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Of Arts, Science and Commerce, Camp, Pune- 1
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NAAC accredited 'A' Grade

S.Y.B.Sc. Biotechnology Semester III

Offered as	**Minor**
Course/Paper Title	**Biomolecules and metabolic pathways**
Course Code	**23SBBT31MN**
Semester	**III**
No. of Credits	**2**
Total Teaching Hours	**30**

Course Objectives	
1.	To explore the structures and functions of biomolecules including proteins, carbohydrates, and lipids
2.	To emphasize the importance of metabolic pathways in the cell.
3.	The course will aid the students in understanding the control of metabolic pathways in the cell through hormones.

Course Outcome	
1.	Students will understand the importance of metabolic pathways in the cell.
2.	Students will know important functions of biomolecules in the cell.
3.	Students can correlate how the large biomolecules such as proteins, carbohydrates, lipids, nucleic acids are made from the simple precursors.

Syllabus		
Unit	**Title and Contents**	**Total Hours**
Unit I	**Biomolecules I**	**16**
1	**Carbohydrates and glycobiology**	09

	i. Introduction ii. Monosaccharides: Structure and properties, ketoses and aldoses, D and L configuration, muta-rotation, epimers & anomers. iii. Oligosaccharide: reducing and non-reducing sugars. iv. Polysaccharide and its classification based on function, Storage polysaccharides (Starch, Glycogen and Inulin), Structural polysaccharides (Cellulose, Chitin). v. Functions of carbohydrates.	
2	**Amino acids & Proteins** i. Structure and properties of amino acids, Classification of amino acids. ii. Chemistry of amino acids: Acid-base behavior, reactions of amino acids, Zwitter ion, Titration of amino acid, isoelectric pH. iii. Protein structure: Primary structure & peptide bond formation, Secondary structure, Tertiary structure, Quaternary structure (Hb as example)	07
Unit II	**Biomolecules II and Metabolic Pathways**	14
3	**Lipids** i. Introduction ii. Classification of lipids. iii. Functions of lipids.	03
4	**Metabolism of Carbohydrates and Lipids** i. Glycolysis- Features, energetics and regulation of glycolysis ii. Pentose phosphate pathway and its features iii. TCA cycle- Features and energetics iv. β-Oxidation of fatty acids- Features and energetics.	11

References books

1. Eric E Conn, Paul Stumpf, George Breuning,- *Outlines of Biochemistry***,** John Wiley and Sons, USA, ISBN-13: 978-8126509300 ISBN-10: 8126509309, 5th Edition, January 2006.

2. Donald Voet, Judith Voet and Charlotte Pratt,- *Fundamentals of Biochemistry*, John Wiley and Sons, USA, ISBN-13: 978-0470129302 ISBN-10: 0470129301, 3rd Edition, June 2008.

3. Geoffory Zubay, -*Principles of Biochemistry*, McGraw-Hill College, USA, ISBN-13: 978-0697219008 ISBN-10: 0697219003, 4th edition, April 1997.

4. David Nelson & Michael Cox, -*Lehninger, Principles of Biochemistry,* W.H. Freeman and company, NY, ISBN-13: 978-1319108243 ISBN-10: 9781319108243, 5th Edition, January 2017.

5. Reginald Garett and Charles Grisham, *Biochemistry,* Brook/Cole, Cengage Learning, Boston, USA, ISBN 1133108792, 9781133108795, 5th Edition, January 2012.

6. Peter. J. Kennelly, Kathleen Botham, Owen Mc Guinness, Victor W Rodwell, P. Anthony Weil, *Harper's Illustrated Biochemistry*, McGraw Hill Education, ISBN-13: 978-1260469943 ISBN-10: 1260469948, 32nd Edition, 30 September 2022.

