

MRSPTU B.Sc. BIOTECHNOLOGY SYLLABUS 2016 BATCH ONWARDS
(Approved in 1st MRSPTU Standing Committee of Academic Council on 20.12.2016)

B.Sc. Biotechnology (1st YEAR)

Total Contact Hours = 27

Total Marks = 800

Total Credits = 25

SEMESTER 1 st		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BBOT1-101	Cell Biology	4	0	0	40	60	100	4
BBOT1-102	Genetics	4	0	0	40	60	100	4
BBOT1-103	Organic Chemistry	4	0	0	40	60	100	4
BBOT1-104	Basics of Biosciences	4	0	0	40	60	100	4
BCAP0-195	Computer Applications	4	0	0	40	60	100	4
BBOT1-105	Organic Chemistry Lab	0	0	2	60	40	100	1
BBOT1-196	Computer Applications Lab	0	0	2	60	40	100	1
BMAT0-102/BBIO0-103	*Mathematics/Life Sciences	3	0	0	40	60	100	3
Total	Theory = 6 Labs = 2	23	0	4	360	440	800	25

*Compulsory Deficiency Course for 10+2 students with Mathematics/Biology and to be awarded as satisfactory and non- satisfactory during their final results,

**No credits will be allotted being the deficiency courses

B. Sc. BIOTECHNOLOGY (1st Year)

Total Contact Hours = 26

Total Marks = 800

Total Credits = 24

SEMESTER 2 nd		Contact Hrs			Marks			Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.	Total	
BBOT1-206	Communication Skills	2	0	0	40	60	100	2
BBOT1-207	Fundamentals of Biotechnology	4	0	0	40	60	100	4
BBOT1-208	Microbiology	4	0	0	40	60	100	4
BBOT1-209	Inorganic & Physical Chemistry	4	0	0	40	60	100	4
BBOT1-210	Biochemistry- I	4	0	0	40	60	100	4
BBOT1-211	Techniques in Biotechnology	4	0	0	40	60	100	4
BBOT1-212	Microbiology Laboratory	0	0	2	60	40	100	1
BBOT1-213	Inorganic & Physical Chemistry Laboratory	0	0	2	60	40	100	1
Total	Theory = 6 Labs = 2	22	0	4	360	440	800	24

CELL BIOLOGY

Subject Code: BBOT1-101

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To understand the basic concepts related to cell and its functions.

UNIT-1 (9 Hrs.)

Cell as a basic unit of life

Cell theory and detailed classification of cell types with in an organism. Different levels of organization of cells and cell organelles.

UNIT-II (12 Hrs.)

Cell division and cell cycles

Cell cycle, Mitosis and Meiosis, binary fission, amitosis, molecular organization of mitotic spindle apparatus, cell cycle regulation and carcinogenesis.

UNIT-III (11 Hrs.)

Biochemical compositions of cells

Proteins, lipids, carbohydrates, nucleic acids and metabolic pool and biological membranes.

UNIT-IV (13 Hrs.)

Cellular interactions

Cell recognition and cell coat; differentiation of cell membrane; inter cellular communication and gap junctions.

Recommended Books

1. E.D.P. De Robertis, E.M.F. Jr. De Robertis, 'Cell and Molecular Biology', 8th Edn., Publisher Lea & Febiger.
2. H.F. Lodish., A. Berk., C.A. Kaiser, M. Krieger, M.P. Scott, 'Molecular Cell Biology', 6th Edn., W.H. Freeman & Co.

GENETICS

Subject Code: BBOT1-102

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

Imparting knowledge about the genetic material, their structure, functions and existence in prokaryotes and eukaryotes.

UNIT-1 (11 Hrs.)

Organization of Chromosomes

The structure of prokaryotic and eukaryotic chromosome, centromere and telomere structure, euchromatin and heterochromatin, special chromosomes: polytene Chromosomes and lampbrush chromosomes, satellite DNA, the supercoiling of DNA, detail structure of chromosome consisting of histones, nucleosomes and scaffold proteins.

