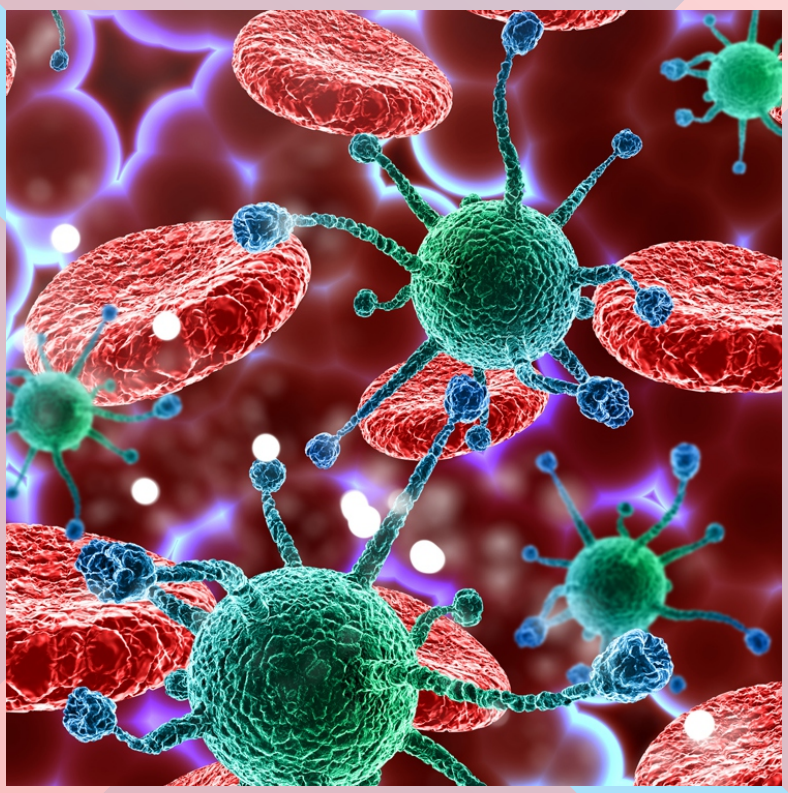
Operational Manual of MBBS Curriculum 2021

Subject: Biochemistry



Developed By-

Directorate General of Medical Education (DGME)

Mohakhali, Dhaka-1213

September-2022

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Preface

Curriculum is not the sole determinant of the outcome, it is very important as it guides the faculty in preparing their instruction and tells the students what knowledge, skills and attitude they are to develop through the teaching learning process. The ultimate indicators of assessing curriculum in medical education is the quality of health services provided by its graduates with required competencies.

To implement that curriculum all concerned such as teachers, students, deans, administrators, policymakers to be more dynamic, should run smoothly with the time & appropriate pace. This operational manual to implement the curriculum will act as a catalyst, will give momentum in implementing the curriculum. This operational manual will help to implement the curriculum uniformly, effectively, efficiently & smoothly at all the govt. & non govt. medical colleges under all the universities all over the country.

I would like to mention that the curriculum planning process is continuous, dynamic and never-ending as it is not static. If it is to serve best, the needs of the individual student, teacher, educational institution and the community to whom we are ultimately accountable, must be assessed. Before that assessment we should seriously concentrate for the better implementation of the curriculum. Implementation in regards to teaching-learning, integrated teaching, teaching on generic topics on medical humanities, clinical teaching, ambulatory care/OPD based teaching and acquiring identified competencies of each subject. There is a proverb that "Assessment drives Learning". To ensure students' learning formative and summative assessments should be taken care of properly. This operational manual on developed MBBS curriculum 2021 will play a vital role in those regards.

I congratulate all who were involved in developing this operational manual to implement MBBS curriculum 2021, particularly the Director (Research, Publication & Curriculum Development), DGME, focal persons & heads of the departments of Anatomy, Physiology & Biochemistry of different Govt. and non Govt. medical colleges. Special appreciation to the Deans, Faculty Medicine of different Universities. They contributed a lot to complete this activity, a commendable job and deserve special appreciation.

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Acknowledgement

It is easier to change a graveyard than to change a curriculum. Yet then time & society demand for the change of the curriculum. In such a situation MBBS curriculum 2012 was reviewed and updated in 2021 to fulfill the need of the stakeholders. For implementation of that reviewed & updated curriculum operational manual is also the demand of the present time.

For better implementation of integrated teaching, teaching as per identified competencies, teaching on generic topics on medical humanities, planning, designing, constructing assessment tools for formative and summative assessment, this operational manual will act as the road map.

Research, Publication & Curriculum Development (RPCD) of DGME in association with heads of the departments of Anatomy, Physiology & Biochemistry of Phase I of different Govt. & non govt. medical colleges & Deans Offices, DGME took the initiative to develop the operational manual. Online meetings were held through active participation of different professional groups, focal persons, faculty members, heads of the department of Anatomy, Physiology & Biochemistry of Phase I of all most all the govt. & non govt medical colleges of Bangladesh.

I hope this operational manual will help to serve as guiding principle for the students and as well as for faculty members.

Last but not least, I would like to extend my deep gratefulness to the Director General, DGME, ADG(ME), DGME, all Directors of DGME, faculty members of Anatomy, Physiology & Biochemistry of different Govt & non Govt medical colleges and others who shared their expertise, insights, contributed and worked hard to generate this precious document. Efforts given by the focal persons providing their valuable time, opinions & efforts during the development process of this operational manual for Phase I of MBBS curriculum are duly acknowledged.

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Background and Rationale

Curriculum is a study track along which students travel throughout the course of study. In this journey teachers play an important role in regards to teaching learning and assessment. To produce need based, community oriented, competent graduate medical doctors, MBBS curriculum was reviewed and updated in 2021. For better implementation of MBBS curriculum 2021 effectively, uniformly & competently an operation manual of each subject was felt by each of the Faculty of Medicine of all universities. In this regard Director (Research, Publication & Curriculum Development (RPCD) of DGME has taken the time felt initiative under the gradience of DG, DGME. Thanks to DG, DGME, Director (RPCD), DGME, focal persons and heads of the department of concerned subject of different government & non government medical colleges to finalise this operational manual. This operational manual will work as the skeleton of the curriculum in a comprehensive manner. This user-friendly document will serve the purposes of the faculty to ensure better teaching-learning and assessment.

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Overview of Assessment in 1st Professional Examination ImplementingMBBS Curriculum 2021

Common Information and Activities of Phase I

1.1. Basic information

i. The course is offered in 3 terms (1st, 2nd & 3rd) and total duration of Phase I is 18 months including First professional MBBS examination. The course is expected to start on first day of January.

ii. First professional examination to be started on first working day of May and November.

iii. Time for integrated teaching, examination, and preparatory leave of formative and summative assessment is common for all subjects of the Phase I.

iv. Assessment:
   a) There will be in-course (item/card/ term) and end-course (professional) assessment for the students.
   b) Formative assessment will be done through results of term final examination and class attendance.

