



BIOCHEMISTRY LAB MANUAL

For the Medical Students of
Brahmanbaria Medical College

ব্রাহ্মণবাড়িয়া মেডিকেল কলেজ



Department of
BIOCHEMISTRY





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Introduction

Clinical biochemistry is that branch of lab medicine in which chemical and biochemical methods are applied to the study of disease. The Department of Biochemistry, BMCH was founded in 2013 with a passionate team of teachers; the department is an example of quality teaching and practical learning. The students are expected to excel in all the branches of Biochemistry including theoretical, practical and oral examination to become good physicians in the future.

Our approach

This laboratory manual is designed to guide students in the development of manipulative skills and techniques essential for understanding the sample collection and preparation of different test results. To help in early diagnosis and treatment biochemistry field have very important role in this aspect by providing authentic and standard result.

The key role of the department

- Conduct practical courses for MBBS, BDS and IHT students.
- Do lab investigations related to Biochemistry.

Manual Identity	Information
College	Brahmanbaria Medical College
Department	Department of Biochemistry
Target group	Medical Students of MBBS
Purpose	Guidance for practical learning, laboratory safety, biochemical tests and examination preparation.

Laboratory Protocol / Laboratory Etiquette

General Instructions

- No student is allowed to enter the laboratory without permission from the laboratory instructor.
- Before attending the laboratory session, students must read the relevant laboratory procedures carefully.
- Students must follow all instructions given by the laboratory instructor and laboratory staff.

During Work in the Laboratory

- No experiment may be performed without the knowledge and permission of the laboratory instructor.
- Students must wear a laboratory apron or lab coat at all times during practical work.
- Students must wear closed shoes in the laboratory. Sandals or slippers are not allowed.
- Hands must be kept away from the face, eyes, ears, nose, and mouth during laboratory work.
- Eating, drinking, smoking, or chewing gum is strictly prohibited in the laboratory.
- Chemicals, reagents, or biological specimens must never be tasted or smelled directly.
- Mouth pipetting is strictly prohibited.
- If any acid, alkali, chemical, or biological material accidentally comes into contact with the eyes, mouth, or skin, the affected area must be washed immediately with plenty of tap water. The laboratory instructor must be informed at once, and medical attention should be taken if necessary.
- Gloves, masks, and eye protection should be used whenever required, especially while handling chemicals, blood, urine, serum, saliva, or other biological specimens.
- All biological specimens must be treated as potentially infectious.
- Spirit lamps, burners, or heating devices must not be used without permission.
- Used matchsticks, filter papers, gloves, cotton, tissue papers, and other solid wastes must not be thrown into the sink. They must be disposed of in the designated waste bins.
- Broken glassware, sharp objects, needles, or blades must be disposed of in proper sharps containers and must not be thrown into ordinary dustbins.
- Any spill, accident, injury, broken equipment, or damaged glassware must be reported immediately to the laboratory instructor or laboratory assistant.

Before Leaving the Laboratory

- All chemicals, reagents, instruments, and glassware must be returned to their proper places.
- Used glassware and equipment must be cleaned or placed in the designated area as instructed.
- Chemicals must not be poured into the sink unless specifically instructed by the laboratory instructor.
- Waste materials must be disposed of in their proper containers.
- Broken equipment or glassware must be reported to the laboratory instructor or laboratory assistant.
- No chemicals, reagents, glassware, instruments, specimens, or other laboratory materials may be removed from the laboratory without written permission from the course instructor.
- Work benches must be cleaned before leaving the laboratory.
- Hands must be washed properly with soap and water before leaving the laboratory.

Location and Faculty

Location

The academic Biochemistry laboratory is located on the second floor of the college building at North East Medical College.

Faculty

Designation	Name	Role
Professor & Head	Prof Dr. Abu Hena mostafa Kamal	Chief supervisor
Professor	Prof. Dr. Abdus Samad	Supervisor
Assistant Professor	Dr. Sheikh Khadija Akter Meeli	Supervisor
Senior Lecture	Dr. Shah Poran Jibon	Lab In charge
Lecturer	Dr. Rifat Sarkar	Demonstrator
Lecturer	Dr. ShehrinTabara Ananna	Demonstrator
Lab Technologist	Md. Mahmudul Hasan Shimul	Maintenance

Expected Skills and Practical Sessions

Expected Skills

The expected skills for a biochemistry laboratory include both technical and soft skills. Students should develop technical skills such as the proper use of laboratory equipment, handling of glassware, preparation of reagents, use of a colorimeter, and performance of common biochemical tests. They should also be able to observe, record, analyze, and interpret test results in order to determine the concentration of different substances in solution.