UNIT-II (13 Hrs.)

Mendel's Law of Inheritance

Principle of segregation and independent assortment, monohybrid, dihybrid and trihybrid crosses, Back cross and test cross. Interaction of Genes: Incomplete inheritance and CO-dominance, pleiotropism, modification of F₂ ratios: epistasis, complementary genes, supplementary genes, inhibitory genes, duplicates genes, lethality and collaborators genes. Multiple allelism.

UNIT-III (9 Hrs.)

Linkage & Crossing over

Coupling and repletion hypothesis, chromosomal theory of linkage, complete and incomplete linkage, linkage groups and significance of linkage. Introduction, mechanism of meiotic crossing over, type of crossing over, factors affecting it and its significance, Hardy Weinberg Law.

UNIT-IV (12 Hrs.)

Mutation & Microbial Genetics Spontaneous versus induced mutations, types of mutations, mutations rate and frequency, mutagens: physical and chemical, the molecular basis of mutations. Significance & Practical application of mutation. Conjugation, transduction, transformation

Recommended Books

1. S.R. Maloy, J.E. Crown and D. Freifelder, 'Microbial Genetics', 2nd Edn., Jones & Bartlett Publishers, 1994.
2. D.L. Hartl, 'Genetics', 3rd Edn., Jones & Bartlett Publishers, 1994.
3. R.J. Brooker, 'Genetics Analysis and Principles', Jim Green, 1999.
4. A.G. Antherly, J.R. Girton, 'The Science of Genetics', Harcourt College Publishers, 1999.
5. D. Freifelder, 'Microbial Genetics', Narosa Publishing House, 2000.
6. D.L. Hartl, E.W. Jones, 'Genetics; Analysis of Genes & Genomes', 5th Edn., Jones & Bartlett Publishers, 2001.
7. P.K. Gupta, 'Genetics', Rastogi Publications, 2007.
8. Snustad and Simmons (2010) Principles of Genetics: 5th Edn., John Wiley & Sons.

ORGANIC CHEMISTRY

Subject Code: BCHM0-10

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To learn about the basic of organic chemistry and their role in daily life.

UNIT-1 (11 Hrs.)

Structure and properties of organic compounds: Ionic and covalent bonds, atomic orbitals, electronic orbital, molecular orbitals, covalent bond length and angles, hybrid orbitals- double and triple bonds.

UNIT-II (13 Hrs.)

Isomerism: Geometric isomerism, free rotation about single bond, conformational isomers, polarity of bonds and molecules, structure and physical properties of organic compounds, solubility, stereochemistry, optical activity, enantiomers and optical activity, chiral centre, stereoisomers, racemization.

UNIT-III (9 Hrs.)

Different types of Organic Compounds: Structure and properties of alkanes, alkyl halides, alkenes, alkynes, aliphatic cyclic compounds, aromatic compounds, resonance structures.

UNIT-IV (12 Hrs.)

Functional Groups and Reaction Mechanisms: Free radical reaction mechanism, nucleophilic and electrophilic substitution, organic molecules with different functional groups; alcohols, aldehydes, esters, ethers, primary, secondary and tertiary amines, amides.

Recommended Books

1. R.T. Morrison and R.N. Boyd, 'Organic Chemistry', 6th Edn., Prentice-Hall of India, Pvt Ltd., 2006.
2. I.L. Finar, 'Organic Chemistry', Vol. 1 and 2, 6th Edn., Pearson Education.

BASICS OF BIOSCIENCES

Subject Code: BBOTI-103

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To impart basic knowledge about the Bio- world in relation to their types, structure and growth.

UNIT-1 (13 Hrs.)

Diversity in the living world: Biotechnological values of biodiversity, five kingdom classification of living world, classification of plants & animals in general.

UNIT-II (17 Hrs.)

Structural Organization in Plants & Animals: Morphology of flowering plants (Root, stem, Inflorescence, flower, fruit, seed) Semi-technical description of a flower plant. Anatomy of plants (Tissues, anatomy of dicots & monocots). Structural organisation in animals (Animal tissues, organ & organ system)

UNIT-III (15 Hrs.)

