B.Sc. BIOTECHNOLOGY PROGRAMME
III Semester

Program Name	**B.Sc Biotechnology**		Semester	**III**
Course Title	**ENZYMOLOGY AND CELLULAR METABOLISM**			
Course No.	**BTC303T**	**Theory**	No. of Credits	**3**
Contact hours	**48 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

Unit I

Enzymes- Nomenclature - trivial and IUBMB, classification of enzymes with enzyme commission code, Characteristics of Enzymes, Chemical nature of enzymes, Apozyme, Holozyme. Cofactors and coenzymes. Active sites and binding sites. Mechanism of enzyme action, enzyme substrate complex formation, lock & key and induced fit theory. Clinical, analytical and biotechnological applications of enzymes. **8 Hrs**

Unit II

Factors affecting enzyme activity- substrate concentration, pH, temperature, metal ions, inhibitors, allosteric inhibitors, activators, Enzyme inhibition-competitive and non-competitive, energy of activation Enzyme kinetics-Michaelis - Menten equation. Special enzymes: Isoenzymes, multienzyme complexes, abzymes, Ribozyme with an example. **10 Hrs**

Unit III

Metabolism – Definition, catabolism and anabolism, overview of metabolic pathways. Carbohydrate Metabolism: Glycolysis- reactions of pathway and energetics. Fates of Pyruvate under aerobic and anaerobic conditions. TCA Cycle: Reactions, regulation and energetics. Gluconeogenesis: Reactions and its significance.

Bioenergetics: Biological oxidation, types of phosphorylation. Electron transport chain - Mechanism of oxidative phosphorylation.

Amino Acid Metabolism: Glucogenic and ketogenic amino acids, general pathways of synthesis and degradation-: Transamination, deamination and decarboxylation. Urea cycle. **20 Hrs**

Unit IV

Lipid Metabolism: Activation of fatty acids, β- oxidation and its energetics. Biosynthesis of Palmitate and its energetics. Metabolism of Nucleotides: Overview of Synthesis and degradation of purines and pyrimidine nucleotides. **10 Hrs**

Program Name	**B.Sc Biotechnology**		Semester	**III**
Course Title	**ENZYMOLOGY AND CELLULAR METABOLISM**			
Course No.	**BTC303P**	**Practical**	No. of Credits	**2**
Contact hours	**64 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

ENZYMOLOGY AND CELLULAR METABOLISM

1. Assay of salivary amylase by DNS method
2. Determination of specific activity
3. Effect of pH on enzyme activity
4. Effect of temperature on enzyme activity
5. Effect of metal ions on enzyme activity
6. Determination of Km and Vmax using Michaelis-Menten plot
7. Qualitative analysis of some metabolites in urine samples-urea, urea acid, creatinine, albumin, glucose, sterols, ketone bodies.
8. Serum analysis-SGPT and SGOT
9. Detection of heart and kidney disease using biochemical markers from serum and urine

Elective 1: Biotechnology for Human Welfare

Program Name	**B.Sc Biotechnology**		Semester	**III**
Course Title	**Elective 1: Biotechnology for Human Welfare**			
Course No.		**Theory**	No. of Credits	**3**
Contact hours	**48 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

UNIT I: Industrial applications	**16Hrs**
Introduction, Scope, branches and applications of Biotechnology. Biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase) Applications of biotechnology in food, detergent and pharmaceutical industries.	
UNIT II: Environmental applications	**16Hrs**
Application of biotechnology in environmental aspects : Bioremediation: Degradation organic pollutants, hydrocarbons and agricultural wastes, Superbug. Bioplastics and Biofuels.	
UNIT III: Applications in Forensic and Health Sciences	**16Hrs**
Application of biotechnology in forensic science: Solving crimes of murder and rape, paternity testing and theft using DNA finger printing techniques. Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, diagnostics-ELISA and PCR, human genome project.	

