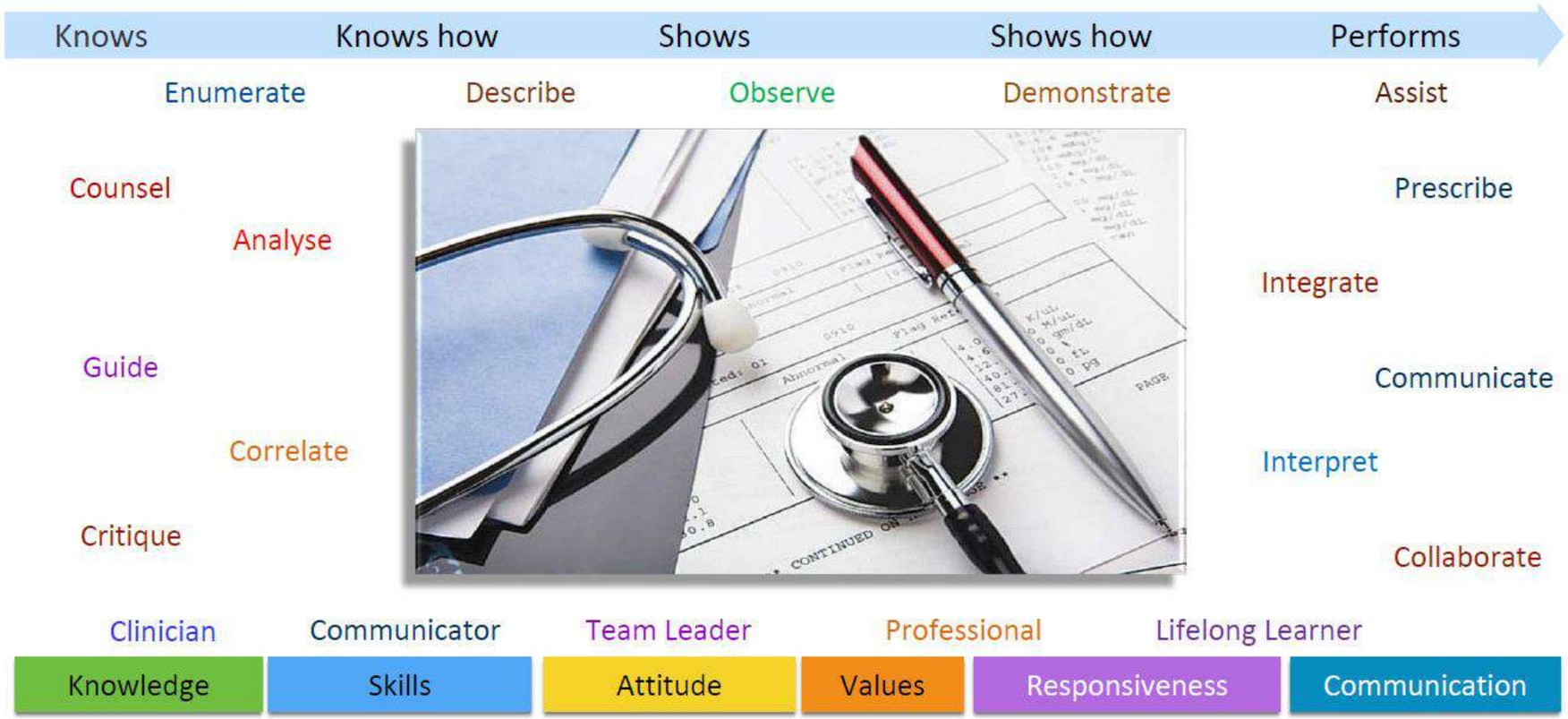
NATIONAL MEDICAL COMMISSION

COMPETENCY BASED UNDERGRADUATE CURRICULUM FOR THE INDIAN MEDICAL GRADUATE



Volume I-2024

COMPETENCY BASED UNDERGRADUATE CURRICULUM FOR THE INDIAN MEDICAL GRADUATE

2024

National Medical Commission
Pocket-14, Sector- 8, Dwarka
New Delhi 110 077

Volume I
Competency based Undergraduate Curriculum
in
Phase I & Phase II subjects

BIOCHEMISTRY (CODE: BC)