Cell Structure, Functions & Biomolecule: Cell theory, overview of Prokaryotes/Eukaryotes, Plant cell/Animal cell. Bio macromolecules- Proteins, polysaccharides, nucleic acids, nature of bond linking monomers in a polymer, metabolism concept, Cell cycle, Mitosis & Meiosis.

Recommend Books

1. K.N. Bhatia & M. Tyagi, 'Trueman's Elementary Biology Vol. 1', Trueman Book Publishers.
2. B.B. Arora & A.K. Sabharwal, 'Modern abc of Biology', Modern Publications.

COMPUTER APPLICATIONS

Subject Code: BCAP0-195

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To give basic knowledge about the various parts of the computer in terms of their functions.

UNIT-1 (13 Hrs.)

Computer Fundamentals: Block structure of a computer, characteristics of computers, problem solving with computers, generations of computers, and classification of computers, Memory Types; Magnetic core, RAM, ROM, Secondary, Cache, Bubble Memory, Input and Output Units; Keyboard, Mouse, Monitor (CRT, LCD & LED), Light pen, joystick, Mouse, Touch screen; OCR, OMR, MICR, Overview of storage devices; Floppy Disk, hard disk, compact disk, tape, Pen drives, Memory Card and Types, Printers;

Impact, non-impact, working mechanism of Drum printer, Dot Matrix printer, Inkjet printer and Laser printer.

UNIT-II (9 Hrs.)

Graphical OS: Operating System and its types, Fundamentals of windows, types of windows, anatomy of windows, windows explorer, customizing windows, control panel, taskbar setting, Network, Internet and its Applications; E-mail, World Wide Web, Search Engines, Web Browsers, Internet, Audio and Video chatting, Video and audio Conferences, uploading and Downloading of files from the web.

UNIT-III (11 Hrs.)

Word Processing: Examine word processing concepts and explore the Microsoft Office Word environment, create a new document, open, save and print a document. Edit and format text. Change the page layout, background and borders. Insert headers and footers. Insert and edit tables. Insert clip art and pictures to documents. Perform a mail merge. Share and review shared document files. Editing features, formatting features, saving, printing, table handling, Graph preparation, page settings, spell-checking, macros, mail-merge, and equation editors.

UNIT-IV (12 Hrs.)

Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, Graph preparation, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs, Presentation Graphics Software; Introduction to PowerPoint, what is PowerPoint? Create new presentations from scratch, using beautiful template, working with Shapes and Pictures, Adding Objects and Effects, Outlining Proofing and Printing, Delivering Your Presentation.

Recommended Books

1. Sunita Goel, 'Computer Fundamentals', Pearson.
2. Anupam Jain and Avneet Mehra, 'Computer Fundamental MS Office: Including Internet & Web Technology'.
3. P.K. Sinha, 'Introduction to Computers', BPB Publications.
4. Raymond Greenlaw, 'Fundamentals of the Internet & the World Wide Web'.
5. Sunjay Saxsena, 'Introduction to Computers and MS office'.

ORGANIC CHEMISTRY LAB

Subject Code: BCAP0-196

L T P C
0 0 2 1

Duration: 24 Hrs.

1. Synthesis of organic compounds (Aspirin / para-bromoacetanilide / anthraquinone)
2. Determination of melting points (Naphthalene / Benzoic acid / Urea / Succinic acid / Salicylic acid / Aspirin)
3. Determination of boiling points (Ethanol / Cyclohexane / Toluene)
4. Crystallization of Phthalic acid from hot water
5. Complete identification including derivation of following organic compounds: Aromatic hydrocarbons, Aldehydes, Ketones, Carbohydrates, Amides, Amines, Carboxylic acids and phenols.