Technical Skills

- Proper use of laboratory equipment
- Handling of glassware
- Preparation of reagents
- Use of a colorimeter
- Performance of common biochemical tests
- Observation, recording, analysis and interpretation of test results

Soft Skills

- Critical thinking
- Problem solving
- Effective communication
- Teamwork
- Attention to detail
- Time management
- Strong organizational ability

In addition, students should maintain ethical conduct, accuracy, honesty, and responsibility while performing laboratory work. These qualities are essential for conducting reliable biochemical analysis in a clinical and academic environment.

Practical Sessions

Hands-on laboratory sessions are an integral part of the curriculum. These sessions allow students to perform important biochemical techniques, including the estimation of serum glucose, cholesterol, urea, bilirubin, and total protein.

Practical work helps students gain proficiency in diagnostic methods, laboratory procedures, observation of biochemical reactions, interpretation of results, and understanding the clinical importance of biochemical investigations.



Biochemistry Practical Curriculum

Learning Objectives	Core Contents	Teaching Aids	Teaching Hours
Students will be able to: - List common laboratory hazards and precautions. - Identify laboratory glassware, instruments and equipment. - Prepare standard solutions from supplied solute, solvent and standard solution. - Identify parts of a photoelectric colorimeter and demonstrate basic technique and calculation. - Perform biochemical tests according to the manual. - Explain clinical indications of common biochemical tests. - Interpret biochemical values in clinical situations.	- Identification of laboratory glassware and equipment. - Preparation of solutions. - Sample collection and processing. - Photometry and colorimetry. - Estimation, demonstration of technique, calculation and interpretation of results. - Blood glucose, serum cholesterol, urea, creatinine, total protein and bilirubin estimation. - Abnormal constituents of urine and their clinical significance.	- Multimedia projector - Whiteboard and marker - Chalkboard and chalk - Charts, flip charts, models and specimens - Study guide and laboratory manual - Glassware and micropipette - Distilled water plant - pH meter - Photoelectric colorimeter - Centrifuge machine - Incubator - Water bath - Hot air oven - Weighing balance and height measuring scale	100 hours

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Card 7: Biochemistry Practical

SL No.	Name of Experiment	Full Marks	Marks Obtained
1	Laboratory etiquette and safety precautions	10	
2	Identification and use of laboratory glassware	10	
3	Identification and use of laboratory equipment and apparatus	10	
4	Preparation of different types of solutions and their uses	10	
5	Conversion of traditional units to SI units	10	
6	Sample collection and processing	10	
7	Physical and chemical analysis of urine	10	
8	Identification of various abnormal constituents of urine and their interpretation in disease diagnosis and treatment	10	
9	Photometry: Estimation, demonstration of technique, calculation, and interpretation of results	10	
10	Blood glucose estimation	10	
11	Serum cholesterol estimation	10	
12	Serum urea estimation	10	
13	Serum creatinine estimation	10	
14	Serum total protein estimation	10	
15	Serum bilirubin estimation	10	

Signature of Batch Teacher: _____

Signature of Head of Department: _____

Lab Hazards

Learning Objectives	Contents	Teaching hours
Students will be able to identify various types of hazards with their symbol.	Explosives	1
	Compressed gases	1
	Flammable gases	1
	Toxic materials	1
	Radioactive materials	2
	Corrosive materials	1
	Biologically hazardous materials	2
	Electrical hazards	1

Good Laboratory Conduct

- Read instructions before the practical session.
- Use gloves, masks and eye protection when required.
- Report every spill, injury or broken instrument immediately.

Waste Safety Reminder

- Use designated waste bins.
- Use sharps containers for broken glassware or blades.
- Treat all biological specimens as potentially infectious.

