OBJECTIVES FOR BIOCHEMISTRY COMPETENCIES

SPECIFIC LEARNING OBJECTIVES FOR COMPETENCIES

NUMBER	COMPETENCY *The student should be able to*	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
TOPIC --Basic Biochemistry		**Number of competencies: (01)**				**Number of procedures that require certification: (NIL)**			
BI1.1	Describe the molecular and functional organization of a cell and its subcellular components.	*At the end of session, the phase I MBBS student must be able to* Explain the structure and biochemical functions of different cell organelles of a eukaryotic cell. List the Marker enzymes related to each cell organelle. Explain the composition and Fluid mosaic model of Cell Membrane. Discuss the different transport mechanisms across cell membranes with examples.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Physiology (H)
Topic: Enzyme, Number of competencies: (07) Number of procedures that require certification: (NIL)									
BI2.1	Explain fundamental concepts of enzyme, isoenzyme, alloenzyme,	*By the end of Session, the Phase – I students Should be able to:* Define the General properties, IUBMB Classification of Enzymes-. Define Coenzymes and Cofactors. Describe the 6 major enzyme classifications	K	KH	Y	Lecture, case discussion	Written assessment/ Viva voce		

		and the basic type of reaction catalysed, including: oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases.							
BI2.2	Observe the estimation of SGOT & SGPT	*By the end of Session, the Phase – I students Should be able to* Discuss the Diagnostic Importance of enzymes – SGOT & SGPT	K	KH	N	Demonstration	Viva voce		
BI2.3	Describe and explain the basic principles of enzyme activity	*By the end of Session, the Phase – I students Should be able to* Explain the Factors affecting enzyme activity Analyse the Mechanism of Enzyme action - Concept of activation energy, transition state, binding energy, active site; Substrate binding to active site - Koshlands Induced fit theory. Explain the Effect of substrate concentration - Michaelis - Menton theory, Km value, Vmax and its significance (derivation required). Effect of concentration of enzyme, temperature, time, pH,Metallo-enzymes.	K	KH	N	Lecture, Small Group Discussion	Written/ Viva voce		
BI2.4	Describe and discuss enzyme inhibitors as poisons and drugs and as therapeutic enzymes	*By the end of Session, the Phase – I students Should be able to* Discuss the Enzyme inhibition - Competitive and Non-competitive inhibition with examples of clinical importance. Differentiate the different types of inhibitors, with examples including transition state inhibitors, suicide inhibitors, and irreversible inhibitors, competitive and non-competitive	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		Pathology and General Medicine (V)

		inhibitors. Evaluate the difference between a competitive versus non-competitive drug inhibitor (e.g. using fomepizole and ethanol treatments for methanol poisoning.) Draw a Lineweaver-Burke plot, defining Vmax and Km and use the plot to evaluate types of inhibition, including competitive, non-competitive, and mixed inhibition in drugs.							
BI2.5	Describe and discuss the clinical utility of various serum enzymes as markers of pathological conditions.	*By the end of Session, the Phase – I students Should be able to* Analyse the importance of Clinical Enzymology – Concept of plasma functional and non-functional enzymes. Explain the Diagnostic Importance of enzymes – LDH, CK, AST, ALT, ALP, GGT, Amylase, Lipase Discuss Isoenzymes – Definition Explain the importance of enzymes as Diagnostic and Therapeutic agents	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology and General Medicine (V)
BI2.6	Discuss use of enzymes in laboratory investigations (Enzyme-based assays)	*By the end of Session, the Phase – I students Should be able to* Explain the Diagnostic Importance of enzymes – G6PD, Cholinesterase, ACP, 5'nucleotidase	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology and General Medicine (V)
BI2.7	Interpret laboratory results of enzyme	*By the end of Session, the Phase – I students Should be able to*	K	KH	Y	Lecture, Small Group	Written/ Viva voce		Pathology and General

	activities & describe the clinical utility of various enzymes as markers of pathological conditions.	Discuss the Mechanisms of enzyme catalysis (List)Suicide inhibition, Uncompetitive inhibition. Discuss the Enzymes used in diagnostic assays – ELISA and RIA.				Discussion			Medicine (V)
TOPIC -- Chemistry and Metabolism of Carbohydrates		**Number of competencies: (10)**				**Number of procedures that require certification: (NIL)**			
BI3.1	Discuss and differentiate monosaccharides, di-saccharides and polysaccharides giving examples of main carbohydrates as energy fuel, structural element and storage in the human body	*At the end of session, the phase I MBBS student must be able to* Classify Carbohydrates. Classiify monosaccharides, disaccharides, oligosaccharides and polysaccharides with examples. Discuss the sources and significance of most common monosaccharides. Discuss the derivatives of monosaccharides and their significance. List the Important reactions of Carbohydrates and discuss their importance. Explain the isomerism of Carbohydrates. Discuss the composition, sources and significance of most common disaccharides. Discuss the composition, sources and significance of most common homopolysaccharides.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		Differentiate between starch and glycogen. Discuss the composition, importance and location of common heteropolysaccharides. Classify Mucopolysaccharidoses and discuss the enzyme defect and related biochemical investigations in each.							
B13.2	Describe the processes involved in digestion and assimilation of carbohydrates and storage.	*At the end of session, the phase I MBBS student must be able to* Enumerate the major monosaccharides, disaccharides, and polysaccharides found in the human body and diet. List the enzymes involved in digestion of carbohydrates. Discuss the hydrolysis of polysaccharides, oligosaccharides and disaccharides. List and discuss the role of glucose transporters (GLUTs) in the transport of glucose into and out of cells. Explain the mechanism of absorption of end products of digestion. Explain the biochemical basis for the symptoms seen in lactose intolerance.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		
B13.3	Describe and discuss the digestion and assimilation of carbohydrates	*At the end of session, the phase I MBBS student must be able to* Enumerate the major monosaccharides,	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

	from food.	disaccharides, and polysaccharides found in the human body and diet. List the enzymes involved in digestion of carbohydrates. Discuss the hydrolysis of polysaccharides, oligosaccharides and disaccharides. List and discuss the role of glucose transporters (GLUTs) in the transport of glucose into and out of cells. Explain the mechanism of absorption of end products of digestion. Explain the biochemical basis for the symptoms seen in lactose intolerance.							
B13.4	Define and differentiate the pathways of carbohydrate metabolism, (glycolysis, gluconeogenesis, glycogen metabolism, HMP shunt).	*At the end of session, the phase I MBBS student must be able to* Discuss the Significance, Site, Subcellular site, reactants and products, enzymes required, energetics, regulation and disorders related to enzyme deficiencies of Glycolysis. Explain the substrate level phosphorylation. Differentiate the roles of hexokinase and glucokinase in blood glucose regulation. Explain the importance of Rapaport leubering cycle in RBC. Differentiate the aerobic and anaerobic	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)

		glycolysis. Discuss the causes, features and parameters altered in Lactic acidosis. Differentiate the aerobic and anaerobic glycolysis. Discuss the Significance, Site, Subcellular site, different substrates required, reactants and products, enzymes required and regulation of Gluconeogenesis. Explain Cori's cycle. Explain the role of gluconeogenesis in blood glucose regulation Differentiate the enzymes involved in glycolysis vs gluconeogenesis. Discuss the Significance, Site, Subcellular site, reactants and products, enzymes required and disorders related to enzyme deficiencies of Pentose Phosphate Pathway. Discuss the biochemical alterations related to Glucose 6- phosphate dehydrogenase deficiency. Explain the role of reduced glutathione in the body, and the contribution of NADPH to its formation. Discuss the Significance, Site, Subcellular							