Recommended Books

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(Approved in 1st MRSPTU Standing Committee of Academic Council on 20.12.2016)

1. W. Moor, A. Winston, 'Laboratory Manual for Organic Chemistry: A Microscale Approach', Publishers Mc- Graw Hill Science.
2. D.L. Pavia, G.M. Lampanana, G.S. Kriz Jr., 'Introduction to Organic Laboratory Techniques', 3rd Edn., Pubs: Thomson Brooks/Cole, 2005.
3. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, 'Vogel's Text Book of Practical Organic Chemistry', 5th Edn., Pubs: ELBS.

COMPUTER APPLICATION LAB

Subject Code: BCAP0-196

L T P C
0 0 2 1

Duration: 24 Hrs.

Introduction to Personal Computing:

1. Introduction to Computer Hardware and Peripherals.
2. Familiarization with Windows Operating System
3. Working with Files and Folders (Cut, Copy, Paste etc.)
4. Desktop Personalization using Control Panel (Changing wallpaper, Screen Saver, Screen Resolution, Mouse Pointer, speed etc.)
5. Working with Notepad, Calculator, Paint and utilities programs.

Introduction to Word:

1. Introduction to Word and its basic editing
2. Text Formatting, Copying and moving text and objects
3. Working with tables and its formatting
4. Working with paragraph and Clipboard
5. Send Emails using Mail Merge and create hyperlinks in it.
6. Printing documents with header and footers

Introduction to Spreadsheets:

1. Introduction to Spread Sheets and its basic editing
2. Modifying Spreadsheets, formatting cells
3. Working with formula and functions,
4. Working with Charts and Graphs
5. Sorting and filtering with different Conditions
6. Printing selected cells and sheets

Introduction to Power Point:

1. Introduction to PowerPoint and its basic Features
2. Working with slides, adding template and contents to slides
3. Working with charts, Graphs and Tables in Slides
4. Adding animations, Videos and Audio to slides
5. Printing of Presentation
6. Creating a full Presentation with all features of PowerPoint.

Introduction to Internet:

1. Introduction to Internet and its Benefits
2. Browsing Internet with Internet Explorer, Firefox and Chrome with Bookmarks
3. Creating and Using Email, Text, Audio and Video Messages/ chat. Placing Video and PC to PC Calls.
4. Downloading files using Different Web Browsers such as Rar, ZIP. docs, exe etc.,
5. Printing of Web Pages

Recommended Books

1. Sunita Goel, 'Computer Fundamentals', Pearson.
2. Anupam Jain and Avneet Mehra, 'Computer Fundamental MS Office: Including Internet & Web Technology'.
3. P.K. Sinha, 'Introduction to Computers', BPB Publications.
4. Raymond Greenlaw, 'Fundamentals of the Internet & the World Wide Web'.
5. Sunjay Saxena, 'Introduction to Computers and MS Office'.

MATHEMATICS

Subject Code: BMAT0-102

L T P C
3 0 0 3

Duration: 36 Hrs.

Learning Objectives

1. The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects.
2. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

UNIT-1 (7 Hrs.)

Algebra: Arithmetic and Geometric progression, Linear and quadratic equations, complex numbers, polar representation of a complex number, square root of a complex number.

UNIT-II (10 Hrs.)

Coordinate Geometry and Trigonometry: Rectangular Coordinate system, Straight lines, Circles. Trigonometric functions, sum and product formulae for trigonometric functions, trigonometric equations and C- D formulae for trigonometric functions, identities related to $\sin(2x)$, $\cos(2x)$ and $\tan(2x)$.

UNIT-III (8 Hrs.)

Determinants and Matrices: Matrices, Operations on Matrices, Determinants and its properties, singular and non-singular matrices, Adjoint and inverse of a matrix and its properties, Solution of system of linear equations using Cramer's rule and inverse of a matrix.

UNIT-IV (11 Hrs.)

Calculus (Differentiation & Integration): Differentiation, review of sets, relations and functions, limit, continuity and differentiability, differentiation of standard functions (polynomials, trigonometric, inverse trigonometric exponentials and logarithmic); product rule, quotient rule, applications of derivatives in Graphing, maxima and minima. Integration - Integral as anti-derivative, integration by substitution, partial fractions and by parts. Definite integral and its properties, areas of bounded regions.

