

**Sri Manakula Vinayagar Medical College and Hospital**

**Department of Biochemistry**

**Specific Learning Objectives - Theory**

<b>Number</b>	<b>BI 1.1</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the molecular and functional organisation of a cell and its sub-cellular components</b>	
<b>SLO</b>	At the end of the sessions the students will be able to	
1.	Describe the basics of Structure of a Cell	
2.	Enlist the differences between eukaryotic and prokaryotic cell	
3.	Know the procedure to separate the sub-cellular organelles by centrifugation	
4.	Enumerate the functions of the various cell organelle	
5.	Explain the structure and functions of a cell membrane	
<b>Horizontal Integ</b>	<b>Physiology</b>	
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 2.1</b>	<b>Time</b>
<b>Competency</b>	<b>Explain fundamental concepts of enzyme, Isoenzyme, Alloenzyme, coenzyme &amp; cofactors .Enumerate the main class of IUBMB nomenclature</b>	
<b>SLO</b>	At the end of the session the students should be able to	
1.	Define enzymes	
2.	List the biomedical importance of enzymes	
3.	Classify enzymes as per IUBMB nomenclature with suitable examples	
4.	Discuss the role of Cofactors, Coenzymes & alloenzymes with examples	
5.	Define isoenzymes with examples	
6.	Describe the clinical importance of isoenzymes	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 2.2</b>	<b>Time</b>
<b>Competency</b>	<b>Observe the estimation of SGOT &amp; SGPT</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Know the principle and procedure of estimation of SGOT	
2.	Know the principle and procedure of estimation of SGPT	
3.	Explain the clinical significance of SGOT & SGPT	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 2.3</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; explain the basic principles of Enzyme activity</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Define activation energy	
2.	Explain the mechanisms by which enzymes increases the rate of the reaction.	
3.	Explain enzyme kinetics with reference to Michaelis Menten equation and Lineweaver burk plot.	
4.	List the factors influencing enzyme activity	
5.	Describe the factors influencing enzyme activity with graph	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 2.4</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; discuss enzyme inhibitors as poisons and drugs and as therapeutic enzymes</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	List the various types of Enzyme Inhibition	
2.	Describe competitive inhibition, non-competitive inhibition, uncompetitive inhibition and suicide inhibition.	
3.	Explain the enzyme kinetics of various enzyme inhibitions with reference to Michaelis menten plot & Lineweaver Burk Plot.	
4.	Discuss the clinical significance of enzyme inhibitions with examples	

5.	Discuss in detail about the therapeutic use of enzymes	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Pathology &amp; General medicine</b>	

<b>Number</b>	<b>BI 2.5</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; discuss the clinical utility of various serum enzymes as markers of pathological conditions</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Discuss the enzyme profile for myocardial infarction	
2.	Discuss the enzyme profile for liver disorders	
3.	Discuss the enzyme profile for pancreatic disorders	
4.	Discuss the enzyme profile for muscular disorders	
5.	Discuss the enzyme profile for prostate cancer	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Pathology, General medicine</b>	

<b>Number</b>	<b>BI 2.6</b>	<b>Time</b>
<b>Competency</b>	<b>Discuss use of enzymes in laboratory investigations (Enzyme based assays)</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Discuss the role of enzymes in the estimation of glucose, urea, creatinine, uric acid, cholesterol	
2.	Discuss the role of enzymes in immunoassays	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Pathology &amp; General medicine</b>	

<b>Number</b>	<b>BI 2.7</b>	<b>Time</b>
<b>Competency</b>	<b>Interpret laboratory results of enzyme activities &amp; describe the clinical utility of various enzymes as markers of pathological conditions</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Interpret the laboratory results of enzyme profile in pathological conditions like Myocardial infarction, liver disorders, pancreatic disorders, prostate cancer and muscular disorders.	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Pathology &amp; General medicine</b>	