		site, reactants and products, enzymes required in Glycogenesis and Glycogenolysis. Explain the regulation of glycogen metabolism in liver and skeletal muscle. List the Glycogen storage diseases. Discuss the deficient enzymes, tissues affected, clinical features and biochemical alterations in Glycogen storage diseases.							
BI3.5	Describe and discuss the regulation, functions and integration of carbohydrate along with associated diseases/disorders.	*At the end of session, the phase I MBBS student must be able to* Discuss the regulation of blood glucose levels in well fed condition and fasting. Explain the metabolic changes during starvation. Discuss the related enzyme defects, biochemical alterations and features of glycogen storage disorders, Glucose-6-Phosphate dehydrogenase deficiency, Galactosemia, Essential Fructosuria, Hereditary fructose intolerance and Essential pentosuria	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)
B13.6	Describe and discuss the concept of TCA cycle as a amphibolic pathway and its regulation.	*At the end of session, the phase I MBBS student must be able to* Discuss the Site, Subcellular site, reactants and products, enzymes required, and energetics of Pyruvate dehydrogenase (PDH) complex.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		Discuss the Significance, Site, Subcellular site, reactants and products, enzymes required, energetics and regulation of TCA Cycle. Explain the anapleurotic role of TCA Cycle. Explain the amphibolic role of TCA Cycle. Explain the biochemical role of thiamine in PDH complex and TCA cycle.							
BI3.7	Describe the common poisons that inhibit crucial enzymes of carbohydrate metabolism (eg; fluoride, arsenate)	*At the end of session, the phase I MBBS student must be able to* Discuss the common poisons that inhibit enzymes of Glycolysis. Discuss the common poisons that inhibit enzymes of TCA cycle.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Physiology(H)
B13.8	Discuss and interpret laboratory results of analytes associated with metabolism of carbohydrates	*At the end of session, the phase I MBBS student must be able to* Discuss the indications, precautions and procedure of Glucose tolerance test (GTT). Analyse the results of GTT. Explain the different investigations related to carbohydrate metabolism such as Glycosylated Hemoglobin, Fructosamine Benedicts test and urinary dipstick analysis for glucose and ketone bodies. Discuss the normal and abnormal values of	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine,Pathology (V)

		FBS, PPBS and HBA1C.							
BI3.9	Discuss the mechanism and significance of blood glucose regulation in health and disease.	*At the end of session, the phase I MBBS student must be able to* Discuss the significance of blood glucose regulation. Explain the mechanism of maintenance of glucose homeostasis in our body. Explain the role of hormones in blood glucose regulation. Discuss the mechanism of action of hormones glucagon and insulin. Differentiate type 1 and type 2 diabetes mellitus with respect to incidence, age of onset, cause, biochemical alterations, clinical features, complications and related investigations.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)
BI3.10	Interpret the results of blood glucose levels and other laboratory investigations related to disorders of carbohydrate metabolism	*At the end of session, the phase I MBBS student must be able to* List the different investigations done in Diabetes mellitus. Discuss the indications, precautions and procedure of Glucose tolerance test (GTT). Analyse the results of GTT. Explain the different investigations related to carbohydrate metabolism such as Glycosylated Hemoglobin, Fructosamine	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)

		Benedicts test and urinary dipstick analysis for glucose and ketone bodies. Discuss the normal and abnormal values of FBS, PPBS and HBA1C and their role in diagnosis and management of Diabetes mellitus.							
Notes : Competencies 3.2 and 3.3 are almost similar **Competencies 3.8 and 3.10 are almost similar**									
TOPIC -- Chemistry and Metabolism of Lipids		**Number of competencies: (07)**				**Number of procedures that require certification: (NIL)**			
BI4.1	Describe and discuss main classes of lipids (Essential / non-essential fatty acids, cholesterol and hormonal steroids, triglycerides, major phospholipids and sphingolipids) relevant to human system and their major functions.	*At the end of the session Phase I student should be able to* Define lipids, Explain Modified Bloor's classification with examples. Explain biomedical importance of lipids Discuss Fatty acids, nomenclature, classification with examples, physical and chemical properties and tests for purity of fats (rancidity, saponification) Enumerate the importance of Essential fatty acids and their deficiency manifestations Discuss Triglycerides, their composition and importance Explain Phospholipids, their classification	K	KH	Y	Lecture, small group discussion	Written/ Viva voce		General Medicine

		and functions with clinical importance Explain Glycolipids their types and importance List the Eicosanoids their Classification and functions Explain Cholesterol its structure and functions							
BI 11.24	Enumerate advantages and /or disadvantages of use of unsaturated, saturated and transfats in foods	*At the end of the session Phase I student should be able to* Differentiate between Mono and Polyunsaturated fatty acids,w3 and w6 fatty acids and their advantages and/or disadvantages. Explain what Trans fatty acids with examples and their disadvantages							General Medicine
NOTE: BI 11.24 is included under topic Biochemistry Laboratory test									
BI4.2	Describe the processes involved in digestion and absorption of dietary lipids and the key features of their metabolism	*At the end of the session Phase I student should be able to* Explain the digestion and absorption of dietary lipids, enzymes and hormones involved in lipid digestion, role of bile salts in digestion and absorption, mechanism of lipid absorption and disorders of digestion and absorption Discuss the synthesis and breakdown of triacylglycerol. Explain the following pathways – Site,	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		reactions, key steps, significance, energetics and regulation of • Beta oxidation and its disorders • Fatty acid synthesis • Ketogenesis, ketolysis, DKA (Clinical features, lab Investigations) • Cholesterol metabolism							
BI4.3	Explain the regulation of lipoprotein metabolism & associated disorders.	*At the end of the session Phase I student should be able to* Explain the formation and fate of Chylomicrons, VLDL, LDL, HDL, HDL cycle its significance, reverse cholesterol transport, uptake of LDL and its regulation, the role of apoproteins Discuss the normal serum levels of HDL, LDL, Triglycerides, VLDL advantages of elevated HDL and decreased LDL, significance of HDL/LDL Categorize the different hyperlipidaemias (Hyperlipoproteinemias)	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine
BI4.4	Describe the structure and functions of lipoproteins, their functions, interrelations & relations with atherosclerosis and fatty liver	*At the end of the session Phase I student should be able to* Differentiate various lipoprotein particles with respect to their Structure, Composition, Types and Functions. Define Atherosclerosis, role of lipids in atherogenesis (OxLDL, Lpa, Small dense LDL, HDL)	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine

		Enumerate the different biochemical pathways that could potentially be targeted pharmacologically in the management of heart disease i.e. high LDL, low HDL. Discuss the increasing incidence of obesity and diabetes and its impact on atherosclerosis. Discuss the risk factors of the metabolic syndrome and its specific lipid abnormalities. List the statins as the main therapeutic intervention in dyslipidemia/atherosclerosis and interpret their action in terms of the inhibition of HMG CoA reductase. Discuss Fatty Liver types, biochemical changes in lipid content of Liver, lipotropic factors and their biochemical mechanisms							
BI4.5 BI4.7	Interpret laboratory results of analytes associated with metabolism of Lipids Interpret laboratory results of analytes associated with metabolism of lipids	*At the end of the session Phase I student should be able to* Discuss the various Hyperlipoproteinemias Explain Lipid Storage Disorders Explain Lipid profile, it's components, normal serum levels, normal and abnormal patterns, Friedwald's formula and its limitations	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine
NOTE: BI 4.7 is repeat of BI 4.5									
BI 4.6	Describe the therapeutic uses of prostaglandins and	*At the end of the session Phase I student should be able to*	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine

	inhibitors of eicosanoid synthesis	Discuss Prostaglandins – types and their biomedical importance. Differentiate the role of dietary omega-3 versus omega-6 fatty acids in the formation of polyunsaturated fatty acids and the consequences for eicosanoid production.							
TOPIC -- Chemistry and Metabolism of Proteins		**Number of competencies: (05)**					**Number of procedures that require certification: (NIL)**		
BI5.1	Describe and discuss structural organization of proteins.	*At the end of the session Phase I student should be able to* Discuss Amino acids – their classification based on structure, polarity, metabolism and nutritional requirements, general reactions Define Proteins, Classification based (a) chemical nature & solubility (b) functions of proteins (c) Nutritional value Explain structural organisation of proteins (primary, secondary, super secondary structures/ motifs, domains, tertiary and quaternary structures) List the various bonds stabilizing protein structure Discuss Protein folding, chaperones and protein misfolding diseases Explain the structure of Insulin, Hemoglobin and Collagen.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		Enumerate the structure function relationship of proteins - haemoglobin, myoglobin, collagen and elastin List the biologically important peptides							
BI5.2 BI6.12	Describe and discuss functions of proteins and structure-function relationships in relevant areas eg, hemoglobin and selected hemoglobinopathies Describe major types of Hb and its dervatives found in body and their physiological and pathological relevance	*At the end of the session Phase I student should be able to* Describe and discuss functions of proteins and structure-function relationships in relevant areas eg, hemoglobin, Various types of Hb HbA_1, HbA_2, HbA_3, HbF, Embryonic Hb, HbA_{1C}, derivatives of Hb and selected hemoglobinopathies. *At the end of the session Phase I student should be able to* Analyze the results of hemoglobin composition studies and use them to differentiate between the major hemoglobinopathies (such as sickle cell trait and disease, thalassemia, HbC, etc) Differentiate the aetiology and genetics of the major hemoglobinopathies (such as sickle cell trait and sickle cell disease, alpha and beta thalassemias,HbC, etc.).	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine, Pathology(V), Physiology (H)
NOTE: Competency BI 6.12 is included here									
BI5.3.	Describe the digestion and absorption of dietary proteins.	*At the end of the session Phase I student should be able to* Explain digestion and absorption of Dietary proteins, enzymes and hormones involved in protein digestion, mechanism of absorption,	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pediatrics (V)