Recommended Books

1. 'Mathematics, A Text Book', (Parts I & II), NCERT, New Delhi, 2011.
2. G.B. Thomas and R.L. Finney, 'Calculus and Analytical Geometry', 10th Edn., Pearson Education, 2007.
3. S. Narayan, 'Differential and Integral Calculus', S. Chand, 2005.
4. N.P. Bali, 'Engineering Mathematics', Laxmi Publications.

LIFE SCIENCES

Subject Code: BBIO0-103

L T P C
3 0 0 3

Duration: 36 Hrs.

Learning Objectives

To understand the real concepts of biology in relation to study of the various body parts and their role.

UNIT-1 (8 Hrs.)

Biological Diversity: Diversity in the living world, Outline classification of plants, animals & microorganisms: Important criteria used for classification in each taxon. Classification of plants, animals and microorganisms. Evolutionary relationships among taxa.

UNIT-II (10 Hrs.)

Plant Physiology: Structural organization in plants, Anatomy of plants. Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Outbreeding devices; Pollen-Pistil interaction; Double fertilization; Post fertilization Events-Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixes, parthenocarpy, polyembryony; Significance of seed and fruit formation.

UNIT-III (8 Hrs.)

Chemical Structures and their role in Biology: Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins; Structural organization in animals. Structural organization in animals – animal tissues, morphology and anatomy of animals.

UNIT-IV (10 Hrs.)

Cellular Organization: Membrane structure and function (Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes). Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility). Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle). Microbial Physiology (Growth yield and characteristics, strategies of cell division, stress response).

Recommended Books

1. Rastogi and Dubey, 'Life Sciences', S. Chand and Co., N. Delhi, 2001.
2. Sobti and Sharma, 'Basics of Bio-Tech.: Introduction to Life Sciences', Vishal Publishing Co. Jalandhar, 2005.
3. R.C. Sobti, 'Animal Physiology', Narosa Publishings, N. Delhi.
4. Bhatia and Tyagi, 'Trueman's Elementary Biology', Trueman Book Company Publishers.
5. Arora and Sabharwal, 'Modern Biology'.

COMMUNICATION SKILLS

Subject Code: BBOT1- 206

L T P C
2 0 0 2

Duration: 24 Hrs.

Learning Objectives

The objective of this course is to make students understand that both oral & written communication is equally important.

UNIT-I (6 Hrs)

Basics of Technical Communication

Meaning, Internal & External functions, Shannon & weaver's model of Communication, Importance of Communication Barriers to communication & ways to improve these barriers, Essentials (7c's & other principles)

UNIT-II (4 Hrs)

Writing Skills

Writing styles of applications, resume & CV, Personal letters, Official/Business letters, Memo, Notice, Report writing, Project writing, Quotation & Tender.

UNIT-III (6 Hrs)

Speaking Skills

Presentation Techniques, Principles of Presentation, Types of Interview, G.D, Extempore speaking, Speech Mechanism, Organs of speech, Production & Classification of Speech sounds, skills of effective speaking.

UNIT-IV (8 Hrs)

Tech Communication & Listening Skills

MS Word, Excel, PowerPoint, Process, Types of listening, Barriers to effective listening, Barriers to effective listening & ways to improve these Barriers

Recommended Books

1. Loveleen Kaur, 'Communication Skills', Satya Prakashan Publication.
2. Narinder Kumar Bodhraj, 'Business Communication', Kalyani Publishers, 2011.
3. S.P. Dhanavel, 'English & Communication Skills for the Students of Science & Engineering', (with audio C.D) Orient Blackswan Publication, 2009.
4. Indrajit Bhattacharya, 'An Approach to Communication Skills'.
5. Wright, Chissie, 'Handbook of Practical Communication Skills'.

