting Suitable Solvent. 9. Organic Estimations: Acetone, Amide, Benzoic Acid. 10. Organic Preparations : <ol style="list-style-type: none"> a) Acetylation of Primary Amine (Preparation of Acetanilide). b) Base Catalysed Aldol Condensation (Synthesis of Dibenzalpropanone). 	2
Course code	Title	Credits
USBTP302 (PRACTICALS based on USBT303 and USBT304)	<ol style="list-style-type: none"> 1. Complement Fixation Test (CFT). 2. Passive Agglutination- RA Factor Test. 3. Immunoelectrophoresis. 4. ELISA (Kit-based) - HEPALISA. 5. DOT-ELISA. 6. Western Blotting - Demonstration. 7. Flow Cytometry - Lab Visit. 8. Study of Chromosomal Aberrations- Deletion, Duplication, Inversion, Translocation and Syndromes- Trisomy 21 Trisomy 13 Trisomy 18, Klinefelter and Turner, Cri-du-Chat. 	2

Department of Biotechnology

S.Y.B.Sc FC project submission 22-23 Semester 3

SR No	Roll no	Name of student	Project title	Signature
1	94001	Priti Mourya	Waste Management Industry	<u>Priti</u>
2	94002	Gouri Raut	Waste Management Industry	<u>Gouri</u>
3	94003	Nidhi Poojari	Waste Management Industry	<u>Nidhi</u>
4	94004	Alakanandha Edachali	Side foods	<u>Alakananda</u>
5	94005	Ajmi Khan	Side foods	<u>Ajmi</u>
6	94006	Pratibha Vishwakarma	Side foods	<u>P. Vishwakarma</u>
7	94007	Girija Patil	Organoveggies	<u>Girija Patil</u>
8	94008	Hrishikesh Palave	Organoveggies	<u>Hrishikesh</u>
9	94009	Rai Vani Datt Ashok Kumar	Waste Management Industry	<u>Vani Rai</u>
10	94010	Om Prajapati	Waste Management Industry	<u>Om</u>
11	94011	Raghvendra Dubey	Waste Management Industry	<u>Raghav</u>
12	94012	Shivam Shingre	Waste Management Industry	<u>Shivam</u>
13	94013	Vedant Gharat	Waste Management Industry	<u>Vedant</u>
14	94014	Divya Gawad	Organoveggies	<u>Divya</u>
15	94015	Aakanksha Behere	Organoveggies	<u>A. Behere</u>
16	94016	Raina Pal	Organoveggies	<u>R. Pal</u>
17	94017	Shreyash Dixit	Organoveggies	<u>Shreyas</u>
18	94018	Karnavi Patel	Side foods	<u>Karnavi</u>
19	94019	Preeti Singh	Side foods	<u>P. Singh</u>
20	94020	Khushboo Yadav	Cosmetic Industry	<u>Khushboo</u>
21	94021	Ashish Vishwakarma	Cosmetic Industry	<u>Ashish</u>
22	94022	Yadnyesh	Side foods	<u>Yadnesh Atkar</u>
23	94023	Disha Naudiyal	Side foods	<u>D. Naudiyal</u>
24	94024	Anisha Bhoir	Side foods	<u>Anisha Bhoir</u>
25	94025	Sarika Sharma	Cosmetic Industry	<u>Sarika</u>
26	94026	Chandrabhan Shukla	Cosmetic Industry	<u>C. Shukla</u>
27	94027	Mayur Dhangada	Waste Management Industry	<u>Mayur D.</u>
28	94028	Khushbu	Organoveggies	<u>Khushbu</u>
29	94029	Riddhi Sankhe	Organoveggies	<u>Riddhi</u>
30	94030	Laxmi Singh	Organoveggies	<u>Lakshmi Singh</u>
31	94031	Roshani Sumada	Side foods	<u>Roshani</u>
32	94032	Jitu Karbat	Side foods	<u>Jitu Karbat</u>
33	94033	Tamanna Bhoir	Cosmetic Industry	<u>T. Bhoir</u>
34	94034	Princi Tiwari	Cosmetic Industry	<u>Princi</u>
35	94035	Shivanshu Tiwari	Cosmetic Industry	<u>Shivanshu</u>
36	94036	Neha Khan	Cosmetic Industry	<u>Neha Khan</u>
37	94037	Isha Gharat	Cosmetic Industry	<u>Isha Gharat</u>
38	94038	Dhara Solanki	Waste Management Industry	<u>Dhara</u>
39	94039	Om Raut	Waste Management Industry	<u>Om</u>
40	94040	Sanika Gaikwad	Side foods	<u>Sanika</u>