		meister cycle and disorders of absorption. Explain the dynamics of the free amino acid pool, including (A) inputs from diet, body protein breakdown, and de novo synthesis (B) outputs to protein synthesis, urea production, synthesis of specialized products and other metabolic processes.							
BI5.4	Describe common disorders associated with protein metabolism.	*At the end of the session Phase I student should be able to* List the common inborn errors of protein metabolism, their enzyme defect, clinical features, various lab tests available for diagnosis of – Phenylketonuria, Tyrosinosis, Alkaptonuria, Albinism, Homocysteinuria, MSUD(Maple syrup urine disease), Glycinuria, Cystinuria. List the causes for hyperammonemia, its consequences, and treatments to reduce blood ammonia levels.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pediatrics (V)
BI5.5	Interpret laboratory results of analytes associated with metabolism of proteins.	*At the end of the session Phase I student should be able to* Analyse laboratory results of analytes associated with metabolism of proteins. Differentiate the following disease states associated with Inborn Errors of protein metabolism, including (A) the deficient enzyme, (B) relation of the deficiency to the build-up of secondary metabolites, and (C) clinically relevant information related to the disease state (vitamin deficiencies,	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine

		symptoms, diagnosis, pathology and treatments - diseases are listed in order of most common to least common). a. Cystinuria b.Histidinemia c. Phenylketonuria (PKU) – knows difference between classical, atypical and maternal PKU. d. Methylmalonyl CoA mutase deficiency e. Albinism (with lesser priority to vitiligo and Menke disease). f. Homocystinuria g. Alkaptonuria h. Maple syrup urine disease (branched chain amino acids; tie in with pyruvate dehydrogenase complex and alpha-ketoglutarate dehydrogenase complex, and the requirement for thiamine, lipoic acid, niacin, riboflavin and pantothenate). i. Cystathioninuria j. Tyrosinemia							
TOPIC -- Metabolism and Homeostasis		**Number of competencies: (15)**				**Number of procedures that require certification: (NIL)**			
BI6.1	Discuss the metabolic Process that take place in specific organ in the body in Fed and Fasting States.	*By the end of Session, the Phase – I students Should be able to:* Discuss the historical background for metabolism. Explain the basic elements of the integration of metabolism Compare and contrast the basic differences between carbohydrate, lipid and protein metabolism.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)

		Describe and identify the main characteristics and classification hormones affecting metabolism such as insulin, adrenaline, and glucagon. Apply the processes of scientific research and experimental design to the diversity of metabolism Distinguish scientific explanations that show the hormonal effects on different types of metabolism. Describe how the hormones control metabolic responds of cells.							
BI6.2	Describe and discuss the metabolic process in which nucleotides are involved	*By the end of Session, the Phase – I students Should be able to:* Name the major purine and pyrimidine bases and identify amino acid and one-carbon metabolites that contribute to the synthesis of these ring structures. Integrate the terminology and defining structural features that distinguish different classes of nucleotide metabolites (such as purine vs. pyrimidine, bases vs. nucleoside vs. nucleotide, and ribo- vs. deoxyribose-). Explain the biosynthesis of the purine and pyrimidine nucleotides with emphasis on the key regulated steps. Connect the pentose phosphate pathway to 5'phosphoribosyl-1-pyrophosphate (PRPP)	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		synthesis and explain the central role of this metabolite in nucleotide metabolism. Differentiate the interplay and relative contributions of the de novo and salvage pathways in maintaining steady-state purine and pyrimidine nucleotide levels. Explain the role of adenylate kinase in nucleotide interconversion and connect this to adenine nucleotide catabolism during periods of increased demand or reduced supply of ATP. Summarize purine nucleotide catabolism and explain the significance of alternate adenine nucleotide catabolic pathways under physiological (such as intense anaerobic exercise) and pathophysiological (such as myocardial ischemia) conditions.							
BI6.3	Describe the common disorders associated with nucleotide Metabolism.	*By the end of Session, the Phase – I students Should be able to:* Explain the purine salvage pathways and discuss the central role of hypoxanthine phosphoribosyl transferase (HPRT) under physiological (such as steady-state purine nucleotide synthesis) and pathophysiological (such as gout in partial and complete HPRT deficiencies) conditions, and in pharmacotherapy (anti-purine chemotherapy). Explain the salvage pathways for uracil and	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Physiology (H)

		thymine and their relevance to pharmacotherapy (such as for the treatment of cancer or herpes infections). Identify inborn errors of purine metabolism (such as deficiencies of HPRTase and adenosine deaminase) and compare their primary clinical presentations. Describe the ribonucleotide reductase reaction and its regulation and explain its role in cancer chemotherapy and in adenosine deaminase deficiency. Summarize folate metabolism and explain its connection to nucleotide metabolism (such as the synthesis of thymidine and IMP). Compare and contrast the effects of 5-flurouracil (5-FU) and methotrexate (MTX) on the synthesis of thymidine. Explain the mechanisms by which antifolates interfere with bacterial growth. Discuss the roles of antifolates in treating bacterial infections. Describe the synthesis of S-adenosylmethionine and its role in methylation reactions. Explain how a cobalamin deficiency leads to a secondary folate deficiency.							
BI6.4	Discuss the Laboratory results of	*By the end of Session, the Phase – I students Should be able to:*	K	KH	Y	Lecture, Small Group	Written/ Viva voce		General Medicine (V)

	Analytes associated with gout and Lesch Nyhan Syndrome,	Distinguish between hyperuricemia and gout and identify physiological and pathophysiological effectors of circulating uric acid levels. Explain the relationship between uric acid insolubility and gout and discuss the differential diagnosis of this disorder. Distinguish between xanthine dehydrogenase/oxidase and explain how allopurinol and febuxostat inhibit uric acid formation. Compare and contrast the management of acute vs. chronic gout. Compare and contrast the benefits and drawbacks of approved therapies for gout (such as allopurinol vs febuxostat vs pegylated uricase) and ADA-SCD (such as gene therapy vs pegylated ADA). Describe conditions that lead to elevated orotic acid and interpret urine orotic acid concentration for the diagnosis of defects of the urea cycle or pyrimidine biosynthesis. Interpret laboratory data (such as serum folic acid, cobalamin, and methylmalonic acid) to distinguish between primary and secondary folate deficiency. Select lab tests that would contribute to the				Discussion			

		diagnosis of pernicious anemia.							
BI6.5	Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	*At the end of session, the phase I MBBS student must be ableto* Classify Vitamins. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin A. Explain Wald's visual cycle. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin D. Explain why Vitamin D is considered as a hormone. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin E. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin K. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Thiamine. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Riboflavin.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)

		Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Niacin. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Pyridoxine. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Pantothenic acid. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Biotin. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of Folic acid. Explain Folate Trap. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin B12. Discuss the Chemistry, Sources, RDA, Metabolism, Biochemical functions and deficiency manifestations of vitamin C.							
BI6.6	Describe Various Biochemical processes involved in generation of energy in cells.	*By the end of Session, the Phase – I students Should be able to:* Compare the mitochondrial content of different tissues and relate this characteristic	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		to the function of the particular tissue (e.g. parietal cells, which utilize an ATP-requiring proton pump, have high mitochondrial content). Describe the purpose of the electron transport chain (particularly complexes I, III, and IV) and ATP synthase, their substrates and products, their cellular localization, and their tissue distribution. Explain how electron transport and ATP synthase are functionally coupled. Explain how the process of oxidative phosphorylation is influenced by the availability of oxygen and NADH Explain how the cellular ATP:ADP ratio regulates the rate of ATP production by oxidative phosphorylation Discuss how succinate dehydrogenase, mitochondrial glycerol 3-phosphate dehydrogenase and electron-transferring-flavoprotein dehydrogenase transfer electrons to ubiquinone from succinate, cytosolic NADH and fatty acid dehydrogenases, respectively. Explain the biochemical basis for generation of heat by brown fat and discuss the role of brown fat in infants and the possible role in adults							