FUNDAMENTALS OF BIOTECHNOLOGY

Subject Code: BBOT1- 207

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

1. Students will learn the basics and applied areas of biotechnology.

UNIT- I (11 Hrs)

Role of Microbes in Biotechnology

Advent, scope and basis of biotechnology. Bacteria as work horses of biotechnology, E-coli as the model bacteria. Role of yeast, viruses and bacteriophages in biotechnology.

UNIT- II (13 Hrs)

Introduction to Bioinformatics & Biotechnological Techniques

Introduction to genomics, transcriptomics, proteomics and metabolomics; bioinformatics and its role in biotechnology. Introduction to basic techniques like sterilization, centrifugation, electrophoresis, chromatography, sonication, lyophilisation, basic microscopy, radioscopy, spectroscopy. Fundamentals of recombinant DNA technology: restriction enzymes, vectors and their properties.

UNIT-III (12 Hrs)

Applications of Biotechnology

Biotechnology in fermentation and pharmaceutical processes. Green technology to control pollution. Role of biotechnology in diagnostics, introduction to gene therapy.

UNIT-IV (9 Hrs)

Biotechnology and Society

Genetically modified organisms (GMOs)-transgenic plants and animals and their applications in biotechnology. Public concern and risks associated with genetic engineering: bioterrorism and biowarfare. Ethical, social and legal implication of biotechnology.

Recommended Books

1. Murray Moo-Young, 'Comprehensive Biotechnology', 2nd Edn., Pergamon Press, **2011**.
2. William J. Thieman and Michael A. Palladino, 'Introduction to Biotechnology', 3rd Edn., Benjamin Cummings.
3. B.D. Singh, 'Biotechnology Expanding Horizons', 4th Edn., Kalyani Publishers, **2012**.
4. Jonathan Morris, 'The Ethics of Biotechnology (Biotechnology in the 21st Century)', 1st Edn., Chelsea House Publication (L), **2005**.
5. Sandy B. Primrose, 'Molecular Biotechnology', 2nd Edn., Blackwell Scientific Publications, **1991**.
6. Bourgaize, Thomas R. Jewell and Rodolfo G. Buiser, 'Biotechnology: Demystifying the concepts', 1st Edn., Benjamin Cummings, **1999**.
7. Richard Sherlock and John D. Merrey, 'Ethics issues in Biotechnology', 1st Edn., Rowman and Littlefield Publishers, **2002**.

Subject Code: BBOT1- 208

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

1. Discovery origin and evolution of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

UNIT-I (12 Hrs)

History of Microbiology

Spontaneous Generation versus Biogenesis, Germ Theory of Fermentation and diseases. Applied areas of Microbiology. Microscopy: Bright field, dark field, phase contrast, fluorescent and electron microscopy.

UNIT-II (13 Hrs)

Morphology and Fine Structures

Bacteria: size, shape, internal and external structures, cell wall of Gram positive and Negative bacteria, sporulation, Fungi and viruses.

UNIT-III (9 Hrs)

Microbial Nutrition and Growth

Nutritional requirements and types, culture media preparation and sterilization, growth patterns, growth curve, generation time, synchronous growth and chemostat. Culture collection, purification and preservation. Microbes in extreme environments.

UNIT-IV (11 Hrs)

Control of Microorganisms and Normal Micro Flora

Physical agents, chemical agents, antibiotics and other chemotherapeutic agents. Normal micro flora of the soil, microbial interactions (positive and negative). Nitrogen cycle, Carbon Cycle, Sulphur cycle, Phosphorus cycle.

Recommended Books

1. M.J. Pelczar Jr., Chan E. C.S., and R. Krieg, 'Microbiology', Mac Graw Hill.
2. G.J. Tortora, B.R. Funke, and C.L. Case, 'Microbiology-An Introduction', Benjamin Cummings.
3. B.D. Davis, R. Dulbecco, H.N. Eisen and H.S. Ginsber, 'Microbiology', Harper & Row Publisher.
4. R.Y. Stainer, J.L. Ingraham, M.L. Wheelis and P.R. Palmer, 'General Microbiology', MacMilan Press Ltd.
5. M.T. Madiga, J.M. Martinko, D.A. Stahl, D.P. Clark, 'Brock Biology of Microorganisms', Benjamin Cummings
6. R.P. Gupta, A. Kalia, S.K. Kapoor, 'Bioinoculants: A Step towards Sustainable Agriculture', New India Publishers.