Consolidated Teaching Hours and Marks Distribution

Consolidated teaching hours of Biochemistry Practical

1st Term Allotted time (30 Hours)		2nd Term Allotted time (45 Hours)		3rd Term Allotted time (25 Hours)	
System	Practical	System	Practical	System	Practical
Biophysics and biochemistry	20	Digestion absorption bioenergetics and metabolism	25	Clinical biochemistry and clinical endocrinology	20
Food nutrition, vitamins and minerals	10	Body fluids, electrolytes and acid base balance	20	Molecular biology and genetics	5

Practical Examination Marks Distribution

Component	Marks
OSPE: each question/station carries 4 marks × 10 stations	40
Traditional practical examination	40
Practical notebook	10
Assignment on Integrated Teaching	10
Total	100

Assessment Structure

Topics for Assignment on Integrated Teaching

- Diarrhea
- Diabetes mellitus
- Electrolyte imbalance
- Proteinuria
- Thyroid function tests



Objective Structured Practical Examination

- The number of stations in OSPE will be ten.
- The number of procedure stations will be four to five.
- The number of question stations will be five to six.
- The allocation of time for each station will be two minutes.
- The allocation of marks for each station will be four.
- In the question station, some questions may be based on the information obtained from the previous station.
- OSPE with its checklist should be prepared by the internal examiner.
- The observer at the procedure station will observe the student's performance and give marks according to the checklist.
- If any procedure requires more than two minutes, a gap station may be arranged after that station.
- The four examiners will evaluate the answer scripts of the question stations according to the checklist.
- Fractional marks should preferably be avoided.



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.



List of Laboratory Equipment and Articles

SL No.	Name of Equipment/Article	Quantity
1	Autoanalyzer / Automated biochemistry analyzer	1
4	Photoelectric colorimeter	5
6	Electronic balance	2
7	Weighing balance with pans	2
8	Centrifuge machine, 12-place	2
12	Shaker	5
13	Rotator	1
14	Refrigerator	1
16	Urinometers	5
17	Albuminometers	5
18	Thermometers, Celsius and Fahrenheit	3
19	Boiling point determination apparatus	1
20	Freezing point determination apparatus	1
21	Ryle's stomach tubes	5
22	Rubber catheters	5
24	Magnetic stirrer	1
25	Stopwatch	3
26	Spirit lamps	15
27	Water distillation and deionizing plant	01
28	pH meter	2
29	Educational films, slides, and models	As necessary
30	Binocular microscope	1
31	Glassware	As required
32	Micropipettes of various capacities	As necessary

List of Glassware, Small Instruments and Accessories

1. Beaker	15. Dropper bottle	29. Forceps
2. Conical flask	16. Watch glass	30. Test tube holder
3. Volumetric flask	17. Cuvette	31. Test tube rack
4. Measuring cylinder	18. Glass slide and cover slip, if required	32. Thermometer
5. Funnel	19. Specimen container / urine container	33. Stopwatch
6. Test tubes, big and small	20. Disposable syringe	34. pH paper / universal indicator paper
7. Boiling tube	21. Tourniquet	35. Wash bottle
8. Centrifuge tube	22. Micropipette	36. Test tube brush
9. Glass rod / stirring rod	23. Micropipette tips	37. Marker pen or glass-marking pencil
10. Glass pipette	24. Pipette filler / rubber bulb	38. Sharps disposal box
11. Graduated pipette	25. Metallic wire loop	39. Biohazard waste container
12. Volumetric pipette	26. Spirit lamp	40. Disposable gloves
13. Dropper	27. Stirrer	41. Apron / laboratory coat
14. Reagent bottle	28. Spatula	42. Face mask

List of Reagents and Solutions Used in Biochemistry Practical

1. 5% Acetic acid	14. Reagent kit for estimation of serum total protein
2. Benedict's solution	15. Protein standard solution or albumin standard solution
3. Sodium nitroprusside powder or 5% aqueous sodium nitroprusside solution	16. Reagent kit for estimation of serum creatinine
4. Ammonium sulphate crystals or saturated ammonium sulphate solution	17. Creatinine standard solution
5. Concentrated ammonium hydroxide or liquor ammonia	18. Normal saline
6. Reagent kit for estimation of blood glucose	19. Molar solution of sodium chloride
7. Glucose standard solution	20. Sodium hydroxide solution
8. Reagent kit for estimation of serum cholesterol	21. Distilled water or deionized water
9. Cholesterol standard solution	22. Dilute hydrochloric acid
10. Reagent kit for estimation of blood/serum urea	23. Dilute sulphuric acid
11. Urea standard solution	24. Dilute nitric acid
12. Reagent kit for estimation of serum bilirubin	25. pH buffer solutions, preferably pH 4.0, pH 7.0 and pH 9.0/10.0
13. Bilirubin standard solution, if required	26. Universal indicator solution or pH indicator paper



Practical Class Schedule

Practical Class schedule: 1st year MBBS

Sunday	Tuesday	Wednesday
8.00-10.00 AM	8.00-10.00 AM	8.00-10.00 AM
A batch	B batch	C batch

Practical class schedule: 2nd Year MBBS

Sunday	Tuesday	Wednesday
12.30-2.30 PM	12.30-2.30 PM	12.30-2.30 PM
A batch	B batch	C batch

Batch	Teacher Signature	Remarks
A batch		
B batch		
C batch		

Traditional Practical Exam

Traditional practical exam in Biochemistry is a hands-on assessment where students perform and interpret standard laboratory techniques with enzymic colorimetric methods within a time limit.

