

## C o n t e n t s

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### **Preamble:**

Banglabandhu Sheikh Mujib Medical University (BSMMU) was established by replacing the former Institute of Postgraduate Medicine and Research (IPGM&R) by an act of Parliament as an autonomous institute of national interest in 30<sup>th</sup> April 1998 which also defines its objectives and functions. By virtue of this act the university has been granted the authority to confer postgraduate medical degree and other academic distinctions. The faculty of basic science & paraclinical science are one of the faculties of this university. The degrees granted by this department/faculty are recognized postgraduate medical qualifications in accordance with Bangladesh Medical and Dental Council (BMDC) Act. The Degree holders of this university will be entitled to the same privileges are those awarded by an equivalent awards from any other recognized university of Bangladesh.

### **Language of education:**

The language of education of this university is English.

### **Purpose:**

The purpose of this program is to standardize Biochemistry teaching at postgraduate level throughout the country so that it will benefit in achieving uniformity in undergraduate teaching as well. Accordingly the training in MD Biochemistry should be distinctive from that of M Phil, PhD, M sc in such a way so that it can pace with global change in attitude towards medical education as well as the out look regarding the research in the field of Medical Biochemistry toward its clinical implication.

### **Course Objectives:**

A student upon qualifying MD Biochemistry will be able to

- Be a competent Biochemist and academician.

- Provide teaching and training to the students at the postgraduate level in a field of research and enrich and equip them for teaching in medical colleges and other medical and health institutions.
- Effectively teach undergraduate and paramedical students the basic Biochemical mechanisms of human body with references to their implications in the pathogenesis of disease and the Biochemical basis of their management.
- Equip themselves with adequate knowledge, skill and proper attitudes required to conduct medical education on medical Biochemistry at different level.
- Acquire adequate knowledge and skill required to conduct independent research in medical Biochemistry in relation to needs and disease profile of the country.
- Conduct such clinical /experimental research those would have significant bearing on human health and patient care.
- Interact with allied departments by rendering services in advanced laboratory investigations.
- Acquire skills in conducting collaborative research in the field of Biochemistry and allied sciences.
- Implement prerequisite knowledge and skill to proceed to further advanced studies and research in Biochemistry and in allied sciences.

### **Academic Courses offered by the department:**

The Department of Biochemistry will run the following academic courses:

- **MD in Medical Biochemistry (Biochemistry Residency Program)**
- Ph D

### **General Information:**

#### **A. Entry qualification**

- The candidate must have an MBBS or an equivalent degree from an university recognized by Bangladesh Medical and Dental Council(BMDC) and completed one year internship.

- A candidate who has already been enrolled or selected in any other course or subject at any university or institute including BSMMU shall not be considered for admission unless he/she provides satisfactory documents regarding cancellation of his/her previous course. If any candidate is found to conceal any information regarding this, the authority will have the right to cancel his/her admission.

#### **B. Commencement of course**

March-beginning of each calendar year (Annual)

#### **C. Method of Selection of candidates**

If the above criteria is fulfilled the candidate will face an admission test comprising a written entry test. Selection will be absolutely on the basis of merit of the entry test result. A minimum mark as determined by the Central Examination Committee before examination which is subjected to vary must be obtained to get admitted in the course.

#### **Foreign Candidates**

Foreign nationals are required to send their application to the university authority and should reach the office of dean of the faculty of Basic Science & Paraclinical Science before the admission test for the following session. Their application will be scrutinized by a selection committee formed by the faculty. The eligible applicant will be required to appear before an interview board for final selection.

#### **D. Number of seats**

The number of seats of each course will be determined by the central committee for admission consulting the respective faculty.

## Residency Program:

### Program Description

The training of the residents of MD course is full time and continuous. Private practice or part time job of any kind is strictly prohibited during the course period. Each student shall be considered as resident and honorarium will be given as per rule of the university. If any resident violates this rule his/her studentship will be terminated.

### Duties and responsibilities

Duties and responsibilities of students shall be fixed by a course supervisory committee of the Department of biochemistry. They will be required to perform such work as may be required for the interest of the discipline.

