Raffles University, Neemrana,

Alwar, Rajasthan- 301705

School of Pharmacy

Course: Biochemsitry-1 (BP 203T)	**Number of Prescribed Hours: 60**
Academic Year: 2023-24 **Programme: B.Pharmacy**	
Name of Faculty: Mrs. Tanniru Rajeswari	**Year/Semester: I Year II Sem**

SCHOOL: (SOP) School of Pharmacy		**ACADEMIC SESSION: 2023 – 2024**		**FOR STUDENTS' BATCH:**		**2023-2027**
1	**Course No.**	**BP203T**				
2	**Course Name**	**Biochemistry -I**				
3	**Credits**	**4 (3 Lectures+1Tutorial)**				
4	**Learning Hours**	**Theory hours** 45 **Tutorial** 15 **Total hours** 60				
5	**Course Objective**	1.Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes. 2. Understand the metabolism of nutrient molecules in physiological and pathological conditions. 3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.				
6	**Course Outcomes**	1.Understand classification, chemical nature, biological role and metabolism of biomolecules 2. Understand bioenergetics and biological oxidation pathway of carbohydrates 3. Understand bioenergetics and biological oxidation pathway of lipids and amino acids 4. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins. 5. Understand the catalytic role of enzymes and importance of enzyme in biochemical process				
7	**Outline syllabus:**					
7.01	**Paper Code**	**Unit**	**Introduction**	**Lectures hours**	**Reference NO**	**Teaching Methods**
7.02	**BP203T**	**Unit-I Biomolecules, Bioenergetics**	**Biomolecules** Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. **Bioenergetics**	10	T1,T2, T3	BB, PPt, Videos

			Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP			
		Unit-II Carbohydrate metabolism, biological oxidation	Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers	14	T1,T2, T3 ,R1,R2	BB, PPt, Videos
		Unit-III Lipid metabolism, Amino acid metabolism	β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. General reactions of amino acid metabolism: Transamination,	12	T1,T2, T3 ,R1,R2	BB, PPt, Videos

			deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice			
7.03		**Unit-IV Nucleic acid metabolism and genetic information transfer**	Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors.	14	T1,T2, T3 ,R1,R2	BB, PPt, Videos
		Unit-V Enzymes	Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	8	T1,T2, T3 ,R1,R2	BB, PPt, Videos, charts
8	**Course Evaluation**					
8.1	**Continuous Mode 10M (25%)**					
8.11	**Attendance**	4M (10%)				
8.12	Quiz, assignment	6 Assignments and 3M (7.5%)				

	open book test, field work, group discussion and seminar		
8.13	Student – Teacher interaction	3M (7.5%)	
8.3	**End-term examination: 75%**		
9	**Text Books & References**		
9.1	**Text books**	1) Principles of Biochemistry by Lehninger. 2) Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell. 3) Biochemistry by Stryer. 4) Biochemistry by D. Satyanarayan and U.Chakrapani 5) Textbook of Biochemistry by Rama Rao. 6) Textbook of Biochemistry by Deb. 7) Outlines of Biochemistry by Conn and Stumpf.	
9.2	**References**	1) Lehninger: Lehninger Principles of **Biochemistry**: David L. Nelson, Michael M. 2) Biochemistry 3rd edition DONALD VOET	
9.3	**Video References**	1) https://www.youtube.com/watch?v=lkoDv6qgRjE 2) https://www.youtube.com/watch?X2fq2DBBo 3) http://bcs.whfreeman.com/WebPub/Biology/hillis1e/Animated%20Tutorials/at0502/at_0502_active_trans.html 4) https://www.youtube.com/watch?v=pwAWFFwcqnk 5) https://www.youtube.com/watch?v=0OMNyVzLnVc 6) https://onlinecourses.nptel.ac.in/noc22_cy06/preview	

Course Outcome Mapping with Programme Outcomes

CO's/PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	0	0	1	1	2	1	0	3
CO2	3	2	1	1	0	0	1	2	2	0	2
CO3	3	3	2	2	0	2	2	3	3	3	3
CO4	3	3	3	3	2	3	2	3	3	3	3

CO5	3	2	1	1	0	3	1	2	1	2	2

3- Strong :2- Medium: 1: Weak 0- No Mapping

Teaching Content Session Wise

S.No	Unit No	Session NO	Session Topic	Name of the Content	Lesson Number	Mode of Teaching
1	1	S1	Carbohydrate	Introduction, classification, chemical nature and biological role of carbohydrate,	L1	BB, PPt, Videos
2		S2	lipids	Introduction, classification, chemical nature and biological role of lipids	L2	BB, PPt, Videos
3		S3	nucleic acids,	Introduction, classification, chemical nature and biological role of Nucleic acids	L3	BB, PPt, Videos
4		S4	Tutorial-01		L4	BB, PPt, Videos
5		S5	amino acids	Introduction, classification, chemical nature and biological role of Amino Acids	L5	BB, PPt, Videos
6		S6	proteins	Introduction, classification, chemical nature and biological role of Proteins	L6	BB, PPt, Videos
7		S7	Bioenergetics	Concept of free energy, endergonic and exergonic reaction	L7	BB, PPt, Videos
8		S8	Tutorial-02		L8	BB, PPt, Videos
9		S9	free energy, enthalpy	Relationship between free energy, enthalpy and entropy	L9	BB, PPt, Videos
10		S10	Redox potential	Redox potential :Definition, calculation	L10	BB, PPt, Videos