1.2. Distribution of teaching-learning hours/days in Phase I

Lecture	**Tutorial**	**Practical**	**Generic topic***	**Integrated teaching for Phase I***	**Formative Exam**		**Summative exam**		**Total Teaching hours**
					Preparatory leave	**Exam time**	**Preparatoy leave**	**Exam time**	
117 hrs	100 hrs	100 hrs	7.5 hrs = 8 hrs	36hrs	35 days	42 days	30days	30 days	337
Timeforintegrated (Time for exam. preparatory leave and formative & summative assessment is common for all subjects of the phase)									
Generic topics : • Behavioral science • Medical Sociology • Etiquette in using social medias • Self-directed learning including team learning • Medical ethics									1.5 hrs x 5 classes = 7.5 hrs

1.3. Common Classes (generic topics)

Following classes shall be conducted as common. These classes will be held from January of each session.

The duration of each class will be 1½ (one and half) hours and would be completed by separate five classes within the time period of three terms.

These classes will be organized by the supervision of Phase 1 coordinator and concerned departments and Medical Education Unit.

Sessions will be planned under the supervision of principal,vice principal, and delivered by the concerned departments.

Topic	**Duration**
Behavioral science	1.5 hr
Medical Sociology	1.5 hr
Etiquette in using social medias	1.5 hr
Self-directed learning, including team learning	1.5 hr
Medical ethics	1.5 hr

1.4. Duration of each term

i. Term I: January to May
First Term Final Exam: 1st& 2nd week of May

ii. Term II: May to October
Second Term Final Exam: 3rd & 4thweek of October

iii. Term III : November to March
Third Term Final Exam: 3rd & 4th of week of March

1.5. Cards of Phase I

Cards of the three subjects will be distributed among the three terms in the following way:

Subjects	**Term I**	**Term II**	**Term III**
Biochemistry	Biophysics & biomolecules Food, nutrition, vitamins & Minerals	Digestion, absorption, bioenergetics & metabolism Body fluids, electrolytes & acid base balance	Clinical biochemistry & Clinical endocrinology Molecular Biology & genetics (Fundamentals)

	Generic topics • Behavioral science • Medical Sociology **Integrated teaching :** • Coronary artery disese • Chronic obstructive pulmonary disease • Anemia • Diarrhoea		**Generic topics** • Etiquette in using social medias • Self-directed learning including team learning **Integrated teaching :** • Diabetes Mellitus • Jaundice • Electrolyte imbalance • Proteinuria		**Generic topics** • Medical ethics **Integrated teaching :** • Thyroid Disorder • Cerebrovascular disease • Deafness • Refractory error	

1.6. In-course assessment

i. The Card final examination will be written only.

ii. In Term final examination (both regular & supplementary) will be written, oral & practical and it will be organized by Phase I committee.

1.7. Pre-requisite for appearing the term examination

- Students must complete all items of the cards and pass the card final examinations.
- At least 75% attendance of generic, integrated teaching and general classes
- Completion of assignment on integrated teaching.

1.8. Leave

Following leaves will be granted to the students:

i. **Pre-term:** Total 21 days, 7 days before each term (term I, II and III).

ii. **Post-term:** Total 14 days, 7 days after each term (term I and II). These leave may be utilized for organizing cultural week, sports, games or any other extra-curricular activities.

iii. **Preparatory leave for first Professional exam:** Total thirty (30) days preparatory leave will be granted to students before First Professional Examination.

Formative marks

Academic performances of the students must be properly documented. Calculation of Formative marks will be in the following way:

Total marks: Twenty (20)= Fifteen (15) from 3 term exams
+ Five (5) from attendances

15 marks will be taken from the total marks obtained in three terms examination as follows:

If a Student obtained

- 80% and above marks he/she will get 5 out of 5 in each term
- 75% to less than 80% marks he/she will get 4.5 out of 5 in each term
- 70% to less than 75%marks he/she will get 4 out of 5 in each term
- 65% to less than 70% marks he/she will get 3.5 out of 5 in each term
- 60% to less than 65% marks he/she will get 3 out of 5 in each term

Attendance: 05 marks

- For attendance of general classes : 2 marks
- For attendance of Integrated teaching : 2 marks
- For attendance of Generic topics : 1 mark

Calculation of marks for attendance of general classes and integrated teaching

- ≥ 90% and above : 2 marks
- 75%-89% : 1 marks
- < 75% : Non eligible

Calculation of marks for attendance of generic topics

- Mandatory : 1 mark

Calculation of lowest marks of formative assessment for an eligible student of First professional examination:

From 3 term examinations must obtained: 9 marks
From all attendance must obtained: 3 marks

Total: 9+3= 12 mark**s**

**Minimum marks to become eligible to appear in First professional examination is 12.
Without scoring these 12 marks, students will not be eligible for first professional examination.

1.10. Pre-requisite for appearing in the First professional examination:

i) Students must pass all the term examinations. If a student fails in aterm examination, he/she will have to pass the supplementary term examination.
ii) Certificate from the respective Head of Departments regarding students' attendance which must be at least 75% in all classes (lecture, practical, and tutorial, including generic topics and integrated teaching)

1.11. Summative Examination

i) Twenty (20) marks of formative assessment of each subjects will be added to the written marks of first professional examination.
ii) For MCQ (MT/F + SBA) of each paper, 20% marks are allocated. There will be separate answer script for MCQ part of examination. Total number of MCQ (MT/F+ SBA) will be 20 for each paper.
iii) For SAQand SEQ of each paper, 70% marks are allocated.
iv) Oral part of examination will be structured.
v) OSPE will be used for assessing skills/ competencies.

vi) Pass marks in examinations is 60% of total marks. Student will have to pass in written, oral and practical examination separately.

vii) The results will be published as per following GPA system with the provision of reflection of marks in the academic transcript.

Numerical Grade	**Letter Grade**	**Grade Point**
80% and above	A+	5.00
75% to less than 80%	A	4.50
70% to less than 75%	A-	4.00
65% to less than 70%	B+	3.50
60% to less than 65%	B	3.00
less than 60%	F	0.00

1.12. Examination: Distribution of marks of First Professional Examination

Subjects	**Written Exam Marks**	**Structured Oral Exam Marks**	**Practical Exam Marks**		**Formative Exam Marks**	**Total Marks**
Anatomy	180	150	**Soft part** 75	**Hard part** 75	20	500
Physiology	180	100	100		20	400
Biochemistry	180	100	100		20	400
Total						**1300**

1.13. Question setting:

Total number of paper setters must be eight (8).

i) For paper I: Four paper setters for both SAQ, SEQ and MCQ (MT/F + SBA)

ii) For paper II: Four paper setters for both SAQ, SEQ and MCQ (MT/F+SBA)

1.14. Moderation

Total number of moderators will be four (two for paper I and two for paper II).