### Leave

During the course resident students will follow the rules regarding leave approval and forwarding as issued by the central BSMMU administration.

### Date of Joining

Selected candidates must join the course within the date mentioned in the letter of selection; otherwise, the candidate's admission shall be automatically cancelled. Delayed joining within 15 days over the last date of joining can be accepted on adequate logical ground for delay.

### Medical Examination

The selection of each student will be subject to medical fitness. No selected student will be allowed to join the course unless declared medically fit by the Medical Board appointed by the University.

## Overview of the Course:

Name of the course: Doctor of Medicine (MD) in Medical Biochemistry.

Duration of the course: 3years

MD Medical Biochemistry will be conducted in 2 phases

- 1) Phase A --theoretical and practical course -2 years duration
- 2) Phase B – Research-- 1 year duration

### Phase-A

#### Duration- 2 years

Phase A consists of Part I(Year- 1) & Part II(Year- 2).

In this phase students have to qualify the examination assessing theoretical and practical knowledge and skill in Biochemistry and in teaching and research methodology.

Each year this phase is divided in to 4 blocks.

Each block is of 3 months duration.

Part I (First year) is composed of Block A, B, C, D

Part II (Second year) composed of Block E, F, G, H

Commencement of the course: 1<sup>st</sup> March of each year.

### Distribution of total course contents in blocks

	Block	Contents
Part I/ Year 1	A March- May	Biophysics, Biomolecules, & Nutrition. (Paper-I).
	B June- Aug	Laboratory technique & Laboratory management. (Paper-II).
	C Sep- Nov	Metabolism & Hormones. ( Paper-III).
	D Dec- Feb	Microbiology/Hematology/Clinical pathology.
<b>First Summative examination</b>		
	E March- May	Molecular Biology & Human genetics. (Paper-IV).
	F	Fluid, electrolyte & acid base balance. (Paper- V).

part II / Year 2	June- Aug	Clinical Biochemistry. (Paper- VI).
	G Sep- Nov	
	H Dec- Feb	Bio-statistics, Medical education and Research Methodology
<b>Second Summative examination</b>		
<b>Phase-B Research Year-3</b>		

**Course activities in year 1:**

Large group teaching session  
 Small group teaching  
 Laboratory exercise  
 Seminar presentation  
 Assignment & Discussion  
 Self learning

**Course activities in year 2:**

Large group teaching session  
 Small group teaching

- supervised teaching (Micro teaching session)
- Journal club presentation
- Assignment & Discussion
- Self learning
- Approval of Research Protocol

**Syllabus in details:****Phase- A****Part- I (1 year)****Paper- I: Biophysics, Biomolecules & Nutrition.****Biophysics**

- Introduction to Biochemistry, Definitions, scope, importance in medicine, units of measurement.
- Solutions & its types.
- Law of Mass action, Donnan-membrane equilibrium, Colloids and Crystalloid, Dialysis, Surface tension and Viscosity, Units of measurement, SI unit, Unit conversion.
- Acids, bases, Alkali, Electrolytes, Ions, Indicators, P<sup>H</sup>, Buffers, and Handerson-Hasselbalch equation.
- Isotope : definition and types, half life, importance in medicine.
- Organization of biological membrane and membrane transport, (osmosis, diffusion, filtration, active and passive transport).
- Important elemental composition of human body.

**Biomolecules**

(Carbohydrates, proteins, lipids, DNA & RNA)

- Introduction, definitions, Biomedical importance, Classification, Physical & Chemical properties, structure and functions of Carbohydrate, Protein, Fat, DNA, RNA.

**Enzymes:**

- Defination, Classification, Function, Factor influencing enzymatic activity.
- Clinical importance of enzyme.
- Coenzyme, Isoenzyme.

**Cellular Communication**

1. Cellular Communication
  - a. Intracellular communication
    - Adenylate cyclase system
    - GTP-dependent regulatory proteins
    - Protein kinas
    - Hydrolysis of C-AMP
      - Calcium/phosphatidyl inositol system
      - Other systems- C-GMP, nitric oxide system.