<b>Number</b>	<b>BI3.1</b>	
<b>Competency</b>	<b>Discuss and differentiate monosaccharides, disaccharides and polysaccharides giving examples of main carbohydrates as energy fuel, structural element and storage in the human body</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Define carbohydrates	
	2. Enumerate the biomedical importance of carbohydrates	
	3. Classify carbohydrates based on the number of sugar units	
	4. Describe glycosides with examples	
	5. Discuss the composition and functions of disaccharides	
	6. Discuss the composition, glycosidic linkage and clinical importance of homopolysaccharides (Starch, glycogen, cellulose, inulin, dextran, chitin)	
	7. Discuss the composition, glycosidic linkage and clinical importance of heteropolysaccharides (Mucopolysaccharides)	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI3.2</b>	
<b>Competency</b>	<b>Describe the processes involved in digestion and assimilation of carbohydrates and storage</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe the enzymes and processes involved in the digestion of carbohydrates	
	2. Discuss the defect, clinical features and treatment of Lactose Intolerance	
	3. Enlist the Glucose transporters in the body and their location	

4.	Explain the absorption and storage of carbohydrates in the body	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI3.3</b>	
<b>Competency</b>	<b>Describe and discuss the digestion and assimilation of carbohydrates from food</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Describe the enzymes and processes involved in the digestion of dietary carbohydrates	
2.	Discuss the defect, clinical features and treatment of Lactose Intolerance	
3.	Enlist the Glucose transporters in the body and their location	
4.	Explain the absorption of dietary carbohydrates in the body	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI3.4</b>	
<b>Competency</b>	<b>Define and differentiate the pathways of carbohydrate metabolism (glycolysis, gluconeogenesis, glycogen metabolism, HMP shunt)</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Explain glycolytic pathway and its energetics	
2.	Discuss the location, substrates, key enzymes and steps of gluconeogenesis	
3.	Explain the location and pathway of glycogenesis	
4.	Explain the location and pathway of glycogenolysis	
5.	Discuss HMP shunt pathway	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI3.5</b>	
<b>Competency</b>	<b>Describe and discuss the regulation, functions and integration of carbohydrate along with associated diseases / disorders</b>	

<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Explain the regulation of key enzymes of Glycolytic pathway	
2.	Explain the regulation of key enzymes of gluconeogenesis	
3.	Explain the regulation of glycogenesis	
4.	Explain the regulation of glycogenolysis	
5.	Discuss the types, enzyme defect and clinical manifestations of glycogen storage disorders	
6.	Discuss the biomedical and clinical significance of HMP shunt pathway	
7.	Discuss the biomedical significance of uronic acid pathway	
8.	Discuss the metabolism of fructose in the body	
9.	Explain the disorders related to fructose metabolism	
1.	Discuss the metabolism of galactose in the body	
11.	Explain the disorders related to galactose metabolism	
12.	Explain the types, complications, laboratory investigations of diabetes mellitus	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI3.6</b>	
<b>Competency</b>	<b>Describe and discuss the concept of TCA cycle as an amphibolic pathway and its regulation</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Illustrate the pathway of TCA cycle and its energetics	
2.	Discuss the regulation of TCA cycle	
3.	Explain the amphibolic and anaplerotic role of TCA cycle	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI3.7</b>	
<b>Competency</b>	<b>Describe the common poisons that inhibit crucial enzymes of carbohydrate metabolism (eg. Fluoride, arsenate)</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	

	1. Describe the common poisons that inhibit the enzymes of Glycolysis and TCA cycle	
<b>Horizontal Integration</b>	<b>Physiology</b>	
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI3.8</b>	
<b>Competency</b>	<b>Discuss and interpret laboratory results of analytes associated with metabolism of carbohydrates</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Enumerate the analytes associated with metabolism of carbohydrates	
	2. Know the normal values of all the analytes associated with metabolism of carbohydrates	
	3. Interpret the derangement in the laboratory values of analytes associated with metabolism of carbohydrates	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>Pathology, General Medicine</b>	