Biochemistry

2. Departmental Objective

At the end of the course in Biochemistry the students should be able to:

- acquire the basic & integrated knowledge on major biomolecules, enzymes, hormones and nutrients with fundamental chemical process within body system upon which life depends.
- demonstrate skills in performing and interpreting Biochemistry laboratory tests and procedures with emphasis on those used in Bangladesh.
- demonstrate skills in using the modern biochemical appliances.
- *equip themselves with requisite knowledge for higher studies and research.*
- *develop sound attitude towards the need for continuing self-directed learning.*

List of Competencies to acquire:

After completing the course of Biochemistry in MBBS course the students will-

1) apply the learned knowledge of biochemistry in medicine.
2) be familiar with the biomolecules forming the structure of human body, their functions and role in health and diseases.
3) explain the role of enzymes in the diagnosis and treatment of diseases.
4) identify the source of energy in human body and the process by which this energy is derived from food.
5) explain metabolism of the body in fed and fasting state and consequences of prolonged starvation.
6) explain the role of liver in metabolism and derangement of metabolism in impaired liver function. Explain dyslipidemia and their clinical consequence
7) describe the water and electrolyte content of human body and their functions. Identify the types, causes and consequences of dehydration and over hydration. Explain the causes the consequences of electrolyte imbalance.
8) describe the sources of acids and bases in our body and the mechanism of their normal balance. Explain the causes and consequences of acidosis and alkalosis and the parameters to diagnose them.
9) demonestrate their basic conception about nutrients, balanced diet. Describe the common nutritional disorders of our country and their causes and consequences.
10) describe the components of balanced diet and explain the basic principles of making a diet chart. Attain the skill to assess nutritional disorders anthropometrically.
11) explain the basis of genetics and molecular biology and the common genetic disorders and explain the modern technology in molecular biology in the diagnosis and treatment of diseases.
12) diagnose diabetes mellitus, impairment of renal, liver and thyroid functions.

Attain the skill to perform and interpret the common biochemical tests in the diagnosis of diseases. Attain the skill to perform common bedside biochemical tests.

Distribution of teaching - learning hours

Lecture	Tutorial	Practical	Total teaching hours	Generic topic + Integrated teaching hour for Phase I	Formative Exam		Summative exam	
					Preparatory leave	Exam time	Preparatory leave	Exam time
117 Hours	100 hours	100 hours	317 hrs	7.5 hrs + 36 hrs	35 days	42 days	30 days	30 Days
Time for integrated teaching, examination, preparatory leave of formative & summative assessment is common for all subjects of the phase								
Related behavioral, professional & ethical issues will be discussed in all teaching learning sessions								

Teaching - learning methods, teaching aids and evaluation

Teaching Methods			Teaching aids	In course evaluation
Large group	Small group	Self learning		
Lecture Integrated teaching	Tutorial Practical Demonstration Problem solving	Assignment, self assessment and self study.	OHP Video tapes, Audio player Slide Projector Charts, Flip charts, Models, Specimens White board and marker Chalk board and chalk Computer and multimedia Study guide and manuals	• Item Examination (oral or written) • Card final (only written) • Term final (written, oral+ practical [OSPE, traditional & assignment])

Related Equipments:

Glass wares, pipette, micropipette, distilled water plant, p^H meter.

Laboratory equipments:

Photoelectric colorimeter, Centrifuge machine, PCR mechine, Incubator, Water bath, Hot air oven, Height and weight measuring instrument.

1st Professional Examination:

Marks distribution of Assessment of Biochemistry:

Total marks – 400

- Written=200 (Formative- 20+MCQ (SBA+MTF) 40+(SAQ+SEQ)140)
- SOE=100
- Practical= 100 (OSPE-40+ Traditional- 40 + Practical note book-10 + Assignment-10)

Learning Objectives and Course Contents in Biochemistry
Biophysics & Biomolecules

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • define biochemistry and explain its importance in medicine. • define solution, standard solution, ways of expressing concentration of a solution. • describe colloid and crystalloid with example, define dialysis and mention its biomedical importance. • define p^H, p^K and p^H scale and mention their importance. • define acid, base, strong acid and weak acid. • define buffer. State the body fluid buffers with their basic mechanism of action. • state Handerson Hasselbach equation and its importance. • define and classify isotope. State its biomedical importance. • define and classify carbohydrates. Mention the sources and importance of biologically important monosaccharides, disaccharides and polysaccharides. • describe the reducing property of carbohydrate. • define amino acid, peptide, polypeptide and protein. • state their sources and functions. • explain the structure of protein and denaturation of protein. • define and classify lipids, state their sources, functions and biomedical importance. • define and classify fatty acids, state their sources, function and biomedical importance, mention eicosanoids with their origin. • state the sources and importance of essential fatty acids: omega-3 fatty acid, omega-6 fatty acid and trans-fatty acid. • define eicosanoids, mention the basic steps of their synthesis. • define steroids and sterols. • describe the sources, and biomedical importance of cholesterol. • define and classify enzymes, describe the factors affecting enzyme activity. • define isoenzyme with example and mention their clinical application. • state the biomedical importance of enzyme. • define co-factors and mention their functions.	**CORE:** • Introduction to Biochemistry • Concept of solutions • Colloids and crystalloids. • Concept of pH and buffer. • Concept of isotope. • Concept of Biomolecules: Carbohydrates. • Amino acids and proteins. • Lipids and fatty acids. • Enzymes	Lecture: 18 hours Tutorial: 25 hours Practical: 20 hours Total teaching hours: 63 hours

Food, Nutrition, Vitamins and Minerals

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • define and explain nutrients, essential nutrients, macro and micronutrients, food, proximate principles of food, diet, balanced diet. • define and explain with full meaning of the abbreviations- BMR, BMI, SDA. • mention the basis of calculating the calorie requirement of a person. • describe the sources, requirement and function of carbohydrate as nutrient and describe the importance of fibers in diet. • state glycaemic index (GI) with its importance. • describe sources, requirement and function of protein as nutrients; mention the name and significance of essential amino acid; state the biological value of protein. • describe the sources, requirement and function of lipids as nutrients. • mention the sources and nutritional role of PUFA • define and classify vitamins. • describe the sources, function, RDA, deficiency disorders of water-soluble vitamins. • describe the sources, functions, RDA, deficiency disorders and toxicity of fat-soluble vitamins. • state the role of minerals as nutrients, define trace elements. • state the importance of minerals: sodium, potassium, calcium, iron, iodine, fluoride, selenium, manganese, copper, zinc etc. • describe iron metabolism. • describe the biochemical basis of the common nutritional disorders e.g. PEM, night blindness, goiter, obesity, nutritional anaemia.	**CORE:** • Basic concepts of food, nutrition and dietary principles. • Energy balance and calculation of energy equivalent of food. • Nutritional aspect of carbohydrates, fats and proteins, dietary fibers. • Vitamins and minerals. • Common Nutritional disorders.	Lecture: 18 hours Tutorial: 15 hours Practical: 10 hours Total teaching hours: 43 hours

