

Scheme of Examination and Syllabus

***Affiliated Colleges
(2018-19)***

***B. Sc. (Medical Group with Biotechnology)
(1st and 2nd Semester)***

***Based on
Choice Based Credit System***



***Department of Bio and Nanotechnology
Guru Jambheshwar University of Science & Technology
Hisar***

Course Curriculum of B. Sc. (Medical Group with Biotechnology)

Semester	Nature of the Course	Name of the Course	Paper Code	Credits
I	Ability Enhancement Compulsory Course-I	Environmental Science		4
	Core course – Biotechnology Paper I	Introduction to Biotechnology	BIT 101 L	3
	Core course - Biotechnology Paper II	Biochemistry – I	BIT 102 L	3
	Core Course – Practical- Paper III	Laboratory Practical- Paper III (Biochemistry)	BIT 103 P	4
	Discipline- 2 Paper I	DSC- 2 Paper I		
	Discipline- 2 Paper II	DSC- 2 Paper II		
	Discipline- 2 Paper III Practical	DSC- 2 Paper I Practical		
	Discipline 3 Paper I	DSC 3 Paper I		
	Discipline 3 Paper II	DSC 3 Paper II		
	Discipline 3 Paper III Practical	DSC 3 Paper I Practical		
II	Ability Enhancement Compulsory Course - II	English/MIL Communication		3
	Core course- Biotechnology Paper IV	General Microbiology	BIT201 L	3
	Core Course- Biotechnology Paper V	Biochemistry – II	BIT 202 L	3
	Core Course- Biotechnology Paper VI Practical/Tutorial	Laboratory Practical- Paper VI (Microbiology)	BIT 203 P	4
	Discipline- 2 Paper II	DSC- 2 Paper II		
	Discipline- 2 Paper I Practical	DSC- 2 Paper II Practical		
	Discipline 3	DSC 3 Paper II		
	Discipline 3 Paper I Practical	DSC 3 Paper II Practical		

Note: Students of B. Sc. (Medical Group with Biotechnology) may choose any two discipline core courses out of Botany, Zoology and Chemistry

Semester I

**Biotechnology Paper I
Introduction to Biotechnology
(BIT 101 L)**

Credit: 3+0

Time: 3 Hours

**Max. Marks: 40
Internal Assessment: 10
Total Marks: 50**

Note: Total 9 questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the entire syllabus, which will be compulsory. Students will have to attempt five questions in all, selecting at least one question from each unit and compulsory question. Each question carries equal marks.

Unit-I

Introduction to Biotechnology: History and major landmarks in the development of biotechnology, Introduction to gene and genomes, Proteins and proteome, Fermentation technology: General introduction, basic technique and applications, Plant Tissue Culture : General introduction, basic technique and applications, Animal Tissue Culture : General introduction, basic technique and applications

Unit-II

Genetic Engineering: Introduction and history, Recombinant DNA technology, Genetically modified organisms (GMOs), DNA finger printing and forensic analysis.

Unit-III

Applications of biotechnology: Applications of biotechnology in agriculture, animal husbandry, veterinary sciences, food & feed industry , chemical industry, environment, bioremediation & waste water treatment, solid waste management , biofuels , human health and medicine (Monoclonal antibodies, hybridoma technology and embryo transfer technology)

Unit-IV

Bio-safety and Ethics:Biotechnology research in India, Biotechnology in context of developing world, Brief account of safety guidelines and risk assessment in biotechnology, Ethics in Biotechnology, Intellectual property rights.

Nanotechnology: Introduction, history and scope (Brief account)

Recommended Books:

1. Das H.K. (2004), Textbook of Biotechnology, Willey Dreamtech. Pvt. Ltd, New Delhi.
2. Natesh S., Chopra V.L. and Ramachandran S. (1987), Biotechnology in Agriculture Oxford & IBH, New Delhi.
3. Kumar H.D. (2004), A Text Book of Biotechnology, Eastern Willey Press, New Delhi.
4. Bhushan, Bharat (Ed.) 2012 Encyclopedia of Nanotechnology. Springer.
5. Bhushan, Bharat (Ed.) 2010 Handbook of Nanotechnology. Springer.
6. Gupta P.K. (2010), Biotechnology & Genomics, 5th Reprint, Rastogi Publications Meerut.
7. Singh B.D. (2010), Biotechnology, 4th edition, Kalyani Publication.
8. Black J.G (2008) Microbiology- Principles and Explorations, 7th edition, John Wiley & Sons

Semester I

Biotechnology Paper II
Biochemistry-I
(BIT 102 L)

Credit: 3+0

Time: 3 Hours

Max. Marks: 40
Internal Assessment: 10
Total Marks: 50

Note: Total 9 questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the entire syllabus, which will be compulsory. Students will have to attempt five questions in all, selecting at least one question from each unit and compulsory question. Each question carries equal marks.