		Describe the effects of electron transport chain inhibitors, ATP synthase inhibitors, and uncouplers on oxidative phosphorylation, and predict the effects of these agents on glycolysis, the citric acid cycle, and lactate production Describe the biochemical and clinical features associated with ingestion/overdose of electron transport inhibitors (e.g. industrial exposure to cyanide and sodium azide) and uncouplers (e.g. aspirin, phthalate plasticizers) of oxidative phosphorylation List known mutations that cause defects in oxidative phosphorylation which result in myopathies and neuropathies (including exercise intolerance) and explain the pathophysiologic basis and genetics of each mitochondrial disease Compare and contrast the activities of glycolysis and oxidative phosphorylation in cancer cells to those of non-cancerous cells							
BI6.7	Describe the process involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with these	*At the end of the session Phase I student should be able to* Discuss water distribution in body, water balance, its regulation and disorders. Explain various electrolytes, their distribution and disorders (Sodium, Potassium, Chloride and Calcium)	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V) Physiology (H)

		Define pH. Discuss the importance of pH maintenance in human body. List the sources of H+ and HCO3- ions. Discuss Henderson and hasselbach equation. Classify buffers. Explain their role in maintenance of pH in human body							
BI6.8	Discuss and Interpret the results of ABG analysis in various disorders	*At the end of the session Phase I student should be able to* Discuss various Acid – Base disorders, compensatory mechanisms (respiratory and renal regulation) and know how to approach to a case of acid – base disorder given a list of parameters correctly	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General medicine (V)
BI6.9	Describe the functions of various minerals in the body, their metabolism and homeostasis	*At the end of session, the phase I MBBS student must be able to* Discuss the Sources, RDA, metabolism, biochemical functions and disorders of Iron. Discuss the Sources, RDA, metabolism, biochemical functions and disorders of Calcium. Discuss the Sources, RDA, metabolism, biochemical functions and disorders of Phosphorus.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V), Physiology (V)

		Discuss the Sources, RDA, metabolism, biochemical functions and deficiency manifestations disorders of Copper. Discuss the Sources, RDA, biochemical functions and disorders of Zinc. Discuss the Sources, RDA, biochemical functions and disorders of Selenium. Discuss the Sources, RDA, biochemical functions and disorders of Fluoride. Discuss the Sources, RDA, biochemical functions and disorders of Iodine. Discuss the Sources, RDA, biochemical functions and disorders of Magnesium. Discuss the Sources, RDA, biochemical functions and disorders of Manganese.							
BI6.10	Enumerate and describe the disorders associated with mineral metabolism	*At the end of session, the phase I MBBS student must be able to* Discuss the biochemical alterations and clinical features of Tetany, Hemosiderosis, Iron deficiency anemia, Hemochromatosis, Wilsons disease, Menke's kinky hair syndrome, Acrodermatitis enteropathica and Fluorosis.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)
BI6.11	Describe the functions of Haem in the body and describe the processes involved	*At the end of the session Phase I student should be able to* Explain Haem structure, types (symmetric and asymmetric), various hemoproteins and	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology, General medicine (V), Physiology (H)

	in its metabolism and describe porphyrin metabolism	their functions Discuss haem metabolism, Haem synthesis – various steps and enzymes and regulation List the Porphyrias, classification and discuss AIP (acute intermittent porphyria), PCT (Porphyria cutanea tarda), CEP (Congenital erythropoietic porphyria) in detail Explain Heme degradation with formation of bilirubin and its metabolism. Define Jaundice, classify them, (Acquired – Hemolytic, Hepatic, Obstructive, physiological Jaundice of newborn, breast milk jaundice and inherited – Criggler Najjar type I and II, Gilbert's disease, Dubin Johnson and rotorsyndrome), biochemical features in each and associated enzyme disorders.							
BI6.12	Describe the major types of Hb and its dervatives found in body and their physiological and pathological relevance	**NOTE: Competency BI 6.12 is included under 5.2**	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology,General Medicine(V)Physiology (H)
BI6.13	Describe the functions of the kidney, liver, thyroid and adrenal glands.	*At the end of session, the phase I MBBS student must be able to* Discuss the functions of the kidney, liver, thyroid and adrenal glands. List the hormones secreted by adrenal cortex	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology,General Medicine(V)Physiology (H), Anatomy (H)

		and medulla. Enumerate the steps and enzymes required during the synthesis of adrenal cortex hormones.							
BI6.14	Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands).	*At the end of session, the phase I MBBS student must be able to* Classify Liver function tests, Renal function tests, Thyroid function tests and Adrenal Gland function tests. Explain the routinely done tests in detail.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology,General Medicine(V)Physiology,Human Anatomy (H)
BI6.15	Describe the abnormalities of kidney, liver, thyroid and adrenal glands	*At the end of session, the phase I MBBS student must be able to* List the abnormalities of / diseases related to functioning of kidney, liver, thyroid and adrenal glands. Explain the role of biochemical investigations and their alterations in abnormalities of kidney, liver, thyroid and adrenal glands.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology,General Medicine(V)Physiology,Human Anatomy (H)
Notes – Better to write competency for each organ including their functions, related investigations and diseases.									
Topic: Molecular Biology		**Number of competencies: (07))**					**Number of procedures that require certification: (NIL)**		
BI7.1	Describe the Structure and function of DNA	*By the end of Session, the Phase – I students Should be able to*	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

	and RNA and outline the cell cycle	Describe, discuss and Enumerate the central dogma of molecular biology, and cite exceptions to the original model. Compare and contrast the structure of DNA and RNA, explaining the difference between the constituent bases, sugars, nucleosides and nucleotides. Differentiate the different types of RNA prokaryotic and eukaryotic gene structure.							
B17.2	Describe the processes involved in Replication & Repair of DNA and the transcription, translation mechanisms.	*By the end of Session, the Phase – I students Should be able to:* Describe the double-stranded, helical, and antiparallel chain structureofDNAand how it relates tothe processes of DNA replication, transcription, recombination and repair.) Summarize the mechanism of DNA replication and why discontinuous synthesis is required. Explain the process of telomere replication and relate telomere dynamics to aging and disease. Discuss how DNA and DNA processes can be used as therapeutic targets (e.g. anticancer and antibacterial drugs). Explain the universal features of the genetic code and describe its biological relevance. Explain the use of the genetic code to predict	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

		the amino acid sequence of a protein for a given nucleic acid sequence and demonstrate how nucleotide mutations can lead to alterations in the primary structure of a protein. Discuss the initiation, elongation, andtermination of transcription, comparing these processes in eukaryotic and prokaryotic cells. Compare and contrast prokaryotic and eukaryotic gene structure. Enumerate the initiation, elongation, and termination of transcription, comparing these processes in eukaryotic and prokaryotic cells. Discuss the posttranscriptional processing of eukaryotic mRNA and explain how the diseases may result from alterations in the processing steps and cite examples. Discuss the three steps of translation: initiation, elongation, and termination. Compare and contrast these processes and their regulation in eukaryotic and prokaryotic cells. Describe the cis and trans acting elements involved in eukaryotic transcription and summarize their regulation. Explain the effects of various antibiotics on							

		prokaryotic protein synthesis, and potential side-effects of these antibiotics. Describe the cis and trans acting elements involved in eukaryotic transcription and summarize their regulation. Discuss the effect of covalent modification of chromatin on gene transcription (including methylation, histone acetylation and phosphorylation).							
B17.3	Describe Gene Mutation and basic Mechanism of regulation of gene expression	*By the end of Session, the Phase – I students Should be able to:* Compare and contrast polymerase proofreading, direct repair, base excision repair, nucleotide excision repair, mismatch repair, and recombination. List the different types of mutations that occur in DNA. Describe and Discuss why mutations in DNA repair systems can lead to disease, including certain types of cancer.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pediatrics(V)
B17.4	Describe Applications of Molecular Technologies Like rDNA Technology, PCR in the diagnosis and treatment of Diseases with	*By the end of Session, the Phase – I students Should be able to:* Define RNAi and describe its role in regulation of gene expression. Discuss the structure and function of chromatin and summarize the mechanism of	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pediatrics,General Medicine(V)