Digestion, Absorption, Bioenergetics and Metabolism

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • define digestion, absorption, metabolism, anabolism, and catabolism. • describe the phases of metabolism • describe biological oxidation, respiratory chain and oxidative phosphorylation. • enumerate high and low energy compounds, describe ATP. **Carbohydrate Metabolism:** • describe digestion and absorption of carbohydrate with endproducts. • define glycolysis and describe the pathway, state the conversion of pyruvate to lactate, acetyl CoA and oxaloacetate. • calculate the amount of energy liberated in glycolysis and oxidative decarboxylation of pyruvate. • describe citric acid cycle and explain why it is called an amphibolic and common metabolic pathway. • calculate the amount of energy liberated in TCA cycle and total energy liberated from complete oxidation of a mole of glucose in aerobic and in anaerobic conditions. • define glycogenesis and glycogenolysis and state their role in storage and supply of glucose to meet body's demand. • state the importance of HMP pathway. • define gluconeogenesis and describe its process and importance. • describe glucose homeostasis and mention its importance, • state the glucostatic functions of liver with other biochemical functions.	**CORE:** • Introduction to metabolism • Biological oxidation, respiratory chain and oxidative phosphorylation. • High and low energy compounds. ATP • Phases of metabolism (digestion, absorption and intermediary metabolism) • Glycolysis • Citric acid cycle • Glycogenesis and glycogenolysis • Hexose monophosphate shunt • Gluconeogenesis • Blood glucose homeostasis • Cori cycle	Lecture: 29 hours Tutorial: 18 hours Practical: 25 hours Total teaching hours: 72 hours

Learning Objectives	Contents	Teaching Hours
Lipid Metabolism • describe digestion and absorption of lipids (triacylglycerol, phospholipids, cholesterol esters) • enumerate the blood lipids with their sources and mention the anabolic and catabolic pathways of lipid metabolism. • describe the process of degradation of triacylglycerol. • state the processes of fatty acid oxidation and describe beta-oxidation of even and odd chain fatty acids. • state the sources and fate of acetyl-CoA. • name the ketone bodies. • describe ketogenesis and fate of ketone bodies, state the biomedical importance of ketone bodies. • define ketosis and mention the causes of ketosis and describe its pathogenesis. • enumerate the lipoproteins, state its general structure and functions, describe the metabolism of chylomicron, VLDL, LDL and HDL cholesterol, explain the clinical importance of LDL & HDL cholesterol. • state the role of HMG-CoA reductase in regulation of blood cholesterol level.	**CORE:** • Digestion and absorption of lipid. • Blood lipids and pathways of lipid metabolism. • Triglyceride metabolism. • Beta-oxidation • Ketogenesis and ketosis. • Lipid transport and lipoprotein metabolism.	

Learning Objectives	Contents	Teaching Hours
Protein Metabolism • describe digestion and absorption of protein. • state the concept of protein turnover, amino acid pool • define nitrogen balance, mention its types and state the routes of nitrogen loss. • state the pathways of amino acid catabolism. • define and describe transamination and deamination. • describe sources and way of disposal of ammonia, explain ammonia intoxication • describe the urea cycle including sites, reactions and importance of the cycle.	**CORE:** • Digestion and absorption of protein • Protein turnover, common amino acid pool, nitrogen balance • Pathways of protein metabolism • Deamination and transamination. • Fate of amino acid in the body • Source and disposal of ammonia **ADDITIONAL:** • Role of liver in over all metabolisms. • **Integrated metabolism** Metabolic adjustment of fed, fasting and starvation state.	

Renal biochemistry, body fluid, electrolytes and acid-base balance

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • define GFR, renal threshold, plasma clearance, osmolar clearance and free water clearance, describe mechanism of acidification of urine. • state the body fluid compartments and state the composition of ECF and ICF • state water turnover, water intake and output, describe volume homeostasis (water balance), enumerate volume disorders with example, define water intoxication. • explain the importance of major electrolytes (Na^+, K^+, Ca^{++}, Mg^{++} and PO_4^{--}) and mechanism of their homeostasis. • describe acid base homeostasis & state the simple acid base disorder with causes of acidosis and alkalosis and mechanism of their compensation and correction. • state acid base parameters, anion gap and base excess, • state the role of kidneys in water, electrolyte and acid-base balance. • state abnormal constituents in urine with normal urine volume and obligatory urine volume, explain limiting p^H of urine. • define and classify diuresis with example.	**CORE:** **Renal biochemistry in relation to water, electrolytes and acid base homeostasis** • Total body water and body fluid compartments. Composition of body fluids. • Regulation of normal water balance. • Major electrolytes and their homeostasis. • Volume disorders. • Acid base homeostasis & disorders.	Lecture: 20 hours Tutorial: 12 hours Practical: 20 hours Total teaching hours: 52 hours

Clinical Biochemistry and clinical endocrinology

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • state the basic concepts of clinical biochemistry eg quality control & quality assurance, specificity, sensitivity • mention measurements of unit eg SI unit. Conversion factor. • list the common anticoagulants used in laboratory • state the laboratory hazards with its types and specimen used in labooratory • state the normal level of serum bilirubin and mechanism of causation of jaundice. • describe the common liver function tests with interpretation. • explain the basis of application of clinical enzymology in disease. • state the lipid profiles of blood & their clinical importance. • state the causes and consequence of hyperglycaemia and hypoglycaemia. • state the laboratory diagnosis of diabetes mellitus, OGTT and its interpretation, define IFG, IGT and HBA_{1c}. • state renal function tests • define proteinuria and microalbuminuria, glycosuria. • state thyroid function tests with interpretation.	**CORE:** • Introduction to clinical biochemistry. • quality control & quality assurance, specificity, sensitivity • Normal biochemical values in conventional and Sl. Units. • Clinical enzymology related to liver and myocardial diseases. • Lipid profiles and dyslipoproteinemias. • Organ function tests (liver, kidney & thyroid) • Diagnosis of diabetes mellitus • Bilirubin metabolism and Jaundice. • Proteinuria and microalbuminuria	Lecture: 14 hours Tutorial: 15hours Practical: 20 hours Total teaching hours: 49 hours