B.Sc. BIOTECHNOLOGY PROGRAMME
IV Semester

Program Name	**B.Sc. Biotechnology**		Semester	**IV**
Course Title	**MOLECULAR BIOLOGY AND GENETIC ENGINEERING**			
Course No.	**BTC-304T**	**Theory**	No. of Credits	**3**
Contact hours	**48 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

UNIT I

DNA as genetic material: Experiments of Griffith and Hershey & Chase. Central Dogma of Molecular biology. Concept of gene: Definition, generalized structure of Prokaryotes and Eukaryotes. DNA Replication: Modes of DNA replication- Semiconservative, conservative and dispersive method. Replication of DNA in prokaryotes and eukaryotes. Components of replication –lagging strand leading strand Okazaki fragment, role of SSBP, gyrase, helicase, RNA polymerase, DNA polymerase. Inhibitors of replication- role of actinomycin, novobiocin,. Genetic code: Major features of genetic code, outline of Deciphering of genetic code and Wobble hypothesis. **12 Hrs**

UNIT II

Transcription and RNA processing: RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation. RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation and splicing. Translation: Activation of amino acids, ribosome (composition & components), formation of initiation complex. Initiation, elongation and termination, inhibitors of protein synthesis. **12 Hrs**

UNIT III

Enzymes in Genetic engineering and its importance-Restriction endonucleases-types of restriction enzymes, ligases, alkaline phosphatases, polynucleotide kinase, terminal deoxynucleotidyltransferase, S1 nuclease, Klenow fragment, taq DNA polymerases, ribonuclease, reverse transcriptase Gene cloning vectors: Types of vectors –Cloning vector and expression vector. Plasmids (pBR322, pUC 19) and cosmids (pLFR5, pJB8). Importance of plasmids as cloning vectors, different forms of plasmids, concepts of YAC and BAC.

Cloning host: Bacteria, yeast, plant and mammalian cells.Outline of Gene transfer methods.**14 Hrs**

UNIT IV

Recombinant DNA technology: Isolation of gene, construction and preparation of complementary DNA. Probes- types, preparation and hybridization, genomic library. Genetic engineering techniques: Gel electrophoresis, southern and northern blotting techniques, PCR, Sanger's, Maxam & Gilbert methods of DNA sequencing, Concept of NGS. Applications of Genetic Engineering. **10 Hrs**

Program Name	**B.Sc Biotechnology**		Semester	**IV**
Course Title	**MOLECULAR BIOLOGY AND GENETIC ENGINEERING**			
Course No.	**BTC304P**	**Practical**	No. of Credits	**2**
Contact hours	**64 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

Molecular Biology and Genetic Engineering

1. Preparation of stock solutions for molecular biology
2. Colorimetric estimation of DNA
3. Colorimetric estimation of RNA
4. Determination of Tm value of DNA
5. Determination of purity of DNA
6. Extraction of DNA from plant and animal sources
7. Quantification of DNA by UV Spectrophotometry
8. Linearization of plasmid DNA (pUC 18 with Sma I)
9. Agarose gel electrophoresis of DNA (demonstration)
10. SDS-PAGE gel electrophoresis of DNA(demonstration)
11. Calculation of molecular weight of unknown DNA and protein fragments from gel pictures
12. Southern blotting (demonstration)
13. Gel electrophoresis of circular and linearized plasmid

Program Name	**B.Sc Biotechnology**		Semester	**IV**
Course Title	**Elective 1:Biophysics and Biochemical techniques**			
Course No.		**Theory**	No. of Credits	**3**
Contact hours	**48 Hours**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

Unit I	**12Hrs**
Basic biophysics: Definition and scope of biophysics, Principles of thermodynamics: first and second laws, Free energy, enthalpy, entropy; concept of equilibrium and redox potential, Bioenergetics: ATP as energy currency, Diffusion, osmosis, and membrane potentials, Surface tension and viscosity in biological systems. Structure of atoms, molecules and chemical bonds Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.	
Unit II	**12Hrs**
Basic principle of chromatography, principle, procedure and application of- paper chromatography, TLC, Column chromatography, Gel permeation chromatography, Affinity chromatography, Ion-exchange chromatography, HPLC and UPLC.	
Unit III	**12Hrs**
Separation techniques: Homogenization, Membrane filtration and Dialysis, Solvent fractionation, Centrifugation, chromatography Electrophoresis-paper electrophoresis, gel electrophoresis (Agarose gel electrophoresis, SDS-PAGE), Disc gel, gradient gel, isoelectric focusing. Genetically engineered insulin, recombinant vaccines, gene therapy, diagnostics-ELISA and PCR, human genome project.	
Unit IV	**12Hrs**
Spectroscopy –Electromagnetic spectrum, properties of the electromagnetic radiations, Basic principle and applications of Absorption spectroscopy, Colorimetry and UV-visible spectrophotometry, fluorescence spectroscopy and NMR.	