	genetic basis	remodeling required to make DNA accessible for biological processes. Define epigenetics and describe its role in development, imprinting and disease. Explain the principles, methods, and applications of Northern, Southern, Western blot, microarray, PCR, and DNA sequencing for clinical and forensic sciences. Describe how recombinant DNA technology is used to clone and express genes.							
BI 7.5	Describe the role of Xenobiotics in disease	*At the end of the session Phase I student should be able to* Define detoxification, bio transformation and Xenobiotics. Discuss the compounds to be detoxified, Cytochrome P450 complex and Phase I, II, III reactions in detail	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		
BI 7.6	Describe the anti – oxidant defense systems in the body	*At the end of the session Phase I student should be able to* Discuss the various ROS and Free radicals, how they are generated, and damage caused by them, lipid peroxidation. Discuss various Free radical scavenger systems, their clinical significance. List the Anti- oxidants – types (preventive, chain breaking, therapeutic and others)	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

BI 7.7	Describe the role of oxidative stress in the pathogenesis of conditions such as Cancer, complication of Diabetes mellitus and atherosclerosis					Lecture, Small Group Discussion	Written/ Viva voce		General Medicine and Pathology (V)
NOTE: BI 7.7 is covered in the respective topics									
TOPIC --Nutrition		**Number of competencies: (05)**				**Number of procedures that require certification: (NIL)**			
BI8.1	Discuss the importance of various dietary components and explain importance of dietary fibre.	*At the end of session, the phase I MBBS student must be able to* Define nutrition. List the major components of diet. Discuss the nutritional Importance of Dietary proteins, carbohydrates and fats and state the amount of energy obtained by metabolism of carbohydrates, lipids and proteins. Discuss Nitrogen balance and methods of assessment of nutritive quality of proteins. Explain the nature and beneficial effects of dietary fibres.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine,Pediatrics,Pathology (V)
BI8.2	Describe the types and causes of protein energy	*At the end of session, the phase I MBBS student must be able to*	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine,Pediatrics,Patholog

	malnutrition and its effects	Define the terms Kwashiorkor and Marasmus. Discuss and differentiate Kwashiorkor and Marasmus with respect to age of onset, causes, clinical features and biochemical alterations.							y (V)
BI8.3	Provide dietary advice for optimal health in childhood and adult, in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy.	*At the end of session, the phase I MBBS student must be able to* Discuss the need for energy for maintenance of basal metabolism, physical activity and Specific dynamic action of food. Define Specific Dynamic Action of Food (SDA) and state the SDA values for protein, carbohydrates and fats and mixed diet. Discuss the factors affecting Basal Metabolic Rate (BMR). Calculate Energy Requirement of an adult based on his height, occupation and other activities. Plan a balanced diet based on the energy requirement. Enumerate the modifications while prescribing diets for individuals with Diabetes mellitus, coronary artery disease and in pregnancy.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine(V)
BI8.4	Describe the causes	*At the end of session, the phase I MBBS*	K	KH	Y	Lecture,	Written/		General

	(including dietary habits), effects and health risks associated with being overweight/ obesity.	*student must be able to* Define obesity. Define body mass index (BMI). Discuss the calculation of BMI and explain grading of obesity based on BMI values. List the different methods of assessment of obesity. Explain briefly the regulation of energy intake and energy expenditure and the role of hormonal and neuronal factors related to it. Discuss the causes, effects and health risks of obesity.				Small Group Discussion	Viva voce		Medicine,Pathology (V)
BI8.5	Summarize the nutritional importance of commonly used items of food including fruits and vegetables.(macro-molecules & its importance)	*At the end of session, the phase I MBBS student must be able to* Discuss the RDA of different nutrients including vitamins and minerals. List the different groups of food items and the predominant nutrients present in each group. Explain the steps in planning a balanced diet.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Community Medicine,GeneralMedicine, Pediatrics (V)
Notes ---Can Include 11.23 competency present under topic Biochemistry Laboratory test as it is related to Nutrition. Some objectives of 8.3 competency can be included under practical topic (Biochemistry Laboratory Test)									

TOPIC –Extracellular Matrix		**Number of competencies: (03)**				**Number of procedures that require certification: (NIL)**			
BI9.1	List the functions and components of the extracellular matrix (ECM).	*At the end of session, the phase I MBBS student must be able to* List the Main Components of Extracellular Matrix. Discuss the functions of Extracellular matrix.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		
BI9.2	Discuss the involvement of ECM components in health and disease.	*At the end of session, the phase I MBBS student must be able to* Explain the role of Structural Proteins, Specialised proteins and Mucopolysaccharides in our body List the diseases caused due to abnormalities in Structural Proteins, Specialised proteins and Mucopolysaccharides.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine (V)
BI9.3	Describe protein targeting & sorting along with its associated disorders	*At the end of session, the phase I MBBS student must be able to* Define protein targeting & sorting. Discuss Co-translational and post translational Translocation. List the diseases due to defective protein targeting.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		
Topic: Oncogenesis and Immunity Number of competencies: (05))Number of procedures that require certification: (NIL)									
BI10.1	Describe the Cancer Initiation. Promotion Oncogenes and Oncogene activation. Also	*By the end of Session, the Phase – I students Should be able to:* Discuss basic aspects of cancer pathology.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		OBG, General Surgery and pathology (V)

	Focus on P53 and Apoptosis.	Describe epigenetics, somatic and genetic changes in tumors. Enumerate modern aspects of RNA and protein biology. Describe the cell cycle, angiogenesis and apoptosis. Explain the basic facets of carcinogenesis and methods to study the process. Discuss the basic principles and applications of cell culture and animal models to study cancer. Discuss how genetics contributes to predisposition and progression of cancer. Differentiate cancers by tissue type. Explain how immunotherapy is, and can be, used to treat human illness: strategies, advantages, and hurdles to overcome to realize its potential.							
BI0.2	Describe Various Biochemical tumor markers and biochemical basis of cancer treatment	*By the end of Session, the Phase – I students Should be able to:* Define the Tumor Marker, Clinical Uses of Tumor Marker, Classification of Tumor Marker along with Examples of Specific Tumor Markers.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		OBG, General Surgery and pathology (V)
BI10.3	Describe the cellular and humoral	*At the end of session, the phase I MBBS student must be able to*	K	KH	Y	Lecture, Small Group	Written/ Viva voce		Obstetrics and Gynaecology,

	components of the immune system & describe the types and structure of antibody	Explain the structure of Antibody. Classify Antibodies. Explain in detail about Cell mediated immunity and Humoral immunity.				Discussion			GeneralSurgery,Pathology(V)
BI10.4	Describe & discuss innate and adaptive immune responses, self/non-self recognition and the central role of T-helper cells in immune responses.	*At the end of session, the phase I MBBS student must be able to* Discuss Innate Immunity and Adaptive immunity. Define Self and Non-self antigen. Explain the role of T helper cells in immune responses.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		General Medicine,Pathology (V,)Physiology (H)
BI10.5	Describe antigens and concepts involved in vaccine development	At the end of session, the phase I MBBS student must be able to Discuss the concepts involved in Vaccine development.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Pathology,Pediatrics,Microbiology(V)