Fundamentals of Molecular Biology and genetics

Learning Objectives	Contents	Teaching Hours
At the end of the course, students will be able to: • explain chemistry, & functions of nucleic acid, nucleosides, and nucleotides. • describe the structure and functions of DNA. • describe the structure, types and functions of RNA. • describe DNA organization, cell cycle and genetic code. • describe the the central dogma & processes of replication of DNA, • define gene, allele, genome, genotype, phenotype, trait, and codon. • describe transcription and post transcriptional modification. • describe translation and post translational modification. • explain the concepts & application of medical Biotechnology • explain the concepts & application of recombinant DNA technology. • explain the concept of DNA cloning, PCR, DNA fingerprinting • define and classify mutations, mutagens.	**CORE:** • Basic concepts of molecular biology. • Nnucleic acid, nucleosides, and nucleotides. • Replication, transcription and translation. • Gene, genome, allele, trait, genetic code, mutation, mutagens. • PCR, DNA cloning, recombinant DNA technology • Biomedical aspects of medical biotechnology: understanding & application.	Lecture: 18 hours Tutorial: 15 hours Practical: 05 hours Total teaching hours: 38 hours

Biochemistry practical

Learning Objectives	Contents	Teaching Aids	Teaching Hours
Students will be able to: • list the laboratory hazards and the precautions to prevent them. • identify the different laboratory glass wares and equipments. Mention their uses. • prepare different type of standard solution from supplied solute, solvent and standard solution. • identify different parts of photoelectric colorimeter. Demonstrate its technique and the basic principle of calculation. • perform different biochemical tests according to given method and manual. • know the clinical indication of performing biochemical tests. • interpret biochemical values to apply in clinical situations.	**CORE** • Identification of laboratory glass wares and equipment. • Preparation of solutions. • Sample collection & processing • Photometry. • Estimation, demonstration of technique, calculation and interpretation of result: • Blood glucose estimation. • Serum cholesterol estimation. • Serum urea • Serum creatinine • Serum total protein • Serum bilirubin • Abnormal constituents of urine and their clinical significance.	• OHP • Video tapes, Audio player. • Charts, Flip charts, Models, Specimens • White board and marker • Chalk board and chalks • Computer and multimedia • Study guide and manuals • Glass ware, micropipette • Distil water plant • pH meter • Laboratory equipments: • photoelectric colorimeter • Centrifuge machine • PCR mechine • Incubator • Water bath • Hot air woven • Height and weight measuring instrument	**100 hours**

Evaluation of Biochemistry
Summative Assessment (1st Professional Examination)

Components	Marks	Total Marks
Formative assessment	10+10	20
WRITTEN EXAMINATION Paper – I- MCQ (50% SBA + 50% MTF) (~75% SAQ+ ~25% SEQ) Paper - II- MCQ (50% SBA + 50% MTF) (~75% SAQ+ ~25% SEQ)	 20 70 20 70	180
PRACTICAL EXAMINATION OSPE Traditional methods Practical note book Assignment on Integrated Teaching	 40 40 10 10	100
ORAL EXAMINATION (Structured)		100
Grand Total		**400**

- OMR sheet will be provided for MCQ.
- Pass marks 60 % in each of theoretical, oral and practical.

Continuous Assessment Card

Card No- 1. Biophysics and Biomolecules

No.	Items	Marks(10 in each item)	Initials and date
1.	Introduction of biochemistry, acid, base, p^H, p^K, buffer, Henderson-Hasselbalch equation.		
2.	Solutions, crystalloid, colloid, dialysis and isotopes.		
4.	Carbohydrates.		
5.	Lipids		
6.	Amino Acids and Protein.		
7.	Enzymes, coenzymes, cofactors, isoenzsymes		

Card No- 2. Food, nutrition and vitamins

No	Items	Marks(10 in each item)	Initial and date
1.	Basic concepts of Nutrient, food, diet, balanced diet, essential dietary components, , total calorie calculation,DRI, RDA, MR, BMR, BMI, SDA.		
2.	Dietary fibers, nutritional importance of carbohydrate, lipid & protein, glycaemic index (GI) of food.		
3.	Minerals- (macro & micro), trace elements, common nutritional disorders, PEM, obesity, iron metabolism and its deficiency, iodine deficiency		
4.	Water soluble vitamins		
5.	Fat soluble vitamins		

Card No- 3. Digestion, absorption, bioenergetics and metabolism

No	Items	Marks(10 in each item)	Initial and date
1.	**Digestive juices**, local hormone of GIT, digestion & absorption of carbohydrate, lipid, protein.		
2.	**Bioenergetics-** biological oxidation, high energy phosphates, oxidative phosphorylation, respiratory chain. Metabolism-definition, phases, anabolism, catabolism		
3.	**Carbohydrate metabolism**- glycolysis, fate of pyruvate, TCA cycle, HMP pathway, gluconeogenesis, glycogenesis, glycogenolysis, blood glucose regulation.		
4.	**Lipid metabolism:** lipolysis, Beta-oxidation of fatty acid, fate of Actyl-CoA, ketone bodies, ketosis & its pathoghenesis. Lipoproteins & their metabolism, Cholesterol metabolism.		
5.	**Protein metabolism:** Amino acid pool, Transamination, Deamination. Source & fate of ammonia, ammonia intoxication, Urea cycle.		

Card No- 4. Renal biochemistry, body fluid, electrolytes and acid base balance

No	Items	Marks(10 in each item)	Initial and date
1.	**Renal biochemistry-** GFR, tubular load, TM, renal threshold, plasma clearance, osmolar clearance, free water clearance, acidification of urine.		
2.	**Body fluid-** Body fluid compartments, daily water intake & output, water turnover, body fluid volume regulation, volume disorders and diuresis.		
3.	**Acid-Base Balance-** origin of acids & bases, maintenance of static blood p^H. Acid base disorders, their compensation & coprrection, anion gap and base excess.		
4.	**Serum Electrolytes**- Serum electrolytes & their reference ranges. Functions, regulations, hypo & hyper states **o**f serum $[Na^+]$, $[K^+]$ $[Ca^{++}]$ & $[PO_4^{--}]$		

Card No- 5. Clinical biochemistry and clinical endocrinology

No	Items	Marks(10 in each item)	Initial and date
1.	Clinical biochemistry- S I unit, Laboratory hazards, Sample collection, Photometry.		
2.	Clinical enzymology and lipid profiles of blood.		
3.	Diagnosis of diabetes mellitus. OGTT, IGT, IFG and $HbA_{1C.}$		
4.	Thyroid function tests and interpretation.		
5.	Commonly done LFT. Jaundice.		
6.	Renal function tests and interpretation.		

Card No- 6. Fundamental of molecular biology and genetics

No	Items	Marks(10 in each item)	Initial and date
1.	Nucleic acids, nucleotides, DNA, RNA, DNA organization, Cell cycle.		
2.	The central dogma, Genome, Gene, Genetic code, Codon, Mutation, mutagens, Genotype, Phenotype, trait, allele.		
3.	Replication, Transcription and post transcriptional modification,		
4.	Translation and post translational modification.		
5.	Recombinent DNA technology, PCR, Cloning.		