Subject Code: BBOT1- 209

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To understand the basic concepts of inorganic and physical chemistry in terms of their utilization in various applications.

UNIT-I (12 Hrs)

Atomic Structure and Periodic Properties

Atomic spectra of hydrogen, Bohr theory and its refinement, dual nature of electrons, Heisenberg uncertainty principle, Schrödinger wave equation, Pauli's exclusion principle, Hund's rule, energy levels, arrangement of elements in groups in periodic table, types of bonds - ionic, covalent, coordinate bonds, oxidation number, metallic bonds, conductivity, melting point, solubility.

UNIT-II (11 Hrs)

Periodic Table and Properties

Long form of periodic table, alkali and alkaline earth metals and their biological properties, ionization and electronegativity, p-block elements, oxidation states, halogens and noble gases, transition elements, variability in oxidation state, complex formation, f-block elements.

UNIT-III (9 Hrs)

Thermodynamics

Properties of gases, perfect gas, gas laws, kinetic theory of gases, mole concept, real gases, van der Waals equation, laws of thermodynamics, enthalpy, relation between C_V and C_P , entropy, Gibbs energy, phase rule and phase diagrams.

UNIT-IV (13 Hrs)

Chemical Equilibrium

Spontaneous chemical reaction, Gibbs energy minimum, effect of pressure and temperature on equilibria, acids and bases, biological activity, thermodynamics of ATP, thermodynamic properties of ions in solution, ion activities, electrochemical cells, electrochemical series, solubility constants, measure of pH and pK, potentiometric titrations.

Recommended Books

1. J.D. Lee, 'Concise Inorganic Chemistry, 5th Edn., Blackwell Science.
2. P.W. Atkins, 'Physical Chemistry' ELBS Oxford University Press.

Subject Code: BBOT1- 210

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To aware students about the different types of biomolecules, their structure, functions and metabolism.

UNIT-I (13 Hrs)

Carbohydrate Metabolism and Energy Production

Biosynthesis and degradation of carbohydrates, glycolysis, pentose pathway, Kreb's cycle (enzymes, regulation), substrate level, oxidative and photo-phosphorylation, mitochondrial electron transport chain, regulation of ATP synthesis.

UNIT-II (11 Hrs)

Lipids and Vitamins

Classification and functions of lipids and fatty acids, digestion, absorption, biosynthesis and degradation of fatty acids, metabolism of triacyl glycerol, cholesterol, ketone bodies, structure of water soluble & fat soluble vitamins and their functions.

UNIT-III (12 Hrs)

Proteins

Structure of amino acids and their chemical reactions, biosynthesis and degradation of amino acids, classification and functions of protein, enzyme classification, properties and factors affecting enzyme activity, regulation of enzyme activity.

UNIT-IV (9 Hrs)

Nucleic Acids

Sugar (ribose, deoxyribose), nucleoside, nucleotide, DNA structure, types of DNA, Chargaff's rule, RNA structure and its types, replication, transcription, translation.

Recommended Books

1. U. Satyanaryana, U. Chkrapani, 'Biochemistry', 4th Edn., Elsevier
2. D.L. Nelson, L.A. Lehninger, M. Cox, Lehninger, 'Principles of Biochemistry', 5th Edn., W.H. Freeman.
3. J.M. Berg, J.L. Tymoczko, L. Stryer, 'Biochemistry', 5th Edn., W.H. Freeman.
4. D. Voet, J.G. Voet, 'Biochemistry', 4th Edn., John Wiley & Sons.

TECHNIQUES IN BIOTECHNOLOGY

Subject Code: BBOT1-211

L T P C
4 0 0 4

Duration: 45 Hrs.

Learning Objectives

To impart knowledge about the various techniques used in biotechnology in terms of their principle, working and applications.