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
TOPIC -- Biochemistry laboratory Tests		**Number of competencies: (24)**				**Number of procedures that require certification: (05)**			
BI 11.1	Describe commonly used laboratory apparatus and equipments, good safe laboratory practice and waste disposal	*At the end of the session Phase I student should be able to* List the commonly used laboratory equipments Explain the principle, components, types, advantages and disadvantages and applications of Pipettes and glassware, burettes, condensers, funnels, test tubes, distillation apparatus and dessicators, different types of balances, centrifuge, hot air oven, Incubator, water bath (constant and variable temperature), hot plate and magnetic stirrer and urinometer Explain safe laboratory practices like identifying safety signs, listing the incompatible chemicals, equipment related hazards, basics of disinfection, decontamination and disposal. Define biomedical waste management, classify and colour code them. Explain the risks associated with improper disposal of waste and discuss the various steps in waste management Enumerate the different waste treatment	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		

		procedures							
BI 11.2	Describe the preparation of buffers and estimation of pH	*At the end of the session Phase I student should be able to* Define pH and Buffers. Discuss the method of preparation of most commonly used buffers in the lab. Explain the various methods of determination of pH	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		
BI 11.3	Describe the chemical components of normal urine.	*At the end of the session Phase I student should be able to* Explain the organic (Nitrogenous, Non nitrogenous) and inorganic constituents of urine.	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		
BI 11.4	Perform urine analysis to estimate and determine normal and abnormal constituents	*At the end of the session Phase I student should be able to* Perform the normal organic and inorganic constituents present in urine by various tests Identify the abnormal constituents of urine (Glucose, protein, blood, ketone bodies, bile salts and bile pigments)	S	P	Y	DOAP session	Skill assessment	1	General Medicine(V) Physiology (H)
BI 11.5	Describe screening of urine for inborn errors & describe the use of paper	*At the end of the session Phase I student should be able to* Identify an unknown analyte in a given	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		General Medicine(V)

	chromatography	sample by performing the reactions for identification of unknown biological substance (reaction of carbohydrates, proteins (precipitation and colour reactions), non-protein nitrogenous substances) Define chromatography and explain the principle, instrumentation, reagents, procedure, types and applications of Paper chromatography							
BI 11.6	Describe the principles of colorimetry	*At the end of the session Phase I student should be able to* Discuss Principles, components, beer-lambert's law, deviations in law, applications, advantages and disadvantages	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		
BI 11.7	Demonstrate the estimation of serum creatinine and creatinine clearance	*At the end of the session Phase I student should be able to* Explain principle, methodology (Jaffe's kinetic test) reagents, apparatus, procedure, interfering substances, other methods of estimation of creatinine in urine and serum Discuss the normal values and abnormal values in physiological and pathological conditions Define clearance, types, formula and how to calculate the clearance from given set of parameters and its significance	S	P	Y	Practical	Skill assessment	1	

BI 11.8	Demonstrate estimation of serum proteins, albumin and A:G ratio	*At the end of the session Phase I student should be able to* Explain principle, methodology (Biuret for proteins, BCG for Albumin) reagents, apparatus, procedure, interfering substances, other methods of estimation of serum protein and albumin Discuss the normal values and abnormal values in physiological and pathological conditions and significance of A:G ratio and conditions where it is reversed	S	P	Y	Practical	Skill assessment	1	
BI 11.9	Demonstrate the estimation of serum total cholesterol and HDLcholesterol	*At the end of the session Phase I student should be able to* Explain principle, methodology (Cholesterol – CHOD POD or Zat,Zlatkis,boyle method, HDL – Phosphotungstate/Mg method -- manual or autoanalyzer) reagents, apparatus, procedure, interfering substances, other methods of estimation of Total cholesterol and HDL cholesterol Discuss the normal values and abnormal values in physiological and pathological conditions	S	P	Y	Practical	Skill assessment		
BI 11.10	Demonstrate the estimation of triglycerides	*At the end of the session Phase I student should be able to* Explain principle, methodology (hantzsch method– manual or autoanalyzer) reagents, apparatus, procedure, interfering substances, other methods of estimation of Triglycerides	S	P	Y	Practical	Skill assessment		

		Discuss the normal values and abnormal values in physiological and pathological conditions							
BI 11.11	Demonstrate estimation of calcium and phosphorous	*At the end of the session Phase I student should be able to* Explain principle, methodology (Calcium – Titration, phosphorous – Reduction method manual / autoanalyzer method) reagents, apparatus, procedure, interfering substances, other methods of estimation of Calcium and phosphorous. Discuss the normal values and abnormal values in physiological and pathological conditions	S	P	Y	Practical	Skill assessment		
BI 11.12	Demonstrate the estimation of serum bilirubin	*At the end of the session Phase I student should be able to* Explain principle, methodology (Malloy and Evelyn – Diazo reagent method manual or autoanalyzer) reagents, apparatus, procedure, interfering substances, other methods of estimation of bilirubin Discuss the normal values and abnormal values in physiological and pathological conditions	S	P	Y	Practical	Skill assessment		
BI 11.13	Demonstrate the estimation of SGOT/ SGPT	*At the end of the session Phase I student should be able to* Explain principle, methodology (Reitman and Frankel – manual or autoanalyzer method) reagents, apparatus, procedure, interfering substances, other methods of	S	P	Y	Practical	Skill assessment		

		estimation of SGOT and SGPT Discuss the normal values and abnormal values in physiological and pathological conditions							
BI 11.14	Demonstrate the estimation of alkaline phosphatase	*At the end of the session Phase I student should be able to* Explain principle, methodology (King and Kind – manual or autoanalyzer method) reagents, apparatus, procedure, interfering substances, other methods of estimation of Alkaline phosphatase Discuss the normal values and abnormal values in physiological and pathological conditions	S	P	Y	Practical	Skill assessment		
BI 11.15	Describe & discuss the composition of CSF	*At the end of the session Phase I student should be able to* Discuss the composition and Normal values of analytes present in the CSF. Explain the significance of their variations and their role in diagnosing diseases.	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		
BI 11.16	Observe use of commonly used equipments/techniques in biochemistry laboratory including: •pHmeter •Paper chromatography of amino acid •Protein	*At the end of the session Phase I student should be able to* Explain the principle, components of the instrument, reagents required, procedure, types, advantages and disadvantages and applications of pH meter, Paper chromatography, protein electrophoresis, TLC, PAGE, ISE, ABG analyser, Auto analyser, DNA isolation, ELISA.	S	KH	Y	Demonstration	Skill assessment		

	electrophoresis •TLC, PAGE •Electrolyte analysis by ISE •ABG analyzer •ELISA •Immunodiffusion •Autoanalyser •Quality control •DNA isolation from blood/ tissue	Discuss the components of quality control, types, materials used and interpretation. Discuss in brief about Levy Jenning's Charts							
BI 11.17	Explain the basis and rationale of biochemical tests done in the following conditions: - diabetes mellitus, - dyslipidemia, - myocardial infarction, - renal failure, gout, - proteinuria, - nephrotic syndrome, - edema, - jaundice, - liver diseases, pancreatitis, disorders of acid-base balance, - thyroid disorders.	*At the end of the session Phase I student should be able to* Enumerate the various biochemical alterations observed, various laboratory investigations done, normal and abnormal serum and urine values of analytes routinely done in Diabetes mellitus, Dyslipidemia, MI, renal failure, gout, Proteinuria, Nephrotic syndrome, Oedema, Jaundice, thyroid disorders, Pancreatitis, Liver diseases and Acid – base disorders. Analyse and interpret the given condition based on the biochemical parameters	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		General Medicine, Pathology
BI 11.18	Discuss the principles of spectrophotometry	*At the end of the session Phase I student should be able to*	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		

		Discuss the principle, components of the instrument, reagents required, procedure, types, advantages and disadvantages and applications							
BI 11.19	Outline the basic principles involved in the functioning of instruments commonly used in a biochemistry laboratory and their applications.	*At the end of the session Phase I student should be able to* List the commonly used laboratory equipments. Discuss their principle, components of the instrument, types, advantages and disadvantages, applications - Pipettes and glassware, burettes, condensers, funnels, test tubes, distillation apparatus and dessicators, different types of balances, centrifuge, hot air oven, Incubator, water bath (constant and variable temperature), hot plate and magnetic stirrer, urinometer	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		
BI 11.20	Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states.	*At the end of the session Phase I student should be able to* Identify the abnormal constituents of urine performing a battery of tests. Discuss the normal and abnormal serum and urine levels of those analytes Analyse, interpret and correlate with the clinical findings under given set of parameters	S	SH	Y	DOAP session	Skill assessment	1	