Total Teaching Hours for Biochemistry

System	Lecture	Tutorial	Practical	Integrated teaching
1. Biophysics and biomolecules'	18	25	20	Common hour of Phase I
2. Food, nutrition, vitamins and minerals	18	15	10	
3. Digestion, absorption, bionergetics and metabolism	29	18	25	
4. Body fluids, electrolytes and acid base balance	20	12	20	
5. Clinical biochemistry and clinical endocrinology	14	15	20	
6. Molecular Biology and genetics (Fundamentals)	18	15	05	
Total Teaching Hours: (317)	**117**	**100**	**100**	**36**

Academic Calendar for Biochemistry

First Term				
System (Two)	**Lectures**	**Tutorials**	**Practical**	***Generic topic & integrated teching**
Card-1.Biophysics and biomolecules	18 hrs.	25 hrs.	20 hrs.	1 generic topic 1.5 hrs. 2 integrated teaching 6 hrs
Card-2. Food and Nutrition	18 hrs.	15 hrs.	10 hrs.	1 generic topic 1.5 hrs. 2 integrated topic 6 hrs
Total	36 hrs.	40 hrs.	30 hrs.	15 hrs.

Second Term				
System (Two)	**Lectures**	**Tutorials**	**Practical**	***Generic topic & integrated teching**
Card-3.Digestion,absorption, bioenergetics and metabolism	29 hrs.	18 hrs.	25 hrs.	1 generic topic 1.5 hrs. 2 integrated teaching 6 hrs
Card-4.Bodyfluids, electrolytes,renal chemistry and acid base balance	20 hrs.	12 hrs.	20 hrs.	1 generic topic 1.5 hrs. 2 integrated topic 6 hrs
Total	49 hrs.	30 hrs.	45 hrs.	15 hrs.

Third Term				
System (Two)	**Lectures**	**Tutorials**	**Practical**	***Generic topic & integrated teching**
Card-5.Clinical biochemistry and clinical Endocrinology	14 hrs.	15 hrs.	20 hrs.	1 generic topic 1.5 hrs. 2 integrated teaching 6 hrs
Card-6.Molecular Biology	18 hrs.	15 hrs.	05 hrs.	2 integrated topic 6 hrs
Total	32 hrs.	30 hrs.	25 hrs.	13.5 hrs.

3. Overview of Assessment in 1st Professional Examination

Written	Oral	Practical
(Total marks – 200)	(Total marks – 100)	(Total marks- 100)

Grand total – 400, pass marks- 60% in each part i.e. in written, oral and practical

3:1. Assessment systems and marks distribution

Components	Marks	Total Marks	Contents
WRITTEN EXAMINATION Paper – I- Formative Assessment + MCQ +(SAQ +SEQ) Paper – II- Formative Assessment + MCQ +(SAQ+SEQ)	10+20+70 = 100 10+20+70 =100	200	**Paper – I** 1 Biophysics & Biomolecules 2. Digestion, absorption, bioenergetics & metabolism 3. Clinical biochemistry & Clinical endocrinology
PRACTICAL EXAMINATION OSPE Traditional practical methods and experiments Practical Note Book Assignment on Integrated Teaching	 40 40 10 10	100	**Paper – II** 1. Food, nutrition, vitamins & minerals 2. Renal biochemistry, body fluid, electrolytes and acid base balance 3. Fundamental of molecular biology & genetics
STRUCTURED ORAL EXAMINATION (SOE) 2 boards	Board – I = 50 Board – II = 50	100	
Grand Total		400	

3:2. Written examination:

i). Formative assessment

- Three term examination
- Attendance in classes (lecture, tutorial & practical)

Distribution of marks in formative assessment:

Marks of formative assessment are on the basis of three term examination and percentage of attendance.

- From three terms - 15
- From class attendance – 05
- Head of the department will keep the records of formative assessment of the students.
- It is the responsibility of the Convener of the examination to send the calculated marks of formative assessment to the controller of examination signed by all the four (2 internals+ 2 externals) examiners

ii) Multiple choice questions (MCQ) MTF + SBA:

- Time allocation for MCQ is 30 minutes
- Number of question is 20, 10 questions in each group (Group A and B). Among the 20 questions, 10 questions will be Multiple True/False (MT/F Type**)** and 10 questions will be Single Best Answer (SBA type).
- Each question will carry one stem and five alternatives.
- Each stem will carry one mark.

[For multiple true/false (MT/F)

- Type of question is multiple choice true/false type
- Each alternative will carry 0.2 marks
- Ideally True: False in each stem should be 3:2 or 2:3.]

[For SBA

- Most appropriate answer will be considered as correct answer.
- Single correct answer will carry one (1) mark.
- More than one alternative will produce no mark]
- No negative marking for MCQ.
- Fraction marks should be excluded, 0.5 marks or more than 0.5 marks will be considered as 1 mark and less than 0.5 marks will be considered as "0".
- Keys of MCQ must be supplied (if MCQ is not checked centrally by OMR machine).
- OMR sheet will be supplied for answering MCQ.
- MCQ will be checked centrally by digital process.

i) Short answer questions (SAQ) + Structured essay questions (SEQ): Marks distribution

Paper		Marks
I		70
	Group – A	35
	Group – B	35
II		70
	Group – A	35
	Group – B	35
Total		140

- There will be two groups in each paper, group A and group B.
- There will be seven questions in each group.
- In Group A:
  Q. No.1-5: each carrying 5 marks are SAQ type of which 4 to be answered
  Q. No. 6: problem based question (PBL) of SAQ type carrying 5 marks (mandatory)
  Q. No. 7: (with or without an alternate) carrying 10 marks is SEQ type (mandatory)

- In Group B:
  Q. No.8-12: each carrying 5 marks are SAQ type of which 4 to be answered
  Q. No. 13: problem based question (PBL) of SAQ type carrying 5 marks (mandatory)
  Q. No. 14: (with an alternate) carrying 10 marks is SEQ type (mandatory)

Allocation of time for SAQ +SEQ is two (2) hours and thirty (30) minutes.

- The question may have stems but it is not mandatory to have stems in all questions.
- The students will use separate answer script for each group.