- b.** Intercellular communication (Hormones, neurotransmitters and their receptors, 2<sup>nd</sup> messenger molecules)
- Introduction, mechanism of hormone actions.

**Vitamins:**

- Water & fat soluble vitamins.
- Sources, RDA, function, deficiency disorders and toxic effects of all vitamins.
- Role of vitamin-B complex & vitamin-K in metabolism.

**Nutrition:**

- Balance diet, Minerals (micro& macro), Dietary fibre, BMR, BMI.
- Essential nutrients, Thermogenic effect of food (SDA).
- Nutritional diseases, Protein energy malnutrition, Obesity, Metabolic Syndrome.

**Practical:**

- Preparation of solutions,
- Use of balance, Normal solution, Molar solution.
- Sample dilution.
- Use of common techniques in Biochemistry-Photometry.

**Paper-II: Laboratory technique & Laboratory management.**

Laboratory technique, Laboratory principles, Analytical techniques, Instrumentation & laboratory operation.

- Laboratory Hazards, Laboratory Records and Data management.
- Point to care testing.
- Automation in clinical laboratory.
- Principles of Immunochemical techniques.

- Mass Spectrometry.
- Optical techniques.
- Electrochemistry and chemical sensor.
- Collection, processing and preservation of samples
- Units, Establishment & use of reference values and Interpretation of Biochemical data and use of Biochemical data in Clinical Medicine.
- Anticoagulant.
- Reagent grade water in laboratory.
- Laboratory set up & error in the laboratory.
- Total quality management of the clinical laboratory :
  - Levey-Jenning control chart.
  - Westgard multicontrol chart
- Biochemical Techniques:
- Spectrophotometer, Flame photometry, atomic absorption spectrophotometer, chromatography, electrophoresis, centrifugation, ultracentrifugation, flurometry, turbidimetry, ionselective electrode, isoelectric focusing, immunochemical methods, radioimmunoassay (RIA), radioisotope technique, EIA, ELISA, Immunoradiometric assay (IRMA) Fluorescent in situ hybridization (FISH), Fluorescent activated cell sorter (FACS), Crystallography.

**Paper III: Metabolism & Hormones.****Metabolism:**

- Bioenergetics & Biological oxidation.
- Metabolism of carbohydrates .

*Intermediary metabolism of carbohydrate.*

1. Glycolysis .
2. Glycogenolysis.
3. Gluconeogenesis .

4. Urea cycle.
5. TCA cycle.
6. Respiratory chain.
7. HMP shunt pathway.

**Metabolism of Protein.**

1. Amino acid pool.
2. Protein turnover.
3. Deamination, Transamination & Oxidative deamination.
4. Nitrogen balance.
5. Ammonia production, excretion & ammonia intoxication.

**Metabolism of Lipid.**

1.  $\beta$ -oxidation of fatty acid.
2. Metabolism of Lipoproteins.
3. Ketone bodies formation & utilization.
4. Overview of cholesterol fatty acid synthesis.

*Interrelation between carbohydrate, protein & lipid metabolism.*

**Digestion and absorption:**

- Carbohydrate
- Protein
- Lipid
- G.I- tract hormones
- Vitamins & Minerals

**Hormones:**

- Endocrinology & Reproduction.
- The Pituitary hormones & their control by hypothalamus.
- The Thyroid metabolic hormones.
- The Adrenocortical hormones.

- Insulin, Glucagon & Diabetes Mellitus.
- Parathyroid hormone, Calcitonin, Calcium & Phosphate metabolism, Vitamin-D.
- Reproductive & Hormonal functions of the male & female.

**Practical:**

- Estimation serum glucose .
- Estimation of serum urea, creatinine.
- Estimation of serum cholesterol.
- Estimation of serum bilirubin.