BI 11.21	Demonstrate estimation of glucose, creatinine, urea and total protein in serum.	*At the end of the session Phase I student should be able to* Explain principle, methodology (Glucose – GOD/POD method, Creatinine – Jaffe's Kinetic method, Urea – Diacetyl monoxime method, Total protein – Biuret method) reagents, apparatus, procedure, interfering substances, other methods of estimation of glucose, creatinine, urea and total protein in serum. Discuss the normal values and abnormal values in physiological and pathological conditions	S	SH	Y	DOAP session	Skill assessment	1	
BI 11.22	Calculate albumin: globulin (AG) ratio and creatinine clearance	*At the end of the session Phase I student should be able to* Explain the calculation of AG Ratio. Discuss the significance of A:G ratio and conditions where it is reversed. Define clearance. List the different substances used for calculating clearance, their advantages and disadvantages. Discuss the formula for clearance and calculation of clearance from serum and urine creatinine values.	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		General Medicine

BI 11.23	Calculate energy content of different food Items, identify food items with high and low glycemic index and explain the importance of these in the diet	*At the end of the session Phase I student should be able to* Discuss the calorific values of different nutrients. Calculate the energy content of a food item based on its composition. Define Glycemic Index and give examples of food items with high and low glycemic index. Explain the role of Glycemic index in planning a diet.	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		General Medicine
BI 11.24	Enumerate advantages and/or disadvantages of use of unsaturated, saturated and trans fats in food.	*At the end of the session Phase I student should be able to* Differentiate between Mono and Polyunsaturated fatty acids,w3 and w6 fatty acids and their advantages and/or disadvantages. Explain what Trans fatty acids with examples and their disadvantages	K	KH	Y	Lecture, Small group discussion	Written/ Viva voce		General Medicine

TOPIC -- Biochemical Laboratory Tests

Notes

Can rearrange the competencies as Lecture/Demonstration/Perform Competencies in order

Lectures/Small group discussions

Competency Number -- 11.1,11.2,11.3,11.5,11.6,11.15,11.17,11.18,11.19.11.22

Demonstrations

Competency Number -- 11.4,11.7,11.8,11.9,11.10,11.11,11.12,11.13,11.14.11.16,11.20,11.21

Perform(5) 0r Procedures requiring certification were given as 5 in number

Competency Number -- 11.4,11.7,11.8,11.20,11.21

All perform experiments have to be included under demonstrations as first we have to do and show to the students.

Under Perform experiments there is a repetition in

A) 11.4 and 11.20

11.4 – Perform urine analysis to estimate and determine normal and abnormal constituents

11.20 -- Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states

B) 11.7,11.8 and 11.21

– Demonstrate the estimation of serum **creatinine** and **creatinine clearance**

– Demonstrate estimation of serum **proteins**, albumin and **A:G ratio**

11.21 -- Demonstrate estimation of glucose, **creatinine**, urea and **total protein** in serum

Also, Competence (11.22) -- Calculate albumin: globulin **(AG) ratio** and **creatinine clearance** is repeated and given under Lecture/small group discussion

Competency can be included under Nutrition

Competency can be included under Lipid Chemistry

Competency (8.3) related to nutrition can be included under practicals .Objectives that can be included under that competency are **Calculation of energy requirement and planning a balanced diet for self / any Patient**

General Notes----
Topics not included are Plasma proteins and Hormones

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
TOPIC -- Plasma Proteins		**Number of competencies: (01)**				**Number of procedures that require certification: (NIL)**			
1	List the major plasma proteins and describe their functions and causes for variations	*At the end of session, the phase I MBBS student must be able to* Enumerate the different plasma proteins. Discuss the physiological functions of plasma proteins . Explain about Acute phase proteins. Discuss the various methods of plasma protein measurement and separation techniques. Analyse the normal values of plasma proteins. Enumerate the various causes for increase and decrease in plasma proteins. Discuss the Clinically significant alterations in plasma protein electrophoresis.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

NUMBER	COMPETENCY ***The student should***	Specific Learning Objectives	DOMAIN	LEVEL K/KH/S	CORE Y/N	Suggested Teaching	Suggested Assessment	Number Required To	INTEGRATION

	be able to		K/S/A /C	H/P		Learning Method	Method	Certify P	V/H
TOPIC -- Hormones		**Number of competencies: (01)**				**Number of procedures that require certification: (NIL)**			
1	Describe the Mechanism of Action of Hormones	*At the end of session, the phase I MBBS student must be able to* Classify Hormones based on chemical composition and mechanism of action. Explain the mechanism of Hormone Action at Cytosolic or Nuclear Level Explain the mechanism of Hormone Action at Cell Membrane level Explain Signal Transduction	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		
2	Discuss the Synthesis, regulation and biochemical functions of Hormones	*At the end of session, the phase I MBBS student must be able to* Discuss the Synthesis, regulation and biochemical functions of Hypothalmic and Pituatary Hormones. Discuss the Synthesis, regulation and biochemical functions of Thyroid and Steroid Hormones. Discuss the Synthesis, regulation and biochemical functions of Peptide Hormones.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		

BIOCHEMISTRY INTEGRATIONS

INTEGRATED TOPICS WITH ANESTHESIA

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI 6.8	Discuss and Interpret the results of ABG analysis in various disorders	*At the end of session, the phase I MBBS student must be able to* Justify the need for ABG. List the parameters in ABG analysis. Explain their role in interpreting the acid – base disorder.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		Anesthesia (V)

INTEGRATED TOPICS WITH PHYSIOLOGY

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI1.1	Describe the molecular and functional organization of a cell and its subcellular components	*At the end of session, the phase I MBBS student must be able to* Describe the different parts of the cell Mention the composition of intracellular fluid. Mention the functions of cell membrane. Mention the functions of different organelles.	K	KH	Y	Small Group Discussion	Written		Physiology (H)

INTEGRATED TOPICS WITH PATHOLOGY

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI6.5	Describe the biochemical role of vitamins in the body and explain the manifestations of their deficiency	*At the end of session, the phase I MBBS student must be able to* Classify the types of vitamins correctly. Explain the metabolism, functions and manifestations of deficiencies of vitamin B12 accurately. Explain the metabolism, functions and manifestations of deficiencies of Folic acid correctly.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		PATHOLOGY (V)
BI 11.20	Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states	*At the end of session, the phase I MBBS student must be able to* Discuss the normal composition of urine correctly. List the causes of proteinuria and different tests to detect them. List the causes of glucosuria and different tests to detect	S	SH	Y	DOAP Session	Skill Assessment		PATHOLOGY (V)

		them. List the causes of ketonuria and different tests to detect them. List the causes of bilirubinuria and different tests to detect them. List the causes of hematuria and different tests to detect them.							
BI 7.7	Describe the role of oxidative stress in the pathogenesis of conditions such as Cancer, complication of Diabetes mellitus and atherosclerosis	*At the end of session, the phase I MBBS student must be able to* Analyse the pathological effects of free radicals in cancer correctly. Explain the role of free radicals in pathogenesis of diabetes mellitus and its complications correctly. Explain the pathological effects of free radicals in atherosclerosis correctly.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		PATHOLOGY (V)
BI 10.1	Describe the Cancer Initiation. Promotion Oncogenes and	*At the end of session, the phase I MBBS student must be able to* Enumerate the steps	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		PATHOLOGY (V)

	Oncogene activation. Also Focus on P53 and Apoptosis.	involved in chemical carcinogenesis (Initiation & promotion) correctly. Discuss the genes responsible for carcinogenesis and their activation correctly. Explain the role of p53 in maintaining the integrity of genome correctly. Explain how cancer cell evade from apoptosis correctly.							