<b>Number</b>	<b>BI3.9</b>	
<b>Competency</b>	<b>Discuss the mechanism and significance of blood glucose regulation in health and disease</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Know the normal blood glucose level in fasting and postprandial state	
	2. Explain the regulation of blood glucose level by hormones in fasting and postprandial state	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI3.10</b>	
<b>Competency</b>	<b>Interpret the results of blood glucose levels and other laboratory investigations related to disorders of carbohydrate metabolism</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Enumerate the laboratory investigations to be done related to disorders of carbohydrate metabolism	
	2. Know the normal blood values of analytes tested in relation to disorders of carbohydrate metabolism	
	3. Interpret the laboratory results of analytes associated with disorders of carbohydrate metabolism	

<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI4.1</b>	
<b>Competency</b>	<b>Describe and discuss main classes of lipids (essential/non-essential fatty acids, cholesterol and hormone steroids, triglycerides, major phospholipids and sphingolipids) relevant to human system and their major functions</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Define the term lipids	
	2. Describe the classification of lipids	
	3. Discuss in detail about the functions of individual lipids: Simple lipids – tri acyl-glycerol Compound lipids – Phospholipids, sphingolipids Derived lipids – cholesterol, steroids, fatty acids	
	4. Describe the nutritional classification of fatty acids	
<b>Horizontal Integration</b>		
<b>Vertical integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI4.2</b>	
<b>Competency</b>	<b>Describe the processes involved in digestion and absorption of dietary lipids and also the key features of their metabolism</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Explain in detail about the digestion & absorption of dietary lipids	
	2. Describe the general features of lipid metabolism	
<b>Horizontal Integration</b>		
<b>Vertical integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI4.3</b>	
<b>Competency</b>	<b>Explain the regulation of lipoprotein metabolism &amp; associated disorders</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe in detail about the regulation of lipoprotein metabolism	
	2. Discuss about the disorders of lipoprotein – Hyper lipoproteinemia & Hypo lipoproteinemia	
<b>Horizontal Integration</b>		
<b>Vertical integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI4.4</b>	
<b>Competency</b>	<b>Describe the structure and functions of lipoproteins, their functions, interrelations &amp; relations with atherosclerosis</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	



	1.	Describe the structure and general functions of Lipoprotein	
	2.	Discuss the functions of individual lipoproteins	
	3.	Describe the lipoprotein metabolism and interrelations	
	4.	Explain link and relation between the lipoprotein & atherosclerosis	
<b>Horizontal Integration</b>			
<b>Vertical integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI4.5 &amp; 4.7</b>		
<b>Competency</b>	<b>Interpret laboratory results of analytes associated with metabolism of lipids</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Describe the laboratory analytes related to lipoprotein metabolism	
	2.	Discuss the normal values of the analytes related to lipoprotein metabolism and its interpretation	
<b>Horizontal Integration</b>			
<b>Vertical integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI4.6</b>		
<b>Competency</b>	<b>Describe the therapeutic uses of prostaglandins and inhibitors of eicosanoid synthesis</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Discuss the chemistry of eicosanoids	
	2.	Describe the synthesis of prostaglandin	
	3.	Explain the inhibitors of eicosanoid synthesis	
<b>Horizontal Integration</b>			
<b>Vertical integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI 5.1</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; discuss structural organization of proteins</b>	
<b>SLO</b>	At the end of the session the students should be able to	
	1.	Classification of amino acids based on side chain structure and polarity
	2.	Describe in detail about the primary structure of proteins with suitable examples
	3.	Describe in detail about the secondary structure of protein such as $\alpha$ -helix $\beta$ -pleated sheets, loops & bends with suitable examples. Discuss the various bonds stabilising the secondary structure
	4.	Explain in detail about the tertiary & quaternary structure of

	proteins with suitable examples	
5.	Discuss about denaturation of proteins	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 5.2</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; discuss functions of proteins and structure-function relationships in relevant areas eg ,haemoglobin &amp; selected hemoglobinopathies.</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Discuss the functions of proteins	
2.	Explain the structure function relationship of proteins with reference to hemoglobin	
3.	Discuss the structural variations seen in different hemoglobinopathies	
4.	Discuss the pathogenesis and clinical manifestations of hemoglobinopathies	
<b>Horizontal Integ</b>	<b>Physiology</b>	
<b>Vertical Integ</b>	<b>Pathology, General medicine</b>	

