



Faculty of Science

Master of Science (M.Sc.) I Semester

SUBJECT: MICROBIOLOGY

Paper-CC12

Microbial Biochemistry and Genetics

Course Outcomes

CO. No.	Course Outcomes	Cognitive Level
The students should be able to:		
CO 1	Gain fundamental knowledge on structure, functions and metabolism of biomolecules.	U
CO 2	To understand the microbial genetics of microbes. Learn about gene expression.	U, A,

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	6	40	60 (Minimum Passing marks 24)	100
Practical	4	40	60 (Minimum Passing marks 24)	100
Total	10	200		

Evaluation Scheme

	Marks	
	Internal	External
Theory	3 Internal Exams of 20 Marks (Two written and one assignment) (Best 2 will be taken)	1 External Exams (At the End of Semester)
Practical	Class interaction (10 marks), Quiz (10 marks) Assignment (10 marks), Seminar (10 marks)	1 External Exams (At the End of Semester)

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Content of the Course

Theory

No. of Lectures (in hours per week): 5 Hrs. per week

Total No. of Lectures: 60 Hrs.

Maximum Marks: 60

Unit	Topics	No. of Lectures 60
1	Origin of Universe-Cosmogony, God particle, Big Bang theory, Atoms and Molecules in Vedic period. An introduction, General structure and important features of carbohydrates, glycoproteins & glycolipids. Metabolism of Carbohydrates-Glycolysis, Feeder pathways, Citric acid cycle, Gluconeogenesis and their regulations, Glycogen metabolism, reciprocal control of glycogen synthesis and breakdown, Roles of epinephrine and glucagon and insulin in glycogen metabolism; Starvation responses and insulin signalling. Glyoxylate and Pentose phosphate pathways. <i>Activity</i> 1. Discussion on chronological order of creation. 2. Chart formation on Glucose metabolism or Pentose Phosphate pathways. 3. Model preparation of the DNA double helix structure	18
2	Definition and classification of lipids. Structure and functions of major lipid subclasses- Acylglycerols, Phospholipids, Glycolipids, Sphingolipids, Waxes, Terpenes and Sterols. Fatty acids biosynthesis, degradation and their regulations, Hormone trigger mobilization of stored triacylglycerol, Oxidation of fatty acidssaturated (odd and even carbon) and unsaturated, Ketone bodies synthesis. Biosynthesis of TAG, Phospholipids and Glycolipids. Mevalonate pathway. <i>Activity</i> 1. Chart preparation on major lipid subclasses. 2. Flow chart format of fatty acids degradation. 3. Demonstration and application of Mevalonate pathway.	18
3	Amino Acids- structure, classification and properties. Handerson and Hasselbach equation for ionization of amino acids, Reverse turns and Ramachandran plot. Structure- function relationships in model proteins like, myoglobin, hemoglobin, chymotrypsin etc. A brief account of amino acid biosynthesis and degradation, Urea cycle and its regulation. Chemical synthesis of peptides and small proteins. Protein sequencing. <i>Activity</i> 1. Demonstration of Handerson and Hasselbach equation. 2. Computation and Chart preparation of myoglobin, hemoglobin, chymotrypsin etc. 3. Quiz on protein sequencing.	18
4	Enzymes as biocatalysts- Enzyme classification. Mechanism of enzyme action-specificity, active site, activity unit and isozymes. Factors affecting enzyme efficiency, enzyme activators, coenzymes and cofactors. Enzyme kinetics - Michaelis - Menton equation for simple enzymes, determination of kinetic parameters, multi-step reactions and rate limiting steps. Enzyme inhibition- reversible, irreversible, competitive and noncompetitive. Allostertism- kinetic analysis of allosteric enzymes, Principles of allosteric regulation. <i>Activity</i>	18

	1. Discuss on enzyme, coenzymes and cofactors. 2. Demonstration of allosteric regulation by model. 3. Online visualization of enzyme inhibition.	
5	Fine structure of nucleic acid, DNA replication, DNA damage and Repair pathways, Transcription-General Principles, basic apparatus and types of RNA polymerases. Initiation, elongation and termination steps, Maturation and processing of RNA: Methylation, cutting and trimming of rRNA; capping, polyadenylation and splicing of mRNA, Basic features of the genetic code, Wobble hypothesis, protein synthesis; steps, details of initiation, elongation and termination, Regulation of gene expression: Operon concept, positive and negative regulation of lac operon; catabolite repression, inducers and co-repressors, arabinose and tryptophan operon. Biosynthesis and degradation of purines and pyrimidines, Salvage pathway. Activity 1. Chart making on type of RNA polymerases. 2. Quiz on DNA damage and repair pathway. 3. Discussion of Salvage pathway.	18

Books and other Learning Resources

Suggested Readings:

1. Stryer, L., Biochemistry. (8th Ed.): New York: Freeman. 2015.
2. Nelson, D.L. & Cox, M.M. Lehninger, A.L. Principles of Biochemistry (7th Ed.): Lehninger New York, NY: Worth. 2017.
3. Voet, D. & Voet, J.G., Hoboken, NJ: J. Biochemistry (5th Ed.): Wiley & Sons.
4. Martin. P. A and Rodwell. V. M.D.W, Mayes. Harper's review of Biochemistry
5. B. Lewin. Gene VII.
6. P. K. Gupta. Genetics
7. B.D. Singh. Genetics
8. H.D. Kumar. Microbial Genetics
9. Books published by M.P. Hindi Granth Academy, Bhopal

Suggested equivalent online courses:

1. https://onlinecourses.nptel.ac.in/noc25_bt33/preview
2. https://www.coledavid.com/downloads/datadownloads/chapter_1_biomolecules.pdf
3. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S001174BS/P001202/M010962/ET/1526556203Module_23_ET.pdf
4. <https://uw.pressbooks.pub/fmrbiochemistry/chapter/main-body-3/>
5. <https://ebooks.inflibnet.ac.in/bioci04/chapter/glycolysis/>
6. <https://egyankosh.ac.in/bitstream/123456789/75923/1/Unit-13.pdf>
7. <https://www.medschool.lsuhsu.edu/biochemistry/Courses/Biochemistry201/Desai/Amino%20Acid%20Metabolism%20I%2010-14-08.pdf>
8. <https://basu.org.in/wp-content/uploads/2020/06/Enzymes.pdf>
9. <https://biochem.du.ac.in/userfiles/downloads/Enzyme%20Kinetics.pdf>
10. <https://ugcmoocs.inflibnet.ac.in/assets/uploads/1/223/6898/et/15200319060603031212.pdf>
11. <https://rwu.pressbooks.pub/bio103/chapter/regulation-of-gene-expression/>
12. <http://www.mphindigranthacademy.org>

Part D : Assessment and Evaluation (Theory)		
Maximum Marks:		100
Continuous Comprehensive Evaluation (CCE): University Exam (UE):		40
Time: 03.00 Hours		60
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	20
	Assignment/Presentation	20
	Total	40
External Assessment: University Exam	Section (A) : Objective Type	01 x 05 = 05
	Section (B) : Short Questions	04 x 05 = 20
	Section (C) : Long Questions	07 x 05 = 35
	Total	60

Note: There will be a Seminar of 2 credits in First Semester, of which topics, may be taken from the syllabus of CC-11 and CC-12

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