Practical Skills Evaluation:

The primary goal is to assess hands-on abilities, procedural accuracy, and the ability to correctly apply laboratory methods learned in class.

Aseptic Technique:

Students must demonstrate proper handling of reagent, equipment sterilization, and the maintenance of aseptic conditions to prevent contamination.

Calculation:

Students may be required to calculate analytical substance according to the principal of photometry.

Interpreting Results:

A significant part of the assessment involves accurately interpreting experimental results, such as observing color changes in biochemical tests and conversion from SI to traditional unit.

Item	Observation
Procedure performed within time limit	
Calculation completed accurately	
Result interpreted correctly	
Safety protocol maintained	

Objective Structured Practical Examination (OSPE)

Station-Based

Students move through stations, each designed to test a specific practical competency.

Structured and Objective

The assessment is standardized for all students, using checklists and direct observation to ensure objectivity and reduce bias.

Practical Skills

OSPEs assess psychomotor skills, including handling instruments, performing procedures, making observations, and interpreting results.

Procedure: Benedict's test

Check List	Marks	Roll
1. Safety Precaution	0.5	
2. Identification of Proper instruments	0.5	
3. Identification of Proper sample	0.5	
4. Take 5 ml of Benedict reagent in a test tube & Heat	0.5	
5. Add 8 drops of supplied sample	0.5	
6. Boil the test tube over a flame for 2 minutes	0.5	
7. A change in blue colour gives yellow-red precipitate	0.5	
8. Result: reducing sugar present in supplied sample	0.5	
Total Marks = 4		

Procedure: Heat Coagulation Test

Checklist	Marks	Roll
1. Maintains proper safety precautions during the procedure	0.5	
2. Identifies proper instruments: test tube, test tube holder, spirit lamp/burner, dropper and 5% acetic acid	0.5	
3. Identifies the proper supplied sample, usually urine sample	0.5	
4. Takes about two-thirds of the test tube with the supplied urine sample	0.5	
5. Holds the test tube in a slanting position and heats the upper part of the urine only	0.5	
6. Observes the appearance of turbidity or coagulum in the heated upper part and compares it with the lower unheated part	0.5	
7. Adds 2-3 drops of 5% acetic acid to the heated part and observes whether turbidity persists or disappears	0.5	
8. Interprets the result correctly: persistent turbidity/coagulum indicates the presence of protein/albumin in the supplied urine sample	0.5	
Total Marks = 4		



Procedure: Rothera's Test

No.	Checklist	Marks	Roll
1	Maintains proper safety precautions during the procedure	0.5	
2	Identifies proper instruments: test tube, test tube holder/rack, dropper, spatula and reagent bottles	0.5	
3	Identifies the proper supplied sample, usually urine sample	0.5	
4	Takes about 5 ml of supplied urine sample in a clean test tube	0.5	
5	Adds ammonium sulphate crystals and shakes properly to saturate the urine sample	0.5	
6	Adds sodium nitroprusside powder or a few drops of 5% sodium nitroprusside solution and mixes well	0.5	
7	Carefully adds concentrated ammonium hydroxide/liquor ammonia along the side of the test tube without shaking	0.5	
8	Observes and interprets the result correctly: formation of a purple/violet ring at the junction indicates the presence of ketone bodies in the supplied urine sample	0.5	
Total Marks = 4			



Direct Observation and Immediate Feedback

Immediate Feedback

Students receive prompt feedback, allowing for both formative assessments to improve learning and summative assessment to evaluate overall competence.

Observation Area	Teacher/Observer Comments
Safety precautions followed	
Instrument and sample identification	
Procedure performed correctly	
Observation and result interpretation	
Calculation and reporting	
Overall feedback	

Student Name: _____ Roll: _____

Date: _____ Batch: _____

Signature of Observer: _____

Signature of Head of Department: _____