<b>Number</b>	<b>BI 5.3</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the digestion &amp; Absorption of Dietary proteins</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Describe digestion of proteins	
2.	Explain the absorption of Amino acids	
3.	Discuss the disorders associated with digestion and absorption of proteins	
<b>Horizontal Integ</b>		

<b>Vertical Integ</b>	<b>Paediatrics</b>	
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<b>Number</b>	<b>BI 5.4</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the common disorders associated with protein metabolism</b>	
<b>SLO</b>	At the end of the session students should be able to	
1.	Describe the steps of urea cycle and its regulation	
2.	Discuss Urea cycle disorders	
3.	Explain the steps of phenylalanine and tyrosine metabolism	
4.	Discuss the special metabolic products of phenylalanine and tyrosine	
5.	Discuss the disorders associated with phenylalanine and tyrosine metabolism	
6.	Explain metabolism of branched chain amino acids	
7.	Discuss the disorders associated with metabolism of branched chain amino acids	
8.	Explain metabolism of Glycine	
9.	Discuss the special metabolic functions of Glycine	
10.	Discuss the disorders associated with Glycine metabolism	
11.	Explain the metabolism of sulphur containing amino acids	
12.	Discuss the disorders associated with metabolism of sulphur containing amino acids	
13.	Explain the metabolism of tryptophan	
14.	Discuss the special metabolic products of tryptophan	
15.	Discuss the disorders associated with metabolism of tryptophan	
16.	Discuss in detail about other disorders such as Hisidenemia, Urocanic aciduria, Hyperhydroxyprolinemia,	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Paediatrics</b>	

<b>Number</b>	<b>BI 5.5</b>	<b>Time</b>
<b>Competency</b>	<b>Interpret the laboratory results of analytes associated with metabolism of proteins</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Enumerate the laboratory investigations to be done related to disorders of protein metabolism	
	2. Interpret the laboratory results of analytes associated with disorders of protein metabolism	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>General medicine</b>	

<b>Number</b>	<b>BI6.1</b>	
<b>Competency</b>	<b>Discuss the metabolic processes that take place in specific organs in the body in the fed and fasting states</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe the important inter-organ metabolic interactions	
	2. Explain metabolic interrelationships of tissues during fed and fasting states	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI 6.2</b>	<b>Time</b>
<b>Competency</b>	<b>Describe &amp; Discuss the metabolic process in which nucleotides are involved</b>	
<b>SLO</b>	At the end of the session the students should be able to	
	1. Discuss the Digestion of nucleic acids	
	2. Illustrate the sources of Purine ring	
	3. Describe synthesis of Purines by denovo pathways and salvage pathway	
	4. Explain catabolism of purines	
	5. Describe the denovo synthesis of pyrimidines and its degradation	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 6.3</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the common disorders associated with nucleic acid metabolism</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Explain the causes, clinical features, diagnosis and treatment strategy for gout	
	2. Describe the enzyme defect and clinical features of Lesch Nyhan syndrome	
	3. Discuss the enzyme defect and clinical features of SCID, Xanthinuria	
	4. Discuss the enzyme defect, clinical features and treatment of Orotic aciduria	
<b>Horizontal Integ</b>	<b>Physiology</b>	
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 6.4</b>	<b>Time</b>
<b>Competency</b>	<b>Discuss about the laboratory results of analytes associated with gout &amp; Lesch nyhan syndrome</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Interpret the laboratory results of analytes associated with gout	
	2. Interpret the laboratory results of analytes associated with Lesch Nyhan syndrome	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>General medicine</b>	

<b>Number</b>	<b>BI6.5</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Classify vitamins giving examples	
	2. Discuss the chemistry and sources of Vitamin A, Vitamin D, Vitamin E, Vitamin K	
	3. Explain the metabolism of Vitamin A, Vitamin D	
	4. Describe the biochemical functions of Vitamin A, Vitamin D,	