Program Name	**B.Sc. Biotechnology**		Semester	**IV**
Course Title	**Compulsory Paper (Skill)** **Biotechnological Skills and Analytical Techniques**			
Course No.		**Theory**	No. of Credits	**2**
Contact hours	**24 Hours**		Duration of Exam	**2 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

Unit I

Insights into biotechnology industry:

Biotechnology Industry in Indian and Global context - organization in context of large /medium/ small enterprises, their structure and benefits. **4 Hrs**

Unit II

Industry professional skills to be acquired:

Planning and organising skills, decision-making, problem-solving skills, analytical thinking, critical thinking, team management, risk assessment. **4 Hrs**

Unit III

Interpersonal skills:

Writing skills, reading skills, oral communication, conflict- resolution techniques, interpretation of research data, trouble shooting in workplace. **4 Hrs**

Unit IV

Digital skills:

Basic Computer Skills (MS Office, Excel, Powerpoint, Internet) for Workplace. Professional Email drafting skills and Powerpoint presentation skills. **6 Hrs**

Unit V

Analytical Skills in laboratory:

Solutions: Molarity, Molality, Normality, Mass percent % (w/w), Percent by volume (% v/v), Parts per million (ppm), Parts per billion (ppb), Dilution of concentrated solutions. Standard solutions, stock solution, solution of acids. Reagent bottle label reading and precautions. **6 Hrs**

References:

1. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch (2017)."Principles ofInstrumental Analysis".Cengage Learning.

2. J. Perry Gustafson (2017). "Analytical Methods and Techniques for Advanced Sciences".CRC Press.

3. Dean F. Martin, William M. Ritchey, and Michael W. Wood (2017). "Laboratory Manual forPrinciples of General Chemistry".Wiley.

4. Michael Lufaso (2016). "Laboratory Skills for Science and Medicine: An Introduction". CRCPress.

5. David J. Livingstone and Christopher H. Amonette (2016). "Analytical Techniques inEnvironmental Chemistry: Applications to Air, Water and Soil". CRC Press.

6. Colin A. Ramsden (2014). "Analytical Molecular Biology".Oxford University Press.

7. John M. Walker and Ralph Rapley (2014). "Molecular Biomethods Handbook".HumanaPress.

8. Gary D. Christian, Purnendu K. Dasgupta, and Kevin A. Schug (2013). "AnalyticalChemistry".Wiley.

9. Roger L. Lundblad and Fiona M. Macdonald (2010)."Handbook of Biochemistry andMolecular Biology". CRC Press

Model Theory Paper Pattern

B.Sc. Degree Examination
BIOTECHNOLOGY

Time: 3 Hours **Max. Marks: 80**

Instructions:
1. Answer all the questions.
2. Draw neat labeled diagrams wherever necessary

PART-A

1. Answer all the five questions: 2x 5=10

a.
b.
c.
d.
e.

PART-B

Answer *any six* of the following: 5x6=30

2.
3.
4.
5.
6.
7.
8.
9.

PART-C

Answer *any four* of the following: 10 x 4= 40

9.
10.
11.
12.
13.
14.

Model Practical Examination Scheme
III Semester B.Sc. Degree Examination
(ENZYMOLOGY AND CELLULAR METABOLISM)

Time: 3 Hours **Max Marks: 40**

Q1. Conduct *any one* of the following experiment 15 M

a. Among the two given samples A and B report which sample shows the maximum enzyme activity

b. Among the three given buffers with different pH A,B and C report which buffer shows the maximum enzyme activity

c. Identify any four metabolites in the given urine sample

Scheme of Valuation

a. Writing Principle -3M

b. Conducting experiment -5M

c. Calculation/Tabulation/observation -5M

d. Result-2M

Q2. Identify and comment on A, B, C, D and E 3X5=15 M

a. Identification -1M

b. Comment/Description-2M

(SGPT/SGOT value, Normal/ Abnormal concentration of urine, Effect of pH on enzyme activity, Effect of temperature on enzyme activity , Effect of metal ions on enzyme activity Biochemical Indicators of Kidney disease , Serum and Urine Biomarkers for Heart Disease, Michaelis- Menten equation)

Q3. Record 5 M

Q4. Viva 5 M

Model Practical Examination Scheme
IV Semester B.Sc. Degree Examination
(MOLECULAR BIOLOGY AND GENETIC ENGINEERING)

Time: 3 Hours **Max Marks: 40**

Q1. Conduct *any one* of the following experiment **15 M**

a. Estimation of DNA in the given sample
b. Estimation of RNA in the given sample
c. Extraction of DNA from plant source
d. Extraction of DNA from animal source