Unit I

Biochemistry: Introduction, History and major landmarks in the development of biochemistry, Chemical Foundations of Life – biomolecules and biological chemistry. Interactions in biological systems: Intra and intermolecular forces, Electrostatic and hydrogen bonds, Disulfide bridges, Hydrophobic and hydrophilic molecules and forces, Water and weak interactions, pH and buffers.

Carbohydrates: Structure, Function and properties of biologically important monosaccharides, disaccharides and polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions

Unit-II

Amino acids and Proteins: Structure and properties of amino acids, Essential amino acids, rare and non-protein amino acids, acid base behaviour/zwitterions; pKa value and titration curve.

Proteins: Peptide bond, Structure and function of some biologically important peptides Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins

Unit-III

Lipids: Introduction and Classification – simple and complex lipids, Fatty acids – structure and nomenclature, soap value, acid value, iodine number, rancidity. Essential fatty acids, A general account of structure and function of Triacylglycerols, Phospholipids, Glycolipids.

Unit-IV

Nucleotides and Nucleic acids: Building blocks: bases, sugars and phosphates, Structure and nomenclature of nucleosides and nucleotides; polynucleotides, DNA (A, B, Z-DNA) and RNA (rRNA, mRNA, tRNA).

Properties of DNA – absorption, denaturation, renaturation, hybridization, T_m/Cot values. Biological importance of ATP and GTP.

Recommended Books:

1. Nelson, D.L. and Cox, M.M. (2013), Lehninger Principles of Biochemistry, 6th Edition Freeman and Company, New York.
2. Voet D., Voet J.G. and Pratt C.W. (2013), Principles of Biochemistry, 4th Edition John Wiley and Sons Inc., New York.

Semester I

Laboratory Practical- Paper III (Biochemistry)

BIT: 103P

(Credits: 0+4)

Time: 6 Hours

Max. Marks: 40

Internal Assessment: 10

Total Marks: 50

List of Practicals

1. Preparation of Buffers and Solutions
2. Determination of pKa value
3. Qualitative tests for Carbohydrates
4. Estimation of Carbohydrates
5. Determination of reducing sugars
6. Separation of sugars by paper chromatography
7. Qualitative tests for amino acids and proteins
8. Quantitative estimation of proteins
9. Polyacrylamide Gel Electrophoresis of proteins
10. Separation of lipids by thin layer chromatography (TLC)
11. Determination of saponification and iodine value of lipids
12. Demonstration of Enzyme activity: starch hydrolysis by salivary amylase
13. To study Kinetics of Enzyme activity: Effect of temperature, pH and concentration on enzyme activity
14. Estimation of Enzyme activity
15. Titrimetric analysis of Vitamin C
16. Gel Filtration chromatography or Ion Exchange chromatography

Semester II

**Biotechnology Paper IV
General Microbiology
(BIT 201 L)**

Credit: 3+0

Max. Marks: 40

Internal Assessment: 10

Total Marks: 50

Time : 3 Hours

Note: Total 9 questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the entire syllabus, which will be compulsory. Students will have to attempt five questions in all, selecting at least one question from each unit and compulsory question. Each question carries equal marks.

Unit I

Introduction, Importance and Scope of Microbiology : Definition and history of microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch etc., Branches of microbiology, Microscope Construction and working principles of different types of microscopes – compound, dark field, Phase contrast, Fluorescence and Electron (Scanning and transmission)

Unit-II

Sterilization techniques: Principles and Applications of Physical Methods, Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass filter, and membrane filter, Chemical Methods; Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents, Radiation Methods: UV rays and Gamma rays, Staining techniques: Principles of staining, types of stains – simple stains, structural stains and Differential stains.

Unit III

Microbial Taxonomy: Concept of microbial species and strains, classification of bacteria based on – morphology (shape and flagella), cell wall, nutrition, extreme environment and 16S rRNA techniques.

Viruses and Bacteria: Bacteria – Ultrastructure of bacteria cell (both Gram positive and Gram negative) including endospore and capsule. Viruses – Structure and classification (A brief account), Plant viruses – CaMV, Animal viruses – FMDV, Bacterial Virus – Lambda Phage

Pathogenic Microorganisms: Bacterial diseases of man – tetanus, Tuberculosis, Pneumonia, Cholera and Typhoid. Viral diseases: AIDS (HIV), Ebola, Swine Flu, Hepatitis, Papilloma virus

Unit-IV

Microbial Growth and Metabolism: Kinetics of microbial growth, growth curve, synchronous growth, factors affecting bacterial growth. Methods to study growth. Respiration: Glycolysis, Krebs's cycle (TCA), Oxidative Phosphorylation

Bacterial Photosynthesis: Photosynthetic apparatus in prokaryotes, Photophosphorylation & Dark reaction.