	Vitamin E, Vitamin K with suitable illustrations	
5.	Mention the Recommended Daily Allowance of Vitamin A, Vitamin D, Vitamin E, Vitamin K	
6.	Explain the deficiency manifestations of Vitamin A, Vitamin D, Vitamin E, Vitamin K	
7.	Discuss the co-enzyme forms of B complex vitamins and Vitamin C	
8.	Describe the biochemical functions of B complex vitamins and Vitamin C with suitable illustrations	
9.	Mention the Recommended Daily Allowance of B complex vitamins and Vitamin C	
10.	Explain the deficiency manifestations of B complex vitamins and Vitamin C	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI6.6</b>	
<b>Competency</b>	<b>Describe the biochemical processes involved in generation of energy in cells</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Define High energy compounds and Phosphagens with suitable examples	
2.	Discuss ATP-ADP cycle	
3.	Explain the location, organization and functions of Electron Transport Chain with suitable diagram	
4.	Illustrate Chemiosmotic theory with suitable diagram	
5.	Enlist the inhibitors of Electron transport chain and oxidative phosphorylation	
6.	Describe Uncouplers with suitable examples	
7.	Discuss substrate level phosphorylation with suitable examples	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI6.7</b>	
<b>Competency</b>	<b>Describe the processes involved in maintenance of normal PH, water &amp; electrolyte balance of body fluids and the derangements associated with these</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
1.	Define the term PH and its normal value	
2.	Describe in detail about the regulation of PH	

	3.	Know the normal plasma values of electrolytes in the body	
	4.	Explain the events and hormones involved in maintaining the water and electrolyte balance in the body	
	5.	Discuss the disorders associated with water and electrolyte imbalance of body fluids.	
<b>Horizontal Integration</b>		<b>Physiology</b>	
<b>Vertical integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI6.8</b>		
<b>Competency</b>	<b>Discuss and interpret results of arterial blood gas analysis in various disorders</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Discuss and enlist the analytes measured in ABG analysis	
	2.	Know the normal values of ABG analytes	
	3.	Discuss the interpretation and diagnosis of acid base disorders	
<b>Horizontal Integration</b>			
<b>Vertical integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI6.9</b>		
<b>Competency</b>	<b>Describe the functions of various minerals in the body, their metabolism and homeostasis</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Classify Minerals with suitable examples	
	2.	Explain the biochemical functions of Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride with reference to their clinical importance	
	3.	Discuss the metabolism of Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride in the human body	
	4.	Illustrate the regulation of calcium, phosphorous, iron in the human body	
<b>Horizontal Integration</b>		<b>Physiology</b>	
<b>Vertical Integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI6.10</b>		
<b>Competency</b>	<b>Enumerate and describe the disorders associated with mineral metabolism</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Enumerate the disorders associated with Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride	

2.	Mention the normal blood levels of Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride	
3.	Explain the clinical manifestations of the disorders associated with Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride	
4.	Discuss the genetic variations seen in Hemochromatosis, Wilson's disease, Menkes disease	
5.	Interpret the lab investigations done for the detection of disorders associated with Calcium, phosphorous, sulphur, magnesium, manganese, sodium, chloride, potassium, iron, copper, zinc, selenium, iodine, fluoride	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI 6.11</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the functions of haem in the body &amp; describe the process involved in its metabolism &amp; describe porphyrin metabolism</b>	
<b>SLO</b>	At the end of the session the students should be able to	
1.	Illustrate the structure of Heme	
2.	Describe the synthesis of heme & its regulation	
3.	Discuss the types, enzyme defect, clinical manifestations, diagnosis and treatment of Porphyrrias	
4.	Describe the formation & fate of Bilirubin	
5.	Definition, types, causes of Jaundice	
6.	Interpret the laboratory reports of a case of a Jaundice	
7.	Describe different types of congenital jaundice	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		