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Number	COMPETENCY The student should be able to	Predominant 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
BIOCHEMISTRY (Topics = 14, Competencies = 84)							
	Topic 1: Basic Biochemistry	**Number of competencies:(01)**			**Number of competencies that require certification:(NIL)**		
BC1.1	Describe the molecular and functional organization of a cell and its sub-cellular components and composition and functions of Biological membranes.	K	KH	Y	LGT, SGT / **SDL**	Written assessment/ Viva voce	
	Topic 2: Enzyme	**Number of competencies:(05)**			**Number of competencies that require certification:(NIL)**		
BC2.1	Explain fundamental concepts of enzyme, isoenzyme and coenzyme. Enumerate the main classes of IUBMB nomenclature.	K	KH	Y	LGT, **SGT**	Written assessment / Viva voce	
BC2.2	Describe and explain the basic principles of enzyme activity	K	KH	Y	LGT, **SGT**	Written assessment / Viva voce	
BC2.3	Describe and discuss enzyme Inhibition and role of enzymes or drugs as Inhibitors, and enzymes as therapeutic agents.	K	KH	Y	LGT, Case discussion SGT	Written assessment / Viva voce	
BC2.4	Describe and discuss the clinical utility of various serum enzymes in laboratory and their use as markers of various pathological conditions.	K	KH	Y	LGT, SGT, Flipped class room	Written assessment / Viva voce	
BC2.5	Interpret laboratory results of enzymes in various disorders.	K	KH	Y	SGT, DOAPs, Case Studies	Written assessment/ Viva voce/ Case studies, OSPE	
	Topic 3: Chemistry and Metabolism of Carbohydrates	**Number of competencies:(06)**			**Number of competencies that require certification:(NIL)**		

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BC3.1	Discuss and differentiate monosaccharides, di-saccharides and polysaccharides with examples, their importance as energy fuel, structural element, and storage molecule in human body.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC3.2	Describe the digestion, absorption and transport of carbohydrates from food along with its disorders.	K	KH	Y	LGT, SGT, SDL	Written/Viva-voce	
BC3.3	Define and briefly describe the pathways of carbohydrate metabolism and their regulation (glycolysis, gluconeogenesis, TCA, and significance of glycogen metabolism and HMP shunt), with associated disorders.	K	KH	Y	LGT, SGT, Flipped class room	Written/Viva voce	
BC3.4	Describe and discuss the regulation, functions and integration of minor Carbohydrate Metabolism pathway briefly along with associated diseases /disorders.	K	KH	Y	LGT, SGT	Written/Viva-voce	
BC3.5	Discuss the mechanism and significance of blood glucose regulation (Glucose homeostasis) in health and disease. Describe the types, Biochemical changes, complications and laboratory investigations related to diabetes & other carbohydrate metal disorders.	K	KH	Y	LGT, SGT, Flipped class room	Written/Viva voce	
BC3.6	Interpret the results of analytes associated with metabolism of carbohydrates and other laboratory investigations related to disorders of carbohydrate metabolism.	K	KH	Y	LGT, SGT Case Studies / SDL, Flipped class room	Written/ Viva voce/ Case Studies /OSPE	
Topic 4 : Chemistry and Metabolism of Lipids		**Number of competencies: (08)**			**Number of competencies that require certification:(NIL)**		
BC4.1	Describe and discuss main classes of lipids and their functions.	K	KH	Y	LGT, SGT /SDL	Written/Viva voce	
BC4.2	Describe the digestion and absorption of dietary lipids and its (associated disorders.	K	KH	Y	LGT, SGT /SDL	Written /Viva voce	
BC4.3	Describe and discuss the fatty acid oxidation, metabolism of ketone bodies along with their clinical significance.	K	KH	Y	LGT, SGT	Written /Viva voce	

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BC4.4	Describe metabolism of Triglycerides and cholesterol metabolism along with its regulation and clinical significance.	K	KH	Y	LGT, SGT	Written /Viva voce	
BC4.5	Describe the metabolism of lipoproteins with brief overview of lipoprotein structure, their interrelations & relations with atherosclerosis.	K	KH	Y	LGT, SGT	Written /Viva voce	
BC4.6	Discuss Biological role and therapeutic applications of Eicosanoids and their Inhibitors.	K	KH	Y	LGT, SGT, Flipped class room	Written /Viva voce	
BC4.7	Describe Fatty liver, cholelithiasis and obesity.	K	KH	Y	LGT, SGT, Case Studies/Scenarios/SDL	Written /Viva voce	
BC4.8	Interpret laboratory results of analytes associated with metabolism of lipids	K	KH	Y	LGT, SGT, case studies, Flipped class room	Written/Viva voce/ case studies/OSPE	
	Topic 5: Chemistry & Metabolism of Proteins and Immunology	**Number of competencies:(09)**			**Number of competencies that require certification:(NIL)**		
BC5.1	Discuss briefly structure of amino acids and classify amino acids on the basis of Nutritional and Metabolic significance.	K	KH	Y	LGT, SGT/SDL	Written / Viva voce	
BC5.2	Discuss classification of proteins, structural organization, functions and clinical aspects.	K	KH	Y	LGT, SGT	Written / Viva voce	
BC 5.3	Describe the digestion and absorption of dietary proteins	K	KH	Y	LGT, SGT / SDL	Written / Viva voce	
BC 5.4	Describe plasma proteins and their functions and brief overview of normal and abnormal electrophoretic pattern of serum proteins, acute phase proteins.	K	KH	Y	LGT, SGT	Written / Viva voce	
BC 5.5	Describe the structure, functions and disorders of Immunoglobulins with brief description of cellular and humoral Immunity.	K	KH	Y	LGT, SGT	Written / Viva voce	