Scheme of Valuation
a. Writing Principle -3M
b. Conducting experiment -5M
c. Calculation/Tabulation/observation -5M
d. Result-2M

Q2. Identify and comment on A, B, C, D and E **3X5=15 M**
a. Identification -1M
b. Comment/Description-2M

(Determination of purity of DNA, SDS-PAGE , Agarose gel electrophoresis, Southern Blotting, Tm value of DNA, pBR322 vector map, pUC 19 vector map, pLFR5 vector map, pJB8 vector map, Griffiith's Experiment, Hershey and Chase Experiment, Replication fork, PCR, Sanger's method of DNA sequencing)

Q3. Record 5 M

Q4. Viva 5 M

Model Skill Theory Paper Pattern

B.Sc. Degree Examination
BIOTECHNOLOGY

Time: 2 Hours **Max. Marks: 40**

Instructions:
1. Answer all the questions.
2. Draw neat labeled diagrams wherever necessary

PART-A

1.Answer all the five questions: **2x 5=10**

a.
b.
c.
d.
e.

PART-B

Answer *any six* of the following: **5x6=30**

2.
3.
4.
5.
6.
7.
8.
9.

Proceedings of the BOS (Biotechnology) Meeting

The BOS (Biotechnology) meeting was held in dual mode on **17th May, 2025** at **3pm** in **DOS in Biotechnology, Manasagangotri, Mysuru**

1.	**Prof. H.S. Aparna** Professor DOS in Biotechnology, MGM	Chairperson BOS	Aparna, H.S.
2.	**Dr. S. Umesha** Professor DOS in Biotechnology, MGM	Member	
3.	**Dr. K. RamachandraKini** Professor, DOS in Biotechnology, MGM	Member	
4.	**Dr. Geetha N** Professor DOS in Biotechnology, MGM	Member	
5.	**Dr. K. N. Amruthesh** Professor DOS in Botany, MGM	Member	
6.	**Prof.M. Y. Sreenivas** Professor DOS in Microbiology, MGM	Member	
7.	**Dr. Prakash Halami** Scientist, DOS in Microbiology CSIR-CFTRI, Mysuru	Member	NOT PRESENT
8.	**Dr. P. H. Thejaswini** Department of Biotechnology Maharani's Science for Women, Mysuru	Member	Thejaswini P.H.
9.	**Mrs. Uma S.** Department of Biotechnology JSS College for Science, Ooty road, Mysuru	Member	
10.	**Dr. Nijalingu** Department o Biotechnology Bharathi College, K.M. Doddi Mandya Dist.571422	Member	
11.	**Mrs. UmmeNajma** DOS in Biotechnology Govt. Science College, Hassan-573212	Member	
12	**Dr. Vedamurthy A. B.** DOS in Biotechnology &Microbiology Karnataka University, Dharwad-580003	Member	ATTENDED ONLINE
13.	**Prof. C. Srinivasa** DOS in Microbiology & Biotechnology Bangalore University, Jnanabharathi, Bangalore-560056	Member	NOT PRESENT
14	**Dr. Prasanna Kumar S.** Professor, Dept of Biochemistry, JSS Medical College JSS Academy of Higher Education and Research Sri Shivarathreeshwara Nagar, Mysuru	Member	NOT PRESENT
15	**Sunil kumar C** Research Scientist (GLP PI),Syngene International Ltd, Semicon Park Tower 1, Electronic City –Phase-II, Hosur Road, Bangalore 560100	Member	NOT PRESENT

The Chairperson (BOS) welcomed the members and placed the agenda for the discussion.

1. **Changes, if any, in the course of study, syllabi and scheme of examination related to M.Sc. Biotechnology**

   The course content of M.Sc Biotechnology was revised recently (w e f 2023), hence no changes were made to the existing syllabi.

2. **Changes in the course of study, syllabi and scheme of examination related to B.Sc. Biotechnology Course - III & IV Semesters**

   The course syllabi related to B.Sc Biotechnology -III & IV Semesters was prepared in consultation with BOS members and the same was presented in the foresaid meeting and finalized. Further, the question paper pattern and scheme of valuation for practical examinations was also approved.

3. **Approval of Panel of examiners for both UG and PG Biotechnology Examinations.**

   The panel of examiners for both UG and PG Biotechnology examinations was revised and approved.

4. **Any other matter with permission of the chair.**

   Nil

Chairman
BOS in Biotechnology
University of Mysore
Mysore-570 006