<b>Number</b>	<b>BI 6.12</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the major types of haemoglobin and its derivatives found in the body and their pathological/physiological relevance</b>	
<b>SLO</b>	At the end of the session the students should be able to	
	1. Describe the structure of haemoglobin	
	2. Explain in detail about ODC Curve & factors influencing ODC Curve	
	3. Discuss in detail about the derivatives of hemoglobin	
	4. Discuss in detail about various types of hemoglobinopathies such as Sickle cell anemia HbC,Hb E Hb D & Thalssemias	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI6.13</b>	
<b>Competency</b>	<b>Describe the functions of the kidney, liver, thyroid and adrenal glands</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe the functions of kidney	
	2. Describe the functions of liver	
	3. Describe the functions of thyroid	
	4. Describe the functions of adrenal gland	
<b>Horizontal Integration</b>	<b>Physiology, Human Anatomy</b>	
<b>Vertical integration</b>	<b>Pathology, General Medicine</b>	

<b>Number</b>	<b>BI6.14</b>	
<b>Competency</b>	<b>Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands)</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe the tests, normal values and interpretation of Renal function test	
	2. Describe the tests, normal values and interpretation of liver function test	
	3. Describe the tests, normal values and interpretation of thyroid function test	
	4. Describe the tests, normal values and interpretation of adrenal function test	
<b>Horizontal Integration</b>	<b>Physiology, Human Anatomy</b>	
<b>Vertical integration</b>	<b>Pathology, General Medicine</b>	

<b>Number</b>	<b>BI6.15</b>	
<b>Competency</b>	<b>Describe the abnormalities of kidney, liver, thyroid and adrenal glands</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Enumerate the defect, clinical features and diagnostic features of renal disorders	
	2. Enumerate the defect, clinical features and diagnostic features of liver disorders	
	3. Enumerate the defect, clinical features and diagnostic features of thyroid disorders	
	4. Enumerate the defect, clinical features and diagnostic features of adrenal disorders	
<b>Horizontal Integration</b>	<b>Physiology, Human Anatomy</b>	
<b>Vertical integration</b>	<b>Pathology, General Medicine</b>	

<b>Number</b>	<b>BI 7.1</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the structure &amp; functions of DNA &amp; RNA &amp; Outline the cell cycle</b>	
<b>SLO</b>	At the end of the session the students should be able to	
	1. Describe the structure & functions of DNA	
	2. Discuss about denaturation and renaturation of DNA	
	2. Describe the structure & functions of different types of RNA	
	3. Explain the phases of cell cycle and its regulation	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 7.2</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the process involved in replication &amp; repair of DNA &amp; transcription &amp; Translation mechanisms.</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Describe the process of DNA replication and its inhibitors	
	2. Discuss the types of DNA damages and DNA repair mechanisms	
	3. Explain the process of transcription, post transcriptional modifications and inhibitors of transcription	
	4. Explain the process of translation, post translational modifications and inhibitors of translation	

<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 7.3</b>	<b>Time</b>
<b>Competency</b>	<b>Describe the gene mutations &amp; basic mechanism of regulation of gene expression</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Explain the type of mutations with examples.	
	2. Describe the regulation of gene expression in prokaryotes	
	3. Describe the regulation of gene expressions in eukaryotes	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>		

<b>Number</b>	<b>BI 7.4</b>	<b>Time</b>
<b>Competency</b>	<b>Describe applications of molecular techniques like recombinant DNA technology, PCR in the diagnosis and treatment of diseases with genetic basis.</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Explain the principle and steps of recombinant DNA technology and its applications	
	2. Describe the principle, steps and applications of PCR	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>Paediatrics &amp; general medicine</b>	

<b>Number</b>	<b>BI7.5</b>	
<b>Competency</b>	<b>Describe the role of xenobiotics in disease</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Define the terms Xenobiotics, Detoxification, Biotransformation	
	2. Explain Phase I detoxification reactions	

	3.	Explain Phase II detoxification reactions	
	4.	Describe the role of xenobiotic metabolism in diseases	
<b>Horizontal Integration</b>			
<b>Vertical Integration</b>			