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BC 5.6	Describe the formation, transport, detoxification of Ammonia, Ammonia toxicity and its clinical significance.	K	KH	Y	LGT, SGT	Written / Viva voce	
BC 5.7	Describe the specialized products formed from the amino acids Glycine, Phenylalanine, Tyrosine, Tryptophan, and Methionine, branched chain amino acids and Arginine and the inborn errors associated with them. Discuss new-born screening.	K/S	KH/SH	Y	LGT, SGT	Written / Viva voce	
BC5.8	Describe the structure and functions of haem in the body and describe the processes involved in its metabolism with emphasis on jaundice and describe porphyrin metabolism.	K	KH	Y	LGT, SGT	Written / Viva voce	
BC5.9	Describe the major types of Hemoglobin and its types, derivatives & variants found in the body and their physiological / pathological relevance	K	KH	Y	LGT, SGT	Written / Viva voce	
Topic 6: Extracellular Matrix		**Number of competencies: (03)**			**Number of competencies that require certification: (NIL)**		
BC6.1	Enumerate the functions and components of the extracellular matrix (ECM).	K	KH	Y	LGT, SGT	Written/Viva voce	
BC6.2	Discuss the involvement of ECM components in health and disease.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC6.3	Describe protein targeting & sorting along with its associated disorders.	K	KH	N	LGT, SGT	Written/Viva voce	
Topic 7: **Integration of Metabolism and Biological Oxidation**		**Number of competencies: (02)**			**Number of competencies that require certification: (NIL)**		
BC7.1	Describe the integration of various metabolic processes in the body (Carbohydrate, Lipid, and Protein).	K	KH	Y	LGT, SGT	Written/viva voce	
BC7.2	Describe the Biochemical processes involved in generation of energy in cells.	K	KH	Y	LGT, SGT	Written/Viva voce	
Topic 8: Vitamins and Nutrition		**Number of competencies: (06)**			**Number of competencies that require certification: (NIL)**		

Number	COMPETENCY The student should be able to	Predominant 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
BC8.1	Describe the Biochemical role of vitamins in the body and explain the manifestations of their deficiency	K	KH	Y	LGT, SGT	Written/Viva voce	
BC8.2	Discuss the importance of various dietary components and explain importance of dietary fibre.	K	KH	Y	LGT, SGT, SDL	Written/Viva voce	
BC8.3	Describe the types and causes of protein energy malnutrition and its effects.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC8.4	Provide dietary advice for optimal health in childhood and adult in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy.	K/S/C	KH	Y	LGT, SGT / role play	Written/Viva voce	
BC8.5	Describe the causes (including dietary habits), effects and health risks associated with being overweight/ obese / metabolic syndrome	K	KH	Y	LGT, SGT	Written/Viva voce	
BC8.6	Summarize the nutritional importance of commonly used items of food including fruits and vegetables (macro-molecules & its importance).	K	KH	Y	LGT, SGT, Home assignment	Written/Viva voce	
Topic 9: Minerals, electrolytes, Water and Acid base balance		**Number of competencies: (03)**			**Number of competencies that require certification: (NIL)**		
BC9.1	Describe the dietary sources, absorption, transport, and metabolism, Biochemical functions of Iron, Calcium and copper with its associated clinical disorders.	K	KH	Y	LGT, SGT, Home Assignment, Flipped class room	Written/Viva voce	
BC9.2	Discuss Magnesium, Zinc and Phosphorus along with its clinical significance and discuss the functions of trace elements	K	KH	Y	LGT, SGT, Home Assignment. / SDL	Written/Viva voce	
BC9.3	Describe the processes involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with them	K	KH	Y	LGT, SGT / SDL	Written/Viva voce	