**Block D: Microbiology/Hematology/Clinical pathology (any one of the three).****Part- II (1 year) :****Paper- IV: Molecular Biology & Human genetics.****Molecular Biology & Human genetics.**

- Nucleotide Metabolism
- DNA structure, function and replication
- RNA structure, synthesis, processing and functions.
- Protein synthesis
- Regulation of gene expression, recombinant DNA technology and PCR
- Molecular basis of inherited disease.
- Molecular basis of neoplasm.
- Fundamentals of Medical Genetics.
- Gene therapy.
- Cytogenetic and Mendelian disorders.
- Diagnostic methods in genetic disorders.
- Biotechnology

## **Paper-V: Fluid, Electrolyte Balance & Acid Base Balance.**

### **Fluid and Electrolyte Balance:**

- Fluid balance
  1. Total body water, body fluid compartment & it's distribution, measurement of body fluid.
  2. Principles of water movement between body fluid compartment
  3. Daily water intake & output.
  4. Regulation of water balance.
  5. Solution used clinically for volume replacement therapy.
  6. Water intoxication.
  7. Volume disorders- Isotonic, Hypotonic & Hypertonic.
- Electrolyte balance
  1. Normal electrolytes of ECF & ICF.
  2. Na<sup>+</sup>, K<sup>+</sup> & Ca homeostasis.
  3. Electrolyte disorders- Na<sup>+</sup>, K<sup>+</sup> & Ca.

### **Acid-base balance:**

- Definition
- Buffer system
- Acid-base disorder
- Classification of ABD
- Correction of ABD
- Effect of ABD
- Plasma anion gap
- Acid-base measurement

### **Practical :**

- Estimation serum glucose .
- Estimation of serum urea, creatinine.
- Estimation of serum cholesterol.
- Estimation of serum bilirubin.

## **Paper-VI: Clinical Biochemistry**

### **Clinical Biochemistry:**

- Insulin and its counter-regulatory hormones: DM and hypoglycemic
- Inborn errors of metabolism: glycogen storage disease, dyslipidaemia, disorders of amino acid metabolism, porphyrias.
- Assessment of biochemical changes related to acute and chronic renal and liver diseases.
- Disorders of Ca, Po<sub>4</sub> and Mg metabolism, metabolic bone diseases gout and pseudo gout.
- Plasma enzymes in clinical diagnosis.
- Drug monitoring and metabolism of xenobiotics
- Biochemical effects of tumor.
- Clinical chemistry of newborn, geriatrics and pregnancy, malabsorption intravenous feeding.
- Nutritional disorders, their assessment and principle of nutrition supplement.
- Biochemistry of neurological and muscle diseases.
- Biochemical basis psychiatric diseases and mental handicaps.
- Organ function tests.
- Biochemical derangement and laboratory approach in: Proteinuria, edema, malabsorption syndrome, liver disease and hepatic comma, unconscious patients, acute chest pain, acute abdomen, renal failure and cardio respiratory insufficiency.

### **Block H: Bio-statistics, Medical Education & Research Methodology.**

#### **(A) Research Methodology and Bio-statistics**

- Introduction to research, research strategies and design
- Concept regarding major categories of medical research:
  - a) Experimental studies

- b) Descriptive epidemiological studies
- c) Clinical trials (aspects more related to basic science research shall be emphasize)
- Relevant methodological details of collection and interpretation of data:
  - a) Sampling techniques and sample size
  - b) Questionnaire design
  - c) Preparation of data sheet
  - d) Bias and confounding
  - e) Basic risk measurement
- Tests of significance of difference (both parametric and non-parametric), association and caution.
- Ethical aspects of medical research.
- Preparation of research protocol (protocol).
- Writing up of a thesis-detail of every aspects (from title to appendices) of the thesis including presentation of results (descriptive statistics) in tables, graphs, charts, photographs, photomicrographs etc.
- Writing of research paper.
- Presentation of research paper :
  - a) Oral presentation
  - b) Poster presentation

### **B. Medical education:**

- Basics of learning and teaching, curriculum planning and quality assurance in the institution.
- Teaching methods :
  - a) Basic planning
  - b) Giving lectures
  - c) Small group teaching
  - d) Taking practical classes
- Teaching resources (materials) : Audio-visual aid and their uses.