<b>Number</b>	<b>BI7.6</b>		<b>Time</b>
<b>Competency</b>	<b>Describe the anti-oxidant defence systems in the body</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Definition, sources and examples of free radicals	
	2.	Explain the phases of lipid peroxidation	
	3.	Explain the hazardous effects to human health	
	4.	Definition and Classification of antioxidants	
	5.	Describe the mechanism & significance of anti-oxidant defence system	
<b>Horizontal Integration</b>			
<b>Vertical Integration</b>			

<b>Number</b>	<b>BI7.7</b>		
<b>Competency</b>	<b>Describe the role of oxidative stress in the pathogenesis of conditions such as cancer, complications of diabetes mellitus and atherosclerosis</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Explain the role of oxidative stress in the pathogenesis of cancer	
	2.	Describe the role of oxidative stress in complications of diabetes mellitus	
	3.	Mention in detail about the mechanism of oxidative stress in development of atherosclerosis	
<b>Horizontal Integration</b>			
<b>Vertical Integration</b>	<b>General Medicine, pathology</b>		

<b>Number</b>	<b>BI8.1</b>		
<b>Competency</b>	<b>Discuss the importance of various dietary components and explain importance of dietary fibre</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Explain the dietary importance of Carbohydrates	
	2.	Definition and Classification of Dietary fibre with suitable examples	

	3.	Enumerate the biochemical and clinical importance of Dietary fibre	
	4.	Explain the nutritional importance of Lipids	
	5.	Explain the nutritional importance of Proteins	
<b>Horizontal integration</b>			
<b>Vertical Integration</b>		<b>General Medicine, Paediatrics, Pathology</b>	

<b>Number</b>	<b>BI8.2</b>		
<b>Competency</b>	<b>Describe the types and causes of protein energy malnutrition and its effects</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Enumerate the types of protein energy malnutrition	
	2.	Explain the causes and deficiencies of protein energy malnutrition	
	3.	Enumerate the biochemical and clinical alterations seen in protein energy malnutrition	
<b>Horizontal integration</b>			
<b>Vertical Integration</b>		<b>General Medicine, Paediatrics, Pathology</b>	

<b>Number</b>	<b>BI8.3</b>		
<b>Competency</b>	<b>Provide dietary advice for optimal health in childhood and adult, in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy</b>		
<b>SLO</b>	At the end of this session the I MBBS students shall be able to		
	1.	Definition and normal value of Basal Metabolic Rate	
	2.	Enumerate the factors affecting basal metabolic rate	
	3.	Enlist the clinical importance of basal metabolic rate	
	4.	Definition and values of Specific Dynamic Action of various nutrients	
	5.	Explain the importance of specific dynamic action	
	6.	Calculate the dietary requirements for Children and adults with reference to their physical activity and body weight	
	7.	Calculate the dietary requirements in diabetes mellitus, obesity, coronary artery disease, pregnancy	
<b>Horizontal integration</b>			
<b>Vertical Integration</b>		<b>General Medicine</b>	

<b>Number</b>	<b>BI8.4</b>	
<b>Competency</b>	<b>Describe the causes (including dietary habits), effects and health risks associated with being overweight / obesity</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Define the terms overweight / obesity	
	2. Calculate Body Mass Index and segregate the persons on the basis of BMI	
	3. Enumerate the causes(including dietary habits) of overweight / obesity	
	4. Describe the types of obesity	
	5. Discuss the effects and health risks associated with being overweight / obesity	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>	<b>General Medicine, Pathology</b>	

<b>Number</b>	<b>BI8.5</b>	
<b>Competency</b>	<b>Summarize the nutritional importance of commonly used items of food including fruits and vegetables (macro-molecules &amp; its importance)</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Enumerate the caloric value, micronutrient and macronutrient content of dairy foods	
	2. Enumerate the caloric value, micronutrient and macronutrient content of cereals, pulses	
	3. Enumerate the caloric value, micronutrient and macronutrient content of fruits and vegetables	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>	<b>Community Medicine, General Medicine, Pediatrics</b>	