Recommended Books:

1. Tauro, P., Kapoor, K.K. and Yadav, K.S. (1996). Introduction to Microbiology, New Age Pub., New Delhi
2. Pelczar, M.J. et. al (2001), Microbiology- Concepts and Applications, International Ed. McGraw Hill Publication, New York
3. Black, J.G. (2012), Microbiology: Principles and Explorations, 8th Edition, John Wiley and Sons, USA.

Semester II

Biotechnology Paper V
Biochemistry II
(BIT 202 L)

Credit: 3+0

Time : 3 Hours

Max. Marks: 40
Internal Assessment: 10
Total Marks: 50

Note: Total 9 questions will be set by the examiners, two from each unit and one question of short answer/objective type covering the entire syllabus, which will be compulsory. Students will have to attempt five questions in all, selecting at least one question from each unit and compulsory question. Each question carries equal marks.

Unit I

Enzymes: Introduction, active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Enzyme classification (Major classes only)

Enzyme Kinetics –Hyperbolic curve , Km, Vmax, MM equation, Lineweaver Burk plot/Double reciprocal plot. Effect of pH and temperature on enzyme activity. Enzyme Inhibition – Competitive, non-competitive and uncompetitive inhibition.

Allosteric enzymes (A brief account)

Unit-II

Vitamins: Introduction, Types of vitamins – structure of water soluble vitamins and their coenzyme derivatives, Fat soluble vitamins. Deficiency symptoms and dietary sources.

Hormones : Steroid Hormones: structure and importance. Peptide Hormones: structure and function of important peptide hormones.

Unit-III

Metabolism: General introduction, catabolism and anabolism, Bioenergetics, Carbohydrates metabolism: Glycolysis, Tricarboxylic acid cycle, Gluconeogenesis Glycogenolysis, glycogen synthesis and their regulation.

Unit-IV

Lipid Metabolism: β -oxidation of saturated fatty acids. Degradation of Triacylglycerols. Synthesis of Fatty acids,

Amino acid Metabolism: Transamination, oxidative deamination and decarboxylation reactions in context of amino acid degradation.

Recommended Books:

1. Freifelder D. (1982), Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman and Company, San Francisco.
2. Nelson, D.L. and Cox, M.M. (2013), Lehninger Principles of Biochemistry, 6th Edition Freeman and Company, New York.
3. Voet D., Voet J.G. and Pratt C.W. (2013), Principles of Biochemistry, 4th Edition John Wiley and Sons Inc., New York.
4. Conn E.E., Stumpf P.K., Bruening G. and Doi R.H. (1997,) Outlines of Biochemistry. John Willey and Sons Inc. New York and Toronto.
5. Price N.C. and Stevens L. (1999), Fundamentals of Enzymology 3rd Edition Oxford University Press, New York.
6. Dixon M. and Webb E.C. (1979), Enzyme, 3rd Edition, Academic Press, New York

Semester II

Laboratory Practical- Paper VI (Microbiology)

BIT: 203 P

(Credits: 0+4)

Time: 6 Hours

Max. Marks: 40

Internal Assessment: 10

Total Marks: 50

List of Practical

1. Safety measures and Laboratory precautions
2. Cleaning, drying and sterilization of glassware
3. Disposal of laboratory waste and cultures
4. Principles and working knowledge of laboratory instruments: Compound Microscope, Autoclave, Hot Air Oven, pH meter, Laminar airflow hood, Centrifuge, B.O.D. Incubator, Colony counter etc.
5. Media preparation (Nutrient agar, Nutrient broth, Luria broth etc.) and sterilization.
6. Demonstration of ubiquitous nature of microorganism
7. Hanging drop technique to demonstrate bacterial motility
8. Enumeration of microorganism from soil, water etc. by serial dilution technique
9. Pure culture technique: Pour plate, Spread plate and Streak plate methods
10. Staining of microorganisms: Bacterial staining – Simple, Gram's, Endospore, Capsule, Negative staining and Fungal staining – wet mount technique
11. Study of effect of physical agents on bacterial growth: Effect of pH, effect of temperature, effect of osmotic pressure (NaCl and sucrose)
12. Antibiotic sensitivity testing by disc diffusion method