Number	COMPETENCY The student should be able to	Predominant 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
Topic 10: Molecular Biology		**Number of competencies:(07)**			**Number of competencies that require certification:(NIL)**		
BC10.1	Describe nucleotides and nucleic acids and their clinical significance.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC10.2	Describe briefly synthesis of purines in the body with special stress on salvage pathway.	K	KH	N	LGT, SGT /SDL	Written/Viva voce	
BC10.3	Describe the degradation of purines and its significance with associated disorders.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC10.4	Describe in brief the major steps involved in Replication, Transcription, and translation.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC 10.5	Describe the types of DNA repair, gene mutations and associated disorders.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC10.6	Describe basic mechanism of regulation of gene expression	K	KH	Y	LGT, SGT /SDL	Written/Viva voce	
BC10.7	Describe applications of molecular technologies like recombinant DNA technology and PCR in the diagnosis and treatment of diseases. Briefly discuss microarray, FISH, CRISPR	K	KH	Y	LGT, SGT, Flipped class room	Written/Viva voce	
Topic 11: Organ Function tests and Hormones		**Number of competencies:(02)**			**Number of competencies that require certification:(NIL)**		
BC 11.1	Describe the function tests of kidney, liver, thyroid and adrenal glands and their clinical significance. Interpret the function tests report.	K,S	KH/SH	Y	LGT, SGT, Case studies / SDL	Written/Viva voce/Case studies/OSPE	

Number	COMPETENCY The student should be able to	Predominant 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
BC11.2	Enumerate the hormones and markers related to reproduction and reproductive health and their clinical interpretation (For e.g. LH, FSH, Prolactin, beta-HCG, Estrogen Progesterone, testosterone and AMH. Discuss importance of prenatal screening.	K	KH	Y	LGT, SGT / SDL, Flipped class room	Written/Viva voce/Direct observation/ OSPE	
Topic 12: Xenobiotic, oxidative stress and antioxidants		**Number of competencies:(03)**			**Number of competencies that require certification:(NIL)**		
BC12.1	Describe the role of xenobiotics in disease in health and disease	K	KH	Y	LGT, SGT	Written/Viva voce	
BC12.2	Describe the anti-oxidant defense systems in the body.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC12.3	Describe the role of oxidative stress in the pathogenesis of conditions such as cancer, complications of diabetes mellitus and atherosclerosis	K	KH	Y	LGT, SGT / SDL	Written/Viva voce	
Topic 13: Miscellaneous		**Number of competencies:(05)**			**Number of competencies that require certification:(NIL)**		
BC 13.1	Describe oncogenesis, oncogenes & its activation with focus on p53 & apoptosis.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC 13.2	Describe various Biochemical tumor markers and the Biochemical basis of cancer therapy.	K	KH	Y	LGT, SGT	Written/Viva voce	
BC13.3	Discuss briefly on HIV and Biochemical changes in AIDS.	K	KH	N	LGT, SGT	Written/Viva voce	
BC13.4	Discuss metabolism of alcohol with Biochemical changes and effects of chronic alcoholism.	K	KH	Y	LGT, SGT, SDL	Written/Viva voce	
BC13.5	Describe the role of Artificial Intelligence in clinical Biochemistry laboratory practices.	K	KH	N	LGT, SGT / SDL	Written/ Viva voce Logbook Record	

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Topic 14: Biochemical Laboratory test / Practical Number of competencies: (24) Number of competencies that require certification : (11)							
14.1	Describe commonly used laboratory apparatus equipments, good / safe laboratory practice, Biomedical hazards & waste management.	K	KH	Y	LGT, SGT	Written/ Viva voce/ Direct observation	
BC14.2	Describe estimation of pH by pH meter or ABG analyser and interpretation of results with paper case scenarios.	K	KH	Y	LGT, SGT / Case discussion	Written/ Viva voce Direct observation/ OSPE	
BC14.3	Describe the physical properties, chemical constituents of normal urine and abnormal constituents of urine and Perform urine analysis to determine normal and abnormal constituents (including dipsticks method demonstration).	K,S	KH/P	Y	LGT, Small group Discussion / DOAP	Written/ Viva voce / DOAP	2
BC14.4	Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states and prepare a urine report.	S	P	Y	DOAPs	Skill assessment / OSPE	1
BC14.5	Describe screening of urine for inborn errors & describe the use of paper chromatography	K	KH	Y	LGT, SGT	Written/ Viva voce/ Direct observation/ OSPE	
BC14.6	Describe the principles of Colorimetry & Spectrophotometry.	K	KH	Y	LGT, SGT	Written / Viva voce / Direct observation	
BC14.7	Perform estimation of glucose by manual / semi-automated analyzer method and demonstrate glucometer usage. and interpretation of results with clinical scenarios.	S	P	Y	DOAPs	Skill Assessment OSPE	1
BC14.8	Perform estimation of urea and calculate BUN and interpretation of results in clinical scenarios.	S	P	Y	DOAPs	Skill Assessment OSPE	1