INTEGRATED TOPICS WITH COMMUNITY MEDICINE

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI 8.2	Describe the types and causes of protein energy malnutrition and its effects	*At the end of session, the phase I MBBS student must be able to* List the common types of protein-energy malnutrition correctly. List the common causes of protein-energy malnutrition accurately.	K	KH	Y	Lecture	Written(Short Answer Question)		COMMUNITY MEDICINE (V)
		Describe in detail the effects of protein-energy malnutrition correctly.	K	KH	Y	Lecture	Written(Short Answer Question/Long Answer Question)		
BI 8.3	Provide dietary advice for optimal health in childhood and adult, in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy.	*At the end of session, the phase I MBBS student must be able to* Provide dietary advice for optimal health in childhood correctly. Provide dietary advice for optimal health in adult correctly.	K	SH	Y	Small Group Discussion	Written(Short Answer Question / Exercise)		COMMUNITY MEDICINE (V)

		Provide dietary advice for a patient with diabetes mellitus correctly. Provide dietary advice for a patient with coronary artery disease correctly. Provide dietary advice for a pregnant woman correctly.							
BI 11.23	Calculate energy content of different food Items, identify food items with high and low glycemic index and explain the importance of these in the diet	*At the end of session, the phase I MBBS student must be able to* Calculate the energy content of different food items accurately Identify food items with high and low glycemic index accurately	K	SH	Y	Self Directed Learning	Written(Short Answer Question / Exercise)		COMMUNITY MEDICINE (V)
		Describe in detail the importance of food items with high and low glycemic index	K	KH	Y	Small Group Discussion	Written(Short Answer Question)		

INTEGRATED TOPICS WITH MICROBIOLOGY

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI 10.5	Describe antigens and concepts involved in vaccine development	*At the end of session, the phase I MBBS student must be able to* Classify the types of antigen.	K	KH	Y	Lecture	Written		MICROBIOLOGY (V)
		Enumerate the various factors of antigenicity	K	K	Y	Lecture	Written		
		Explain the concept of Superantigen.	K	KH	Y	Small Group Teaching	Viva voce		
		Discuss the active immunity. List out the various concepts involved in vaccine development	K	K	Y	Lecture	Written		
BI 10.3/ BI 10.4	Describe the cellular and humoral components of the immune system & describe the types and structure of antibody	*At the end of session, the phase I MBBS student must be able to* Explain the various components of Humoral immunity.	K	K	Y	Lecture	Written		MICROBIOLOGY (V)
	Describe & discuss innate and adaptive immune responses,	Explain various components of cellular immunity.	K	KH	Y	Lecture	Written		

	self/non-self recognition and the central role of T-helper cells in immune responses.	Analyze the structure of an immunoglobulin with the help of a neat labeled diagram.	K/S	KH	Y	Small Group Teaching	Viva voce		MICROBIOLOGY (V)
		Differentiate the various types of antibodies.	K	KH	Y	Small Group Teaching	Viva voce		
		Discuss about innate and acquired immunity. Enumerate the various cells involved in antigen presentation.	K	KH	Y	Small Group Teaching	Viva voce		
		Explain in detail about MHC.Discuss the humoral immune response.	K	KH	Y	Lecture	Written		
		Discuss the cell mediated immune response.	K	SH	Y	Small Group Teaching	Viva voce		
BI 7.4	Describe Applications of Molecular Technologies Like rDNA Technology, PCR in the diagnosis and treatment of Diseases with genetic basis	*At the end of session, the phase I MBBS student must be able to* Enumerate the various methods of gene transfer in bacteria.	K	KH	Y	Small Group Teaching	Written/ Viva voce		MICROBIOLOGY (V)

		List out applications of rDNA technology in diagnosis and treatment of diseases with genetic basis.	K	KH	Y	Small Group Teaching	Written/ Viva voce		
		List out applications of PCR technology in diagnosis and treatment of diseases with genetic basis.	K	KH	Y	Small Group Teaching	Written/ Viva voce		
BI 11.16	Observe use of commonly used equipments/techniques in biochemistry laboratory including: ELISA	*At the end of session, the phase I MBBS student must be able to* List out the various Ag-Ab reactions.	K	KH	Y	Small Group Teaching	Viva voce		MICROBIOLOGY (V)
		Explain the principle of ELISA.	K	KH	Y	Lecture	Written		
		Enumerate the various types of ELISA.	K	KH	Y	Small Group Teaching	Viva voce		
		Discuss the applications of ELISA in microbiology.	K	KH	Y	Small Group Teaching	Viva voce		

INTEGRATED TOPICS WITH PAEDIATRICS

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI 3.8, BI 3.5, BI3.10, BI 11.5	Describe and discuss the regulation, functions and integration of carbohydrate along with associated diseases/disorders. Discuss and interpret laboratory results of analytes associated with metabolism of carbohydrates Interpret the results of blood glucose levels and other laboratory investigations related to disorders Describe screening of urine for inborn errors	*At the end of session, the phase I MBBS student must be able to* Define Glycogen storage Disorders Classify Glycogen storage disorders. Explain the patho physiology, clinical features and diagnosis of Glycogen storage disorders. Explain the role of chromatography in management and prognosis of Glycogen storage disorders. Discuss the complications of Glycogen storage disorders. *At the end of session, the phase I MBBS student must be able to*	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		PAEDIATRICS (V)

	& describe the use of paper Chromatography	Discuss the inheritance, biochemical defect, clinical features and diagnosis of Essential Fructosuria, Hereditary fructose intolerance, Essential Pentosuria Interpret the laboratory investigations in Essential Fructosuria, Hereditary fructose intolerance, Essential Pentosuria Explain the role of chromatography in management of Essential Fructosuria, Hereditary fructose intolerance, Essential Pentosuria Discuss the complications of Essential Fructosuria, Hereditary fructose intolerance, Essential Pentosuria							
BI 5.4,11.5	Describe common disorders associated with protein metabolism. Describe	*At the end of session, the phase I MBBS student must be able to* List the common disorders associated with protein metabolism.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		PAEDIATRICS (V)

	screening of urine for inborn errors & describe the use of paper Chromatography	Discuss the inheritance, biochemical defect, clinical features and diagnosis of common inborn errors of protein metabolism. Interpret the common laboratory investigations performed in inborn errors of protein metabolism. Explain the role of chromatography in protein metabolism disorders. Discuss the relevance of screening of urine for protein metabolism disorders. Discuss the management and complications of common inborn errors of protein metabolism.							

INTEGRATED TOPICS WITH GENERAL MEDICINE

NUMBER	COMPETENCY ***The student should be able to***	Specific Learning Objectives	DOMAIN K/S/A/C	LEVEL K/KH/SH/P	CORE Y/N	Suggested Teaching Learning Method	Suggested Assessment Method	Number Required To Certify P	INTEGRATION V/H
BI 3.8, BI 3.10	Discuss and interpret laboratory results of analytes associated with metabolism of carbohydrates Interpret the results of blood glucose levels and other laboratory investigations related to disorders	*At the end of session, the phase I MBBS student must be able to* Describe symptoms of a suspected patient of diabetes mellitus. Enumerate the other conditions associated with diabetes	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)
BI 6.7	Describe the process involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with	*At the end of session, the phase I MBBS student must be able to* Describe the symptoms that reflect the common conditions resulting in loss of fluid from the body and its conscequences.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)

	these								
BI 6.7	Describe the process involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with these	*At the end of session, the phase I MBBS student must be able to* Describe the symptoms of critical nature as a conscequences of acute or chronic diseases which make the patients bed ridden.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)
BI 2.5, BI 2.7	Describe and discuss the clinical utility of various serum enzymes as markers of pathological conditions. Interpret laboratory results of enzyme activities & describe the clinical utility of various enzymes as markers of pathological conditions.	*At the end of session, the phase I MBBS student must be able to* List the various enzymes which are markers of pathological conditions. Explain the symptoms and clinical features of those pathological conditions. Enumerate the common therapeutic enzymes used in clinical practice. Describe the broad manifestations of various disorders which result in alterations of appetite, weight, sensorium, bowel habits, etc.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)

BI 6.13, 6.14, 6.15	Describe the functions of the kidney, liver, thyroid and adrenal glands. Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands). Describe the abnormalities of kidney, liver, thyroid and adrenal glands	*At the end of session, the phase I MBBS student must be able to* **Adrenal Function Tests** Enumerate the symptoms and situations which are due to alterations in the hormonal status of the adrenal glands related diseases. **Liver Function Tests** Enumerate and identify the symptoms of various liver disorders that can be correlated to liver function tests. **Thyroid Function Tests** Enumerate the conditions which cause hyper thyroidism. Enumerate the conditions which cause hypo thyroidism. Enumerate the conditions which cause pituitary disorders. Describe the symptoms manifested in hyper thyroidism, hypo thyroidism	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)

		and pituitary disorders.							
BI 4.4, 7.7	Describe the structure and functions of lipoproteins, their functions, interrelations & relations with atherosclerosis and fatty liver Describe the role of oxidative stress in the pathogenesis of conditions such as Cancer, complication of Diabetes mellitus and atherosclerosis	*At the end of session, the phase I MBBS student must be able to* Discuss Atherosclerosis and its consequences in various organs of the body. Correlate them with laboratory findings so as to take steps of prevention and cure.	K	KH	Y	Lecture, Small Group Discussion	Written/ Viva voce		GENERAL MEDICINE (V)