UNIT-I (13 Hrs)

Chromatography

Distribution coefficient, stationary and mobile phases, paper chromatography, thin layer chromatography, column chromatography, packing a column, loading a sample, chromatographic development, elution of separated analytes, detector and fraction collector, normal phase and reverse phase chromatography, ion exchange chromatography, gel exclusion chromatography, affinity chromatography.

UNIT-II (12 Hrs)

Electrophoresis

Agarose gel electrophoresis, separation of DNA and RNA by electrophoresis, polyacrylamide gel electrophoresis, native PAGE, SDS-PAGE, Isoelectric focusing and 2D gel electrophoresis, separation of DNA and proteins using PAGE, Southern blot, northern blot and western blot analysis urea PAGE for DNA sequencing. Apparatus for casting/polymerizing gels and carrying out electrophoresis, power supply. Visualizing methods such as ethidium bromide, coomassie brilliant blue, acridine orange and silver staining.

UNIT-III (11 Hrs)

Spectroscopy, Radioactive Isotopes & Microscopy

Source of monochromatic light, UV and visible spectroscopy, Beer-Lambert law, applications of UV and visible spectrophotometry in biotechnology, spectrofluorometry, Infra-red spectroscopy. Radioactive decay, half-life, ionizing radiations, their energy and penetration, application of radioactive isotopes in biotechnology, detection and quantification of radioactivity. Simple and compound microscopes, parts of a microscope, magnification and resolution of a microscope, staining procedures, introduction to electron microscopy.

UNIT-IV (9 Hrs)

Centrifugation

Centrifugal force and RCF, rotors of centrifugation machines, types of centrifuges, ultracentrifuge, applications of centrifugation in biotechnology, precautions and safety guidelines for operating centrifuges.

Recommended Books

1. K. Wilson and J. Walker, 'Principles and Techniques of Biochemistry and Molecular Biology', Cambridge University Press.
2. A. Pingoud, C. Urbanke, J. Hoggett and A Jeltsch, 'Biochemical Methods', Wiley-VC.

MICROBIOLOGY LABORATORY

Subject Code: BBOT1-212

L T P C

Duration: 24 Hrs.

0 0 2 1

1. Introduction to the instruments use in the microbiology, aseptic techniques.
2. Cleaning of glass wares, Preparation of media, Cotton plugging and sterilization.
3. Isolation of microorganisms from air, water and soil samples.

4. Preparation of Serial dilution, colony purification.
5. Staining: Methylene blue, Gram, Negative and Spore.
6. Growth curve of bacteria.
7. Testing of water quality.

Recommended Books

1. James G. Cappuccino and Natalie Sherman, 'Microbiology: A Laboratory Manual', Benjamin Cummings.
2. K.R. Aneja, 'Experiments in Microbiology, Plant Pathology and Biotechnology', New Age Publishers.

INORGANIC & PHYSICAL CHEMISTRY LABORATORY

Subject Code: BBOT1-213

L T P C

Duration: 24 Hrs.

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Inorganic Chemistry

1. Volumetric Analysis: Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$. Complexometric titration using EDTA, Ca^{2+} and Mg^{2+}
2. Four ions (Two cations two anions)
3. Preparation of copper tetra-ammine complex. $[Cu(NH_3)_4]SO_4$

Physical Chemistry

1. Determination of surface tension of a given liquid by Stalagmometer (number of drops and weight of drops methods)
2. Determination of coefficient of viscosity of a pure liquid (Acetone, Ethanol, Propanol, Butanol, Glycol)
3. Verification of Lambert beer's law for solution of $CoCl_2 \cdot H_2O$ (in water) and $K_2Cr_2O_7$ (in water)
4. pH of buffer solution
5. Acid base titration HCl vs. NaOH
6. Determination of ionization constant of a weak acid (CH_3COOH)

Recommended Books

1. S. Rattan, 'Engineering Chemistry', S.K. Kataria & Sons.
2. G. Svelha, S. Mittal, 'Vogel's, Qualitative Inorganic Chemistry', Pearson Education.