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S.Y.B.Sc. Biotechnology Semester III

Offered as	**Minor**
Course/Paper Title	**Practicals in clinical biochemistry**
Course Code	**23SBBT32MN**
Semester	**III**
No. of Credits	**2**
Total Teaching Hours	**60**

Course Objectives	
•	To introduce students to the basic and important clinical biochemical techniques.
•	To understand the applications of these techniques in the pathology labs and diagnostics which are helpful in routine analysis related to biotechnological health-care.

•	To provide knowledge of performing these techniques in laboratory so as the students will became aware to interpret the results of the analysis under study.

Course Outcome	
•	Students will also get basic knowledge of detecting blood glucose, serum cholesterol, serum creatinine, serum amylase from unknown samples that will help them to determine the normal and abnormal levels of biomolecule under study.
•	Students will become familiar with the chemical and visual methods of routine biochemical analysis of unknown clinical samples.
•	Students will be able to apply these techniques in various fields of life sciences.

Syllabus

Sr No	**Title and Contents**	**Total Practicals**
1	Introduction to clinical biochemistry and methods of sample collection	2
2	Estimation of glucose by GOD-POD method	1
3	Estimation of Blood serum cholesterol	1
4	Determination of Serum amylase.	2
5	Visual chemical and microscopic test for urine analysis.	2
6	WBC Count test from blood sample	2
7	RBC count test from blood sample	2
8	Estimation of antibodies produced during typhoid fever -Widal test	1
9	Estimation of serum creatinine.	1
10	Estimation of haemoglobin by cyanhaemoglobin method.	2
11	Rapid Antigen-Antibody Test using kits.	2

References books:

1. S.Sadasivam and A. Manickam, *Biochemical methods*, New Age International Publisher, ISBN-13 : 978-9393159656, 4th edition, July 2022.

2. David Plummer, *An Introduction to Practical Biochemistry*, McGraw Hill Education; ISBN-13: 978-0070994874, 3rd edition, July 2017.

3. Geetha Damodaran K, *Practical Biochemistry*, Jaypee Brothers Medical Publishers Pvt. Limited, ISBN 9351529940, 9789351529941, 2nd edition, 2016

4. Soundravally Rajendiran, Pooja Dhiman, *Biochemistry Practical Manual*, Elsevier Publication, ISBN 978-81-312-5351-9, E-book ISBN 978-81-312-5352-6, 2019

5. Divya Shanti and Sowbhagya Lakshmi, *An Easy Guide for Practical Biochemistry*, Jaypee Brothers Medical Publishers Private Limited, ISBN-13 : 978-8184487930, 1st edition, January 2010

6. Prem Prakash Gupta and Neelu Gupta, *Essentials Of Practical Biochemistry* , Jaypee Brothers Medical Publishers, ISBN 9789386056900, 1st Edition, December 2016.

7. Shivraja Shankara YM, Ganesh MK, *Laboratory Manual for Practical Biochemistry*, Jaypee Brothers Medical Publishers, ISBN-13 : 978-9350902769, 2nd edition, January 2013

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Offered as	**Minor**
Course/Paper Title	**Plant and Animal tissue culture**
Course Code	**23SBBT31VS**
Semester	**III**
No. of Credits	**2**
Total Teaching Hours	**60**

Course Objectives	
•	To introduce students to the basic and importance of Plant and Animal Tissue culture.
•	To understand the applications of these techniques in the field of research.
•	To provide knowledge of performing these techniques in laboratory for suitable research.

Course Outcome	
•	Students will also get basic knowledge of culturing plant and animal tissues.
•	Students will become familiar with the quantitative and qualitative analysis of drugs and its applications in research and industry in cell lines
•	Students will be able to apply these techniques in various fields of life sciences and in research.