Type of Questions

- Recall type – 50%
- Understanding type – 35%
- Problem based / Analytical type – 15%

Distribution of topics of groups in Paper I and Paper II (both for SAQ and MCQ) in 1st professional examination:

Paper I		Paper II	
Group A	**Group B**	**Group A**	**Group B**
Topics: 1. Biophysics & Biomolecules 2. Clinical Biochemistry	**Topics:** 1. Digestion, absorption, bioenergetics & metabolism 2. Clinical Endocrinology	**Topics:** 1. Renal biochemistry, body fluid, electrolytes, acid-base balance 2. Vitamins & minerals	**Topics:** 1. Fundamental of Molecular Biology & Genetics 2. Food, nutrition,

- **Distribution of written scripts among the examiners:**
  - There will be four examiners- two internals and two externals.
  - Each examiner has to examine two packets of written scripts, one group of SAQ+SEQ and one group of MCQ (if MCQ is not checked centrally by OMR machine).
  - Paper I, group A has to be examined by one internal examiner and Paper I, group B by one external examiner.
  - Paper II, group A has to be examined by other internal examiner and Paper II, group B by other external examiner.
  - Group A and B will be according to the serial of the name of examiners in examiner's list.

3:3. Structured Oral Examination (SOE)

- Number of oral examination board will be two (board I and board II).
- Number of examiners in each board will be two: one internal and one external.
- SOE must be structured.
- For each board marks are fifty (50).
- Number of questions for each board is ten (10).
- Allocation of marks for each question is five (5).
- For SOE, the ideal pattern of questions are as follows:
  Recall –50%
  Understanding–35%
  Problem based /Analytical –15%
- Topics of paper I and paper II should be distributed between two boards.
- Systems of paper I will be included in board I and paper II will be in Board II. Systems must be exchanged between two boards on every alternate day for better evaluation.
- In each day, maximum fourteen numbers of students should be scheduled for oral and practical examination.
- In the same day, each student will face both oral (board I & board II) examination and practical examination.

Distribution of systems for board I and board II of Structured oral examination (SOE) in 1st professional examination:

Board I	Board II
Biophysics & Biomolecules	Food, nutrition, vitamins & minerals
Digestion, absorption, bioenergetics, metabolism	Renal biochemistry, body fluid, electrolytes, acid base balance
Clinical biochemistry & Clinical endocrinology	Fundamentals of molecular biology & genetics

3:4. Practical examination:

Marks distribution:

OSPE (each question/ station= 4 marks x 10)	40
Traditional practical	40
Practical note book	10
Assignment on Integrated Teaching: Diarrhea Diabetes mellitus Electrolytes imbalance Proteinuria Thyroid function test	10
Total	100

Objective structured practical examination (OSPE):

- Number of stations in OSPE is ten (10).
- Number of procedure station is four (4- 5).
- Number of question station is six (5 - 6).
- Allocation of time for each station is two (2) minutes.
- Allocation of marks for each station is four (4).
- In the question station, some question should be based on the information obtained at the previous station.
- In the question station, some question should be based on the information obtained at the previous station
- OSPE with its check list should be prepared by the internal examiner.
- Observer of procedure station observes & gives mark according to check list.
- If the procedure needs more than two minutes then there may be a gap station in the next.
- The four examiners according to the check list will evaluate answer script of question station.
- Better to avoid fractionation of marks.

➢ **Traditional Practical examination:**

- Experiments of traditional practical examination will be held according to the curriculum.
- Practical examinations will be conducted by all four (two internal and two external) examiners.
- One experiment should be given to each student.

➢ **Practical Notebook:**

- Total number for practical note book is ten.
- Marks will be given by the internal examiner on the basis of content of the topics, regularity and cleanliness.

4. Post Examination Procedure

Preparation and submission of marks sheet

(Marks sheet of formative, oral and practical examination should be sent to the Controller of examination by the Convener of the examination).

❖ Written

➢ **Formative**

- Formative marks should be sent to the Controller of examination in a separate marks sheet.
- Marks sheet should be signed by all four(two external and two internal) examiners

➢ **SAQ+SEQ**

- Short answer question marks should be submitted by all four examiners to Controller of examination within the oral and practical examination schedule.

➢ **MCQ**

- Multiple choice questions will be checked centrally by OMR machine.
- OMR sheets should be packed and sealed properly by hall superintendent of written examination and will be submitted to the Head of the center.
- The Head of the center will send the packet of OMR sheet to the Controller of examination.
- Otherwise numbers of MCQ must be submitted with SAQ number in separate mark sheet.

➢ **Practical**

- Total practical marks (OSPE+ Traditional+ Note book) will be submitted to Controller of examination in a separate marks sheet signed by four (two internal + two external) examiners.

➢ **Oral**

- Marks of board – I & board – II = Total marks.
- These total oral marks will be submitted by the convener signed by four examiners immediately after the end of examination to the head of the center.

➢ **Rules for fill up the mark sheet supplied by University:**

- Subject, paper and group must be written clearly at the top.
- Oral, practical & formative must be mentioned at the top.
- Roll number and obtained marks must be written clearly four times for self, Deputy Controller, Tabulator one & Tabulator two.

- Roll number of absent student/s must be filled up in each section SAQ+SEQ, MCQ (if applicable), oral & practical.
- Three small enveloped must be prepared for each section with clearly mention the subject, paper, group, oral, practical & formative, and closed & sealed appropriately with mark sheet/s.
- Two large envelop must be prepare with above mentioned. One large envelope will be closed & sealed with one small envelope and other large envelop will be closed & sealed with two small envelops.

5. Students In-Course Evaluation Cards

5:1.Cards for Card final & Term final examination on Biochemistry for individual student

Department of Biochemistry

Students name---------- **Roll no.----------**
Session ---------- **Year----------**
Batch----------
Date of starting ---------- **Date of ending ----------**

Components	Written		Oral		Practical		Remarks (Signature & Date)
	Full Marks	Marks Obtained	Full Marks	Marks Obtained	Full Marks	Marks Obtained	
Biophysics, Biomolecules & enzyme	100						
Food, Nutrition, Vitamins & Minerals	100						
Digestion, absorption, Bioenergetics & metabolism	100						
Renal biochemistry, Body fluid, Electrolytes, Acid base balance	100						
Clinical Biochemistry & Clinical Endocrinology	100						
Fundamental of Molecular Biology & Genetics	100						
1st Term	**100**		**100**		**100**		
2nd Term	**100**		**100**		**100**		
3rd Term	**100**		**100**		**100**		

5:2. Class Attendance Record

Department of Biochemistry

Components	Total Class held	Total Class attended	Percentage (attended/ Held)	Remarks (Signature & Date)
Lecture (117 hours)				
Tutorial (100 hours)				
Practical (100 hours)				
Generic classes (7.5 hours)				
Integrated teaching (36 hours)				

5.3. Formative Assessment Record

Total marks obtained in 1^{st} term+ 2^{nd} term+3^{rd} term	Marks from three terms	Marks from class attendance	Total marks of Formative Assessment
Total marks (300+300+300)=900	15	5	20

Signature of Head of Department

5:4. Continuous Assessment Cards

Continuous Assessment Card

Department of Biochemistry---------- **Medical college**----------
Students name---------- **Roll no.**----------
Session ---------- **Year** ---------- **Batch** ----------
Date of starting ---------- **Date of ending** ----------