- Assessment of student performance :
  - a) Principles of assessment
  - b) Planning of written examinations (including setting of various types of written questions and comparisons)
  - c) Planning of oral and practical examinations (including designing OSPE stations)

**N.B.:** Teaching assignments shall be given to student and evaluated by the teachers.

### **C. Information Technology related to Medical Science**

Relevant theoretical and practical knowledge of the equipments and facilities utilized in collection, processing and presenting information related to teaching and research.

- Basics of computer and accessories.
- Literature search including med-line search, Internet browsing, use of library, etc.
- Use of computer software's for writing (e.g, Ms Word) and Processing data, including statistical analysis (eg-SPSS).
- Use of computer software's for preparing visual aid for teaching and scientific presentation (eg-Power Point). Practical training and assignments shall make parts of the course.

**N.B.:** Stimulated assignments on various aspects of research methodology shall be given to the students and evaluated by the teachers.

### **Phase-B:**

#### **Year 3(Research)**

#### **Total duration 1 year**

There will be no provision of carry on from phase A to phase B. After passing all the papers of part I & II summative examinations



each student will start research work with an approved protocol. After completing the study, he/she must write a thesis embodying the results of that research and will give at least one seminar talk before the Faculty of Basic Science & Paraclinical Science. In the last month of this phase, each student will have to face a thesis defense and comprehensive viva examination before an examination board. In addition residents will be involved with teaching activities, administrative work, seminar and others activities as instructed by the departmental administration.

#### **Duties and responsibilities of residents:**

1. Demonstration at small group discussion to junior fellow students.
2. Demonstration of Laboratory practical to junior fellow students.
3. Participation in all kinds of academic and research activities Taking care and assistance to technical operations of the instruments and appliances in the assigned laboratories as well as department.
4. Learning of computer with different program including data analysis, preparation of power point and OHP presentation as well as management and the maintenance of the computer.
5. Beautification of the department.
6. Assistance in the conduction of examination in the department.
7. Perform various task as assigned by the departmental course managing committee.

#### **Course composition:**

1. Theoretical lectures
2. Small group classes (tutorials, discussions session & demonstrations using audio visual aid)

3. Practical classes
4. Seminar, journal club meetings, teaching practice
5. Research & thesis writing
6. Laboratory/teaching attachment
7. Self-learning exercise/ assignments/videotape/CD ROM/Internet

#### **Monitoring tools**

1. Logbook
2. End block assessment
3. Periodic checking of log book

#### **Assessment and Evaluation of the Course:**

MD residents will be assessed throughout the pre research phase periodically by using two system of examination. These are end block examination and summative examination.

#### **End block examination:**

At the end of the specified period for each block the MD students will be assessed by using different instruments of modern assessment technique The syllabus will include the Biochemistry course content of that particular block. This end block examination will be treated as **formative assessment**.

This examination will be conducted by the departmental examination committee involving all the teachers of the department and absolutely under the departmental responsibility. The departmental examination committee will also decide and accomplish all necessary tasks for conducting this examination including selection of the question setter, moderator, examiner, printing questions and will send the examiners list to the course director of basic science & paraclinical science faculty for approval. 30% of the marks achieved by each individual student

in each component of this assessment will be added to the 70% of the marks achieved in summative examination. There is carry on system from block to block but not more than two block. If a student is defaulter in 2 block he/she will appear to the supplementary summative.

Any other subject which is taught as common subject to several discipline such as teaching methodology, biostatistics, research methodology as well as some other performance such as seminar presentation, journal club presentation, teaching session in a particular block will be evaluated as satisfactory and unsatisfactory. The scores of the satisfactory will be determined by grading system. This grade score in addition to the marks obtained in all components of examination of departmental subjects will be recorded in the log book of each individual student. But this graded scores will not be included as part of formative assessment and will not add to the portion of summative marks.