Syllabus		
Sr No	**Title and Contents**	**Total Practicals**
1	Introduction to basic Animal and Plant tissue culture laboratory	1
2	Media preparation and sterilization of media in plant and animal tissue	2

	culture.	
3	Observation passaging and growth of cell lines.(MCF-7,mdamb-231)	2
4	Freezing of cell lines and cryopreservation.	1
5	Discarding procedures of cell lines.	1
6	Cleaning and disinfection of instruments used in animal tissue culture laboratory.	1
7	To study effects of auxin and cytokins on growth of explants	2
8	Micro propagation of important crops and hardening / acclimatization of regenerated plants	1
9	Isolation and culturing of protoplast	2
10	Anther, Embryo and Endosperm culture	2

References books:

1) M.K.Razdan,- *Plant tissue Culture*, Oxford & IBH publishing, ISBN-10 : 9788120417939, ISBN-13 : 978-8120417939, 3rd Edition, 1st January 2019.

2) M.P. Singh, Sunil Kumar,- *Plant tissue culture*, APH Publishing, ISBN 8131304396, 9788131304396, 2009.

3) K.G.Ramawat,- *Plant biotechnology*, S Chand & Co Ltd, ISBN-10 : 8121919878, ISBN-13 : 978-8121919876, 30th Jun, 2008.

4) Sudha Gangal,- *Principles and practice in animal tissue culture*, Universities Press, ISBN-10: 8173717192, ISBN-13: 9788173717192, 2nd Edition, 2007.

5) R. Ian Freshney,- *Animal Cell Culture*, Wiley Publisher, ISBN: 9781118873373, 1118873378, 6th Edition, 23 December 2015.

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S.Y.B.Sc. Biotechnology Semester IV

Offered as	**Minor**
Course/Paper Title	**Molecular biology**
Course Code	**23SBBT41MN**
Semester	**IV**
No. of Credits	**2**
Total Teaching Hours	**30**

Course Objectives	
1.	To introduce the concept of central dogma of molecular biology
2.	To make students familiar with the basic knowledge of nucleic acids with respect to it's structure and function
3.	To make students understand the process of replication of DNA, transcription and translation process in prokaryotes and eukaryotes.
4.	To inculcate the knowledge of post transcriptional and post translational modifications.

Course Outcome	
1.	Students will understand the process, role of enzymes and proteins involved in the process of replication of DNA, transcription and translation.
2.	Students will be aquianted with the knowledge of central dogma of molecular biology
3.	Students will have the knowledge of post translational modifications.

Syllabus		
Unit	**Title and Contents**	**Total Hours**
Unit I	**Genome organization and replication of DNA in prokaryotes and eukaryotes.**	**11**
1	Introduction to molecular biology - Central dogma of molecular biology	01
2	Replication of DNA - Definition and features of replication of DNA - Semiconservative model of DNA (Messelson and Stahl's experiment) - Enzymes and proteins involved in replication of DNA - Process of prokaryotic replication of DNA - Overview of eukaryotic replication of DNA	10
Unit II	**Process of transcription of DNA and translation in prokaryotes and eukaryotes**	19
3	Transcription of DNA - Definition and features of transcription - Enzymes and proteins involved in transcription - Process of prokaryotic transcription - Overview of eukaryotic transcription - Post transcriptional modifications : 5' capping, 3' polyadenylation, overview on intron removal	08
4	Translation - Features of genetic code, Wobble hypothesis, structure of t-RNA, m-RNA and ribosomes - Role of enzymes and proteins involved in translation - Process of Prokaryotic translation - Overview of eukaryotic translation	09
5	Introduction to Post translational modifications- Example – glycosylation, Ubiquitination	02

References books:

1. James D Watson, Tania Baker, - *Molecular Biology of gene*, Pearson Education, ISBN 0321507819, 9780321507815, 6th Edition, 2008.
2. Peter J Russell, *iGenetics: A Molecular approach,* 3rd edition, Benjamin Cummings, ISBN 9780321569769 (ISBN10: 0321569768), 3rd Edition, 2nd February 2009.
3. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick, - *Lewin's Genes X*, Jones and Barlet Publishers, ISBN 1449649831, 9781449649838, 10th edition, 2009.
4. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, - *Molecular Cell Biology*, W H Freeman & Co, ISBN-10:142923413X, ISBN-13 : 978-1429234139, 7th Edition, 2012.