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BC14.9	Perform the estimation of serum creatinine and calculate creatinine clearance.	S	P	Y	DOAP	Skill Assessment OSPE	1
BC14.10	Perform estimation of uric acid in serum and interpretation of results with clinical scenarios.	S	P	Y	DOAPs	Skill Assessment OSPE	1
BC14.11	Perform estimation of serum proteins, albumin and A:G ratio	S	P	Y	DOAPs	Skill Assessment OSPE	1
BC14.12	Perform the estimation of serum total cholesterol	S	P	Y	DOAPs	Skill Assessment OSPE	1
BC14.13	Perform the estimation of serum Bilirubin by manual / semi-automated analyzer method.	S	P	Y	DOAP	Skills assessment / OSPE	1
BC14.14	Describe estimation of calcium and phosphorus and interpretation of results.	K	KH	Y	LGT, SGT, Demonstration	Written / Viva voce	
BC14.15	Describe the estimation Triglycerides, HDL and calculation of LDL and interpretation of results with clinical scenarios.	K	KH	Y	LGT, SGT	Written / Viva voce / OSPE (LDL Calculate)	
BC14.16	Describe the estimation of SGOT (AST) / SGPT (ALT) / Alkaline Phosphatase and interpretation of results with clinical scenarios.	K	KH	Y	LGT, SGT	Written/ Viva voce	
BC14.17	Describe briefly various body fluids & discuss the composition of CSF.	K	KH	Y	LGT, SGT	Written/ Viva voce	
BC14.18	Observe use of commonly used equipments/techniques in Biochemistry laboratory including: •pH meter •Paper chromatography of amino acid •Protein electrophoresis	K	KH	Y	Demonstration (SGT) & Lab Visit	Written/ Viva voce / Direct observation	

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	•TLC, PAGE •Electrolyte analysis by ISE •ABG analyzer •ELISA •Immunodiffusion •Autoanalyser •DNA isolation from blood/ tissue						
BC14.19	Explain the basis and rationale of Biochemical tests done and interpretation of laboratory results in the following conditions: - Diabetes mellitus, - Obesity, - dyslipidaemia, - Fatty liver - myocardial infarction, - Renal failure, - Gout, - Nephrotic syndrome, - Jaundice, - Liver diseases, pancreatitis, disorders of acid- base balance, - Thyroid disorders, - Genetic disorders - Nutritional disorders - Vitamin deficiency disorders, - Disorders of Mineral metabolism, - Disorders of electrolyte metabolism.	K	KH	Y	LGT/ Clinical case studies discussion (SGT)	Written/ Viva voce / OSPE / Case studies interpretation	
BC14.20	Describe & Identify Pre-Analytical (especially order of draw, tourniquet technique), Analytical, Post Analytical errors.	S	SH	Y	LGT, SGT DOAP(clinical lab), Skill lab	Written/ Viva voce/ OSPE/ Direct observation/ OSPE	

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BC14.21	Describe Quality control and identify basic L J charts in Clinical biochemistry lab.	S	SH	Y	LGT / SGT / DOAP (clinical lab)	Written/ Viva voce/ OSPE/ Direct observation/ OSPE	1
BC14.22	Describe performance of OGTT, Glucose Challenge Test and HbA1c and interpretation of results with clinical scenarios.	K	KH	Y	LGT, SGT	Written/ Viva voce/ OSPE /Direct observation/ Case studies interpretation.	
BC14.23	Calculate energy content of different food Items, identify food items with high and low glycaemic index and explain the importance of these in the diet.	K	KH	Y	LGT, SGT	Written/ Viva voce	
BC 14.24	Observe, Interpret and discuss the baseline, diagnostic, prognostic, and discharge investigations of clinical biochemistry.	K,A,S,C	SH	Y	ECE-SGT(Bedside/ Ward visit/ Medical record department	Logbook, reflections	