Common evaluation method for the Biochemistry course contents of each block of year one and two in the phase A as follows:

The residents will be evaluated by the departmental teachers following some prescribed format prepared by the course supervising committee (departmental course coordinator).

Residents will be assessed on several items specific for the block just finished by an end block examination. Their skill and knowledge in Biochemistry course contents will be evaluated separately. Knowledge (cognitive) will be assessed by written examination (SAQ/SEQ and MCQ) and skill will be judged by structured oral and by Objective Structured Practical Examination(OSPE) & Traditional practical examination at the end of each block as mentioned below. 30% of the score achieved in knowledge and skill assessment during end block examination will be accommodated in the total score of the results published of each paper by incorporating the proportion of

the marks achieved in summative assessment at the end of year 1 and 2 individually. The contents of a block which will not come under end block examination will be evaluated as satisfactory/not satisfactory and it will be recorded in log book. Residents must achieve complete clearance of Phase A for entry into phase B.

Example of Assessment & Evaluation method of end block:

System in Block	Formative /End block	Pass Mark	Mark obtained
Block- A, B, C, E, F & G.	Total score		
<b>Written:</b>	50	30(60%)	
SAQ	40		
MCQ	10		
<b>Oral</b>	50	30(60%)	
<b>Practical:</b>	50	30(60%)	
OSPE	20		
Traditional practical	25		
Laboratory note book	05		
<b>Block- D &amp; H, Seminar/Journal presentation &amp; H, club</b>	Unsatisfactory- <60% Satisfactory 60-69% Good- 70-79% Excellent-80-89% Outstanding - >90%	(60%)	
<b>Assignment/Supervised teaching</b>	do	do	
<b>All Attendance</b>	do	do	

Minimum score must be achieved 60% in each individual component to be allowed to take part in summative examination. Results of the end block examination will be published in the departmental notice board incorporating both the obtained

marks and graded score. This result will also be recorded in students log book.

### Summative Assessment:

At the end of part I (year 1) and part II (year 2) during phase A there will be a summative assessment which will cover all the specific Biochemistry course contents specific for each year. 70% of the obtained marks will be added to the final result at the end of the year. The departmental examination committee will select the internal and external examiners as paper setters, moderators for written and for oral and practical examinations as well following the basic rules of conduction for residency course as adopted by the faculty of Basic Science & Paraclinical Science of BSMMU. The office of the controller of examination of BSMMU will provide assistance to hold this examination and also will publish results, and prepare mark sheets and certificates as required.

The total course content of the phase A is distributed in the following papers for assessment in summative examination:-

#### First summative examination:

Paper I: Biophysics, Biomolecules, & Nutrition.

Paper- II: Laboratory technique & Laboratory management.

Paper- III : Metabolism & Hormones

#### Second Summative examination

Paper- IV: Molecular Biology & Human genetics. Group A-  
Endocrinology

Paper- V: Fluid, electrolyte & acid base balance

Paper- VI: Clinical Biochemistry

Summative Examination Part I & II (Year 1,2)		
Assessment Item	Total score	Passing score (60%)
Written SAQ/SEQ	100 SAQ 40X2 = 80 SEQ 10X2 =20	60

Oral- Structured	100	60
Practical- Traditional/OSPE /note book.	100(50+40+10)	60
Grand total	300	
	<b>Summative Year 1</b>	<b>Summative Year II</b>
Written SAQ/SEQ	Paper I, II, III 100 X 3= 300	Paper IV, V, VI 100 X 3= 300
Oral	100 X 3= 300	100 X 3= 300
Practical	100 X 3= 300	100 X 3= 300
Total	900	900

### Final Examination at the end of year 3:

After finishing research work students will submit a thesis and face a thesis defense examination orally before an Examination Board under the supervision of controller of examination. Publishing results, delivering mark sheet/academic transcript and certificate to the qualified students are the responsibility of office of the controller of examination. After qualifying this phase B final examination, the student will be awarded a degree of MD in Biochemistry by Bangabandhu Sheikh Mujib Medical University.