11		S11	Energy rich compounds; significances of ATP and cyclic AMP	Energy rich compounds; classification; significances of ATP and cyclic AMP	L11	BB, PPt, Videos
12		S12	Tutorial-03		L12	BB, PPt, Videos
13		S13	Carbohydrate metabolism: Glycolysis	Glycolysis – Pathway, energetics and significance	L13	BB, PPt, Videos
14	2	S14	Glycolysis	Glycolysis energetics and significance	L14	BB, PPt, Videos
15		S15	Citric acid cycle- Pathway	Energetics and significance of Citric acid cycle	L15	BB, PPt, Videos
16		S16	Tutorial-04		L16	BB, PPt, Videos
17		S17	HMP shunt and its significance	HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency	L17	BB, PPt, Videos
18		S18	Glycogen metabolism	Glycogen metabolism Pathways and glycogen storage diseases (GSD)	L18	BB, PPt, Videos
19		S19	Gluconeogenesis	Gluconeogenesis- Pathway and its significance	L19	BB, PPt, Videos
20		S20	Tutorial-05		L20	BB, PPt, Videos
21		S21	Hormonal regulation of blood glucose level and Diabetes mellitus	Hormonal regulation of blood glucose level and Diabetes mellitus	L21	BB, PPt, Videos
22		S22	Biological oxidation	Electron transport chain (ETC) and its mechanism	L22	BB, PPt, Videos
23		S23	Biological oxidation	Oxidative phosphorylation & its mechanism and substrate level phosphorylation	L23	BB, PPt, Videos

24		S24	Tutorial-06		L24	BB, PPt, Videos
25		S25	Biological oxidation	Inhibitors ETC and oxidative phosphorylation/Uncouplers	L25	BB, PPt, Videos
26		S26	Lipid metabolism	β-Oxidation of saturated fatty acid (Palmitic acid)	L26	BB, PPt, Videos
27		S27	ketone bodies and ketoacidosis	Formation and utilization of ketone bodies; ketoacidosis	L27	BB, PPt, Videos
28		S28	Tutorial-07		L28	BB, PPt, Videos
29		S29	ketone bodies and ketoacidosis	De novo synthesis of fatty acids (Palmitic acid)	L29	BB, PPt, Videos
30		S30	ketone bodies and ketoacidosis	Biological significance of cholesterol and conversion of cholesterol into bile acids,	L30	BB, PPt, Videos
31		S31	Cholesterol	conversion of cholesterol into steroid hormone and vitamin D	L31	BB, PPt, Videos
32		S32	Tutorial-08		L32	BB, PPt, Videos
33		S33	Cholesterol	Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.	L33	BB, PPt, Videos
34		S34	Cholesterol	Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.	L34	BB, PPt, Videos
35		S35	Amino acid metabolism	General reactions of amino acid metabolism: Transamination,deamination & decarboxylation,	L35	BB, PPt, Videos
36		S36	Tutorial-09		L36	BB, PPt, Videos
37		S37	Amino acid metabolism	urea cycle and its disorders	L37	BB, PPt, Videos

38		S38	Amino acid metabolism	Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism,)	L38	BB, PPt, Videos
39		S39	Amino acid metabolism	alkeptonuria, tyrosinemia	L39	BB, PPt, Videos
40		S40	Tutorial-10		L40	BB, PPt, Videos
41		S41	Amino acid metabolism	Synthesis and significance of biological substances; 5-HT, melatonin,	L41	BB, PPt, Videos
42		S42	Amino acid metabolism	Synthesis and significance of biological substances; dopamine, noradrenaline, adrenaline	L42	BB, PPt, Videos
43		S43	Catabolism of heme;	hyperbilirubinemia and jaundice	L43	BB, PPt, Videos
44		S44	Tutorial-11		L44	BB, PPt, Videos
45		S45	Nucleic acid metabolism and genetic information transfer	Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease	L45	BB, PPt, Videos
46		S46	Structure of DNA and RNA and their functions	Organization of mammalian genome Structure of DNA and RNA and their functions	L46	BB, PPt, Videos
47	5	S47	Nucleic acid metabolism	DNA replication (semi conservative model)	L47	BB, PPt, Videos
48		S48	Tutorial-12		L48	BB, PPt, Videos
49		S49	Nucleic acid metabolism	Transcription or RNA synthesis	L49	BB, PPt, Videos
50		S50	Genetic code, Translation or Protein synthesis and inhibitors	Genetic code, Translation or Protein synthesis and inhibitors	L50	BB, PPt, Videos