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S.Y.B.Sc. Biotechnology Semester IV

Offered as	**Minor**
Course/Paper Title	**Practicals in molecular biology and recombinant DNA technology.**
Course Code	**23SBBT42MN**
Semester	**IV**
No. of Credits	**2**
Total Teaching Hours	**60**

Syllabus		
Sr No	**Title and Contents**	**Number of practicals**
1	Preparation of buffers and agarose electrophoresis	02
2	Isolation of Genomic DNA from bacteria	02
3	Isolation of plasmid DNA from bacteria	02

4	Restriction Digestion of DNA	02
5	Ligation of DNA	02
6	Study of Transformation by making host cells competent	03
7	Blue white screening	03

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1) Henderson, L.J. *Concerning the relationship between the strength of acids and their capacity to preserve neutrality*, American Journal of Physiology, 1908, Volume 21: 173-179.

2) Henderson, L.J, *The theory of neutrality regulation in the animal organism*, American Journal of Physiology, 1908, Volume 21: 427-448.

3) Good N.E, Wingset G.D, Winter W, Connolly T.N, Izawa, S, Singh, R.M, *Hydrogen Ion Buffers for Biological Research Biochemistry*, 1966, 5:467-477.

4) Jack, R. Cecil,- *Basic Biochemical Laboratory Procedures and Computing*, Oxford

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5) *Methods in Molecular Biology*, vol. 313: Yeast Protocols: Second Edition, Edited by: W. Xiao © Humana Press Inc., Totowa, NJ.

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S.Y.B.Sc. Biotechnology Semester IV

Offered as	**Minor**
Course/Paper Title	**Recent trends in Biotechnology**
Course Code	**23SBBT41SE**
Semester	**IV**
No. of Credits	**2**
Total Teaching Hours	**30**

Course Objectives	
1	To introduce students To recent trends in biotechnology.
2	To understand the applications of these trends in the field of research and industry.
3	To provide knowledge of performing these techniques in laboratory for suitable research.

Course Outcome	
4	Students will also get basic knowledge and trends in biotechnology
5	Students will become familiar with the techniques used in industries and research
6	Students will be able to apply these techniques in various fields of life sciences and in research.

Syllabus		
Sr No	**Title and Contents**	**Total Practicals**
UNIT I	**Biotechnology in industry**	**17**

1	Antibiotic potency- Term, methods to check and determine potency of given antibiotic by micro-titre plate based resazurin dye assay.	6
2	Introduction to nanoparticles- Synthesis of Cu nanoparticles and its probable biological applications	6
3	Immobilization its definition and types, entrapment of yeast cells on calcium alginate beads.	5
Unit II	**Biotechnology in Environment and in production of commercially important biomolecules.**	**13**
5	Bioremediation, Definition, types of bioremediation, Isolation and characterization of probable petrol degrading organisms from soil.	5
6	Isolation and Characterization of organisms producing enzyme Amylase from soil.	4
7	Probiotics- Role of extracellular proteins and their extraction of from Lactobacillus spp.	4

References books:

1) Brian Mc Neil, Linda M Harvey, -*Practical in fermentation technology*, Wiley Publishers, ISBN 97804700014349, 15th April 2008.

2) Jayanta Kumar Patra, Gitishree Das, Swagat Kumar Das, Hrudayanath Thatoi,- *A Practical Guide to Environmental Biotechnology*, Springer Nature Singapore, ISBN:9789811562518, 9811562512, 4th August 2020.

3) P. Chellapandi, - *Laboratory Manual in Industrial Biotechnology*, Pointer publishers, ISBN 9788171324880,8171324886, 2007.

4) Anshul Nigam, Rupal Gupta, -*Environmental Analysis Laboratory Handbook*, Wiley Publishers, ISBN 9781119724803, 1119724805, 23rd September 2020.

5) S. Sadasivam and A. Manickam, *Biochemical methods*, New Age International Publisher, ISBN-13 : 978-9393159656, 4th edition, July 2022.

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