<b>Number</b>	<b>BI9.1</b>	
<b>Competency</b>	<b>List the functions and components of the extracellular matrix (ECM)</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Discuss the functions of extracellular matrix	
	2. Describe the components of extracellular matrix	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI9.2</b>	
<b>Competency</b>	<b>Discuss the involvement of ECM components in health and disease</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Explain the events involved in the synthesis of collagen and its structural importance	
	2. Know the types of collagen and its tissue distribution	
	3. Discuss about the disorders associated with the collagen	
	4. Explain the structure, properties, functions & diseases associated with elastin	
	5. Discuss the structure, role in health, functions & diseases associated with fibrillin-1, fibronectin & laminin	
	6. Explain the structure, properties, functions & diseases associated with proteoglycan	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>	<b>General Medicine</b>	

<b>Number</b>	<b>BI9.3</b>	
<b>Competency</b>	<b>Describe the protein targeting &amp; sorting along with its associated disorders</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Define the term protein targeting & sorting	
	2. Discuss the events involved in the protein targeting and sorting	
	3. Describe the disorders associated with protein targeting & sorting	
<b>Horizontal Integration</b>		
<b>Vertical Integration</b>		

<b>Number</b>	<b>BI 10.1</b>	<b>Time</b>
<b>Competency</b>	<b>Describe cancer initiation, promotion oncogenes &amp; Oncogene activation. Also focus on P53 &amp; apoptosis</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Discuss the agents causing cancer	
	2. Discuss the molecular basis of cancer	
	3. Discuss the functions of p53	
	4. Discuss the process of Apoptosis	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>OBG, General surgery, pathology</b>	

<b>Number</b>	<b>BI 10.2</b>	<b>Time</b>
<b>Competency</b>	<b>Describe various biochemical tumor markers &amp; biochemical basis of cancer therapy</b>	
<b>SLO</b>	At the end of the session students should be able to	
	1. Define tumor markers	
	2. Enlist the tumour markers with the respective tumours	
	3. Discuss the biochemical basis of Chemotherapy	
<b>Horizontal Integ</b>		
<b>Vertical Integ</b>	<b>OBG, General surgery &amp; pathology</b>	

<b>Number</b>	<b>BI10.3</b>	
<b>Competency</b>	<b>Describe the cellular and humoral components of the immune system and describe the types and structure of antibody</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Discuss the components and functions of cellular immune system	
	2. Discuss the components and functions of humoral immune system	
	3. Describe the structure and types of antibody	
<b>Horizontal integration</b>		
<b>Vertical Integration</b>	<b>Obstetrics &amp; Gynaecology, General Surgery, Pathology</b>	

<b>Number</b>	<b>BI10.4</b>	
<b>Competency</b>	<b>Describe and discuss innate and adaptive immune responses, self / non-self recognition and the central role of T-helper cells in immune responses</b>	
<b>SLO</b>	At the end of this session the I MBBS students shall be able to	
	1. Describe the innate and adaptive immune responses with examples	
	2. Discuss the mechanism of self / non-self recognition by the immune system of the human body	
	3. Explain the types of immune responses in the body	



	4.	Discuss the central role of T-helper cells in immune responses in the body	
<b>Horizontal integration</b>		<b>Physiology</b>	
<b>Vertical Integration</b>		<b>General Medicine, Pathology</b>	

<b>Number</b>		<b>BI10.5</b>	
<b>Competency</b>		<b>Describe antigens and concepts involved in vaccine development</b>	
<b>SLO</b>		At the end of this session the I MBBS students shall be able to	
	1.	Differentiate the terms immunogenicity and antigenicity	
	2.	Discuss the properties of antigens and epitopes	
	3.	Describe Active and passive immunization	
	4.	Enumerate the types of vaccines	
	5.	Explain the designing of vaccines for active and passive immunization	
<b>Horizontal integration</b>			
<b>Vertical Integration</b>		<b>Pathology, Pediatrics, Microbiology</b>	