51		S51	Enzymes	Introduction, properties, nomenclature and IUB classification of enzymes	L51	BB, PPt, Videos
52		S52	Enzyme kinetics	Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)	L52	BB, PPt, Videos
53		S53	Tutorial-13		L53	BB, PPt, Videos
54		S54	Enzyme inhibitors	Enzyme inhibitors with examples	L54	BB, PPt, Videos
55		S55	Regulation of enzymes: enzyme induction and repression	Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation	L55	BB, PPt, Videos
56		S56	Tutorial-14		L56	BB, PPt, Videos
57		S57	Regulation of enzymes: enzyme induction and repression	Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation	L57	BB, PPt, Videos
58		S58	Therapeutic and diagnostic applications of enzymes	Therapeutic and diagnostic applications of enzymes and isoenzymes	L58	BB, PPt, Videos
59		S59	Coenzymes	Coenzymes –Structure and biochemical functions	L59	BB, PPt, Videos
60		S60	Tutorial-14		L60	BB, PPt, Videos

QUESTION BANK

Unit-I

1) write a note on introduction, classification, chemical nature and biological role of
2) Carbohydrate?
3) Write a note on chemical nature and biological role of Carbohydrate?

4) write a note on introduction, classification, chemical nature and biological role of lipids?
5) write a note on introduction, classification, chemical nature and biological role of nucleic acids?
6) write a note on introduction, classification, chemical nature and biological role of amino acids?
7) write a note on introduction, classification, chemical nature and biological role of proteins?
8) Describe Concept of free energy, endergonic and exergonic reaction?
9) Illustrate the relationship between free energy, enthalpy and entropy; Redox potential?
10) write about the classification of Energy rich compounds?
11) Explain the biological significances of ATP and cyclic AMP ?

Unit-II

12) Describe the energetics and significance of Glycolysis Pathway?
13) Describe the energetics and significance of Citric acid cycle Pathway ?
14) Describe the energetics and significance of HMP shunt pathway?
15) Write in details Deficiency of Glucose-6-Phosphate dehydrogenase (G6PD) deficiency?
16) Explain Glycogen metabolism Pathway?
17) Write about the glycogen storage diseases (GSD)?
18) Describe the energetics and significance of Gluconeogenesis?
19) Explain Hormonal regulation of blood glucose level
20) Write a note on Diabetes mellitus ?
21) Explain about Electron transport chain (ETC) and its mechanism?
22) Describe the Oxidative phosphorylation & its mechanism and substrate
23) Phosphorylation ?
24) Inhibitors ETC and oxidative phosphorylation/Uncouplers

Unit-III

25) Write a note on β-Oxidation of saturated fatty acid (Palmitic acid)

26) Describe about the Formation and utilization of ketone bodies?
27) Explain about ketoacidosis?
28) Describe De novo synthesis of fatty acids (Palmitic acid)?
29) Write a note on biological significance of cholesterol?
30) Explain bile acids, steroid hormone and vitamin D?
31) Describe Disorders of lipid metabolism?
32) Explain about Hypercholesterolemia?
33) Describe about the atherosclerosis?
34) Elaborate the fatty liver and obesity?
35) Describe about the General reactions of amino acid metabolism: Transamination?
36) Explain about the deamination & decarboxylation, urea cycle and its disorders
37) Write a note on Catabolism of phenylalanine and tyrosine and their metabolic disorders
38) Explain about the Synthesis and significance of 5-HT?
39) Explain about the Synthesis and significance of melatonin,
40) Explain about the Synthesis and significance of dopamine, noradrenaline, adrenaline
41) Describe the Catabolism of heme; hyperbilirubinemia and jaundice

Unit-IV

42) Write a note on Biosynthesis of purine and pyrimidine nucleotides
43) Explain about the Catabolism of purine nucleotides and Hyperuricemia and Gout disease
44) Describe the Organization of mammalian genome
45) Write Structure of DNA and RNA and their functions DNA replication (semi conservative model)
46) Write a note on Transcription or RNA synthesis
47) Describe the Genetic code, Translation or Protein synthesis and inhibitors

Unit-V

48) Write a note on Introduction, properties, nomenclature and IUB classification of enzymes
49) Explain the Enzyme kinetics by Michaelis plot, Line Weaver Burke plot?

50) Write a note on Enzyme inhibitors with suitable examples?
51) Explain the Regulation of enzymes: enzyme induction and repression, allosteric
52) enzymes regulation?
53) Explain about the Therapeutic and diagnostic applications of enzymes and isoenzymes?
54) Write about Structure and biochemical functions Coenzymes?

PROJECTS

1) Ilustre the glycolysis with neat labelled diagrams?
2) Ilustre the Citric acid pathway with neat labelled diagrams?
3) Ilustre the HMP Shunt with neat labelled diagrams?
4) Ilustre the Glycogenesis with neat labelled diagrams?
5) Explain the concept and importance of Nutrition in daily life with diagrams in charts
6) Complete a MOOC certification program on Biochemistry in NPTEL, Coursera and Udemy