Card No- 1. Biophysics and Biomolecules

No.	Topics	Marks (10 in each item)	Initial with date
1.	Introduction of Biochemistry, Acid, Base, p^H, p^K, Buffer, Henderson-Hasselbalch equation.		
2.	Solutions, Crystalloid, Colloid, Dialysis and Isotopes.		
3.	Carbohydrates.		
4.	Lipids		
5.	Amino Acids and Protein.		
6.	Enzymes, Coenzymes, Cofactors, Isoenzsymes		

Signature of the Batch teacher

Signature of the Head of Department

Continuous Assessment Card

Department of Biochemistry---------- Medical college----------
Students name---------- Roll no.----------
Session ---------- Year ---------- Batch ----------
Date of starting ---------- Date of ending ----------

Card No- 2. Food, nutrition, vitamins and minerals

No	Topics	Marks (10 in each item)	Initial with date
1	Basic concepts of Nutrients, Food, Diet, Balanced diet, Essential dietary components, Total calorie calculation, DRI, RDA, Metabolic rate, BMR, BMI & SDA.		
2	Dietary fibers, Nutritional importance of Carbohydrate, Lipid & Protein, Glycaemic Index (GI) of food.		
3	Minerals- (macro & micro), Trace elements, Common nutritional disorders, PEM, Obesity, Iron metabolism and its deficiency, Iodine deficiency		
4	Water soluble vitamins		
5	Fat soluble vitamins		

Signature of the Batch teacher

Signature of the Head of Department

Continuous Assessment Card

Department of Biochemistry---------- **Medical college**----------
Students name---------- **Roll no.**----------
Session ---------- **Year** ---------- **Batch** ----------
Date of starting ---------- **Date of ending** ----------

Card No. 3. Digestion, absorption, bioenergetics and metabolism

No	Items	Marks (10 in each item)	Initial with date
1.	**Digestive juices**, local hormone of GIT, digestion & absorption of carbohydrate, lipid, protein.		
2.	**Bioenergetics-** biological oxidation, high energy phosphates, oxidative phosphorylation, respiratory chain. metabolism-definition, phases; anabolism, catabolism		
3.	**Carbohydrate metabolism**- glycolysis, fate of pyruvate, TCA cycle, HMP pathway, gluconeogenesis, glycogenesis, glycogenolysis, blood glucose regulation.		
4.	**Lipid metabolism:** lipolysis, Beta-oxidation of fatty acid, fate of Actyl-CoA, ketone bodies, ketosis & its pathoghenesis. Lipoproteins & their metabolism, Cholesterol metabolism.		
5.	**Protein metabolism:** Amino acid pool, Transamination, Deamination. Source & fate of ammonia, ammonia intoxication, Urea cycle.		

ignature of the Batch teacher

Signature of the Head of Department

Continuous Assessment Card

Department of Biochemistry---------- **Medical college**----------
Students name---------- **Roll no.**----------
Session ---------- **Year** ---------- **Batch** ----------
Date of starting ---------- **Date of ending** ----------

Card No- 4. Renal biochemistry, body fluid, electrolytes and acid- base balance

No	Items	Marks (10 in each item)	Initial with date
1.	**Renal biochemistry-** GFR, tubular load, TM, renal threshold, plasma clearance, osmolar clearance, free water clearance, acidification of urine.		
2.	**Body fluid-** Body fluid compartments, daily water intake & output, water turnover, body fluid volume regulation, volume disorders and diuresis.		
3.	**Acid-Base Balance-** origin of acids & bases, maintenance of static blood p^H. Acid base disorders, their compensation & correction, anion gap and base excess.		
4.	**Serum Electrolytes-** Serum electrolytes & their reference ranges. Functions, regulations, hypo & hyper states **o**f serum $[Na^+]$, $[K^+]$ $[Ca^{++}]$ & $[PO_4^{--}]$		

Signature of the Batch teacher

Signature of the Head of Department

Continuous Assessment Card

Department of Biochemistry---------- **Medical college**----------
Students name---------- **Roll no.**----------
Session ---------- **Year** ---------- **Batch** ----------
Date of starting ---------- **Date of ending** ----------

Card No- 5. Clinical biochemistry and clinical endocrinology

No	Items	Marks (10 in each item)	Initial with date
1.	Clinical biochemistry- S I unit, Laboratory hazards, Sample collection, Photometry.		
2.	Clinical enzymology and lipid profiles of blood.		
3.	Diagnosis of diabetes mellitus. OGTT, IGT, IFG and $HbA_{1C.}$		
4.	Thyroid function tests and interpretation.		
5.	Commonly done LFT. Jaundice.		
6.	Renal function tests and interpretation.		

Signature of the Batch teacher

Signature of the Head of Department

Continuous Assessment Card

Department of Biochemistry---------- **Medical college----------**
Students name---------- **Roll no.----------**
Session ---------- **Year ---------- Batch ----------**
Date of starting ---------- **Date of ending ----------**

Card No- 6. Fundamental of molecular biology and genetics

No	Items	Marks (10 in each item)	Initial with date
1.	Nucleic acids, nucleotides, DNA, RNA, DNA organization, Cell cycle.		
2.	The central dogma, Genome, Gene, Genetic code, Codon, Mutation, mutagens, Genotype, Phenotype, trait, allele.		
3.	Replication, Transcription and post transcriptional modification,		
4.	Translation and post translational modification.		
5.	Recombinants DNA technology, PCR, Cloning.		

Signature of the Batch teacher

Signature of the Head of Department

Card 7: Biochemistry Practical

SL NO	**Name of experiment**	**Full Marks**	**Marks obtained**
1	Laboratory etiquette and safety precaution	10	
2	Identification and use of laboratory glass wares	10	
3	Identification and use of laboratory equipments and apparatus.	10	
4	Preparation of different type of solutions with their use	10	
5	Conversion of traditional unit to SI unit	10	
6	Sample collection & processing	10	
7	Physical and chemical analysis of urine	10	
8	Identification of various abnormal constituent of urine with their interpretation in disease diagnosis and treatment.	10	
9	Photometry	10	
	Estimation, demonstration of technique, calculation and interpretation of result:		
10	Blood glucose	10	
11	Serum cholesterol	10	
12	Blood urea	10	
13	Serum creatinine	10	
14	Serum total protein	10	
15	Serum bilirubin	10	

Signature of the Batch teacher

Signature of the Head of Department

6. Provisional Tabulation Sheet for Oral & Practical examination

Department of Biochemistry

---------- Medical College

First professional MBBS Examination of 20----

Date:--/--/----

Roll No	Oral		Total Marks (100)	Practical				Total Marks (100)	
	Board I(50)	Board II(50)		OSPE (40)	Traditional Practical (40)	Note Book (10)	Assignment (10)		Remarks

Signature of the examiners