

*Annexure to Notification No.F(Prescription-Syllabi/Paramedical Courses/Acad/KU/2021
Syllabi and Courses of Study for B.Sc Medical Lab Technology-3rd year
Effective from academic session 2020 and onwards*

<i>BMLT301</i>	<i>Biochemistry-III</i>
<i>BMLT302</i>	<i>Microbiology-III</i>
<i>BMLT303</i>	<i>Pathology-III</i>
<i>BMLT304</i>	<i>Medical Ethics (Subsidiary Subject)</i>

Course Title: Biochemistry-III

Course Code: BMLT301

Biochemistry-III

No. Theory Classes: 100 hours

No. Practical Classes: 80 hours

Theory Syllabus

i. *Laboratory Management*

- Soft skills in patient handling
- Clinical automation, different types of automation
- Quality assurance in clinical laboratory- control of pre-analytical, analytical and post-analytical variables
- Biological reference intervals.
- General approach to quality control. Commonly used terms in quality control - accuracy, precision, specificity, sensitivity, mean, standard deviation, co-efficient of variation etc.,
- Use of controls, Preparation of Levey-Jennings' control charts, Westgard rules

II. Clinical Enzymology

- Sources of plasma enzymes. Units of enzyme activity. Diagnostic importance of enzymes. Isoenzymes. Cardiac troponins

III. Plasma proteins

- Total proteins.
- Functions and clinical importance. - Albumin and globulins-acute phase proteins (CRP, ceruloplasmin, AAT, Immunoglobulins). Genetic deficiencies and disorders
- Electrophoretic separation of plasma proteins. Electrophoretic patterns. Reference intervals and interpretation

IV. Fat soluble vitamins: A, D, E and K

- Chemistry, Sources, RDA, absorption, functions, deficiency and or toxicity.
- Antivitamins

V. Metabolism of Carbohydrates

- HMP pathway, Uronic acid pathway, Metabolism of galactose and fructose
- Disorders

VI. Lipid metabolism

- Digestion and absorption of lipids, β -oxidation of fatty acids-pathway and energetics (palmitic acid). Formation of Ketone bodies
- Cholesterol Pool: Body cholesterol and cellular. Excretion of cholesterol.
- Classification of lipoproteins based on separation and electrophoretic mobility. Metabolism. Frederickson's classification of hyperlipoproteinemias.
- Lipid profile. Coronary Artery Disease

VII. Molecular genetics

Protein biosynthesis-eukaryotic

- Semiconservative DNA replication, Transcription and Translation, Mutations and cancer.

VIII. Tumour markers

- Definition, classification and clinical applications
- Over view of specific tumour markers-AFP, CEA, CA- 125, PSA, hCG, ALP

IX. Acid-base balance

- Regulation of pH
- Disorders
- Blood gases- symbols, reference intervals for arterial blood gases. Procedure for obtaining arterial blood sample. Pre-analytical variables.

X. Liver

- Role of liver in metabolism, functions of liver. Liver enzymes
- Formation of Bilirubin
- Jaundice
- Panel for Liver function in Clinical laboratory

XI. Pancreatic function tests:

- Functions of pancreas, composition of pancreatic juice.
- Clinical utility of enzyme determinations in pancreatitis.

XII. Thyroid function tests

- Overview of function of thyroid hormones.
- Clinical utility and methods for the measurement of circulating thyroid hormones.

XIII. Cardiac markers- Chemistry and overview of cardiac markers. Diagnostic and prognostic use of cardiac markers. Laboratory evaluation

XIV. Techniques- Principle, instrumentation and application

- Flame photometry
- Atomic Absorption Spectrophotometry
- Ion Selective Electrodes
- Agarose gel electrophoresis for separation of plasma proteins
- Immunochemical assays—RIA, ELISA, Chemiluminiscence

XV. Calculi

- Renal and gall. Theory of formation and analysis.

XVI. Mineral metabolism and clinical conditions

- Metabolism of Calcium, Phosphorus and Iron.
- Serum and urine electrolytes-Sodium, Potassium and chloride

XVII. Nutrition

- Nutrition and energy supply
- Utilization of energy in man
- Nutritional importance of carbohydrates, lipids, proteins, vitamins and minerals
- RDA, Balanced diet, fiber in nutrition
- Nutritional disorders

XVIII. Detoxification and biotransformation of xenobiotics

ASSIGNMENT TOPICS:

- Laboratory design
- Preparation of in-house quality control serum. Establishing mean and cutoff limits
- Point-of-Care-Testing

PRACTICAL SYLLABUS

I. QUALITATIVE

- Qualitative tests of lipids, tests for unsaturation, qualitative tests for glycerol and cholesterol.
- Renal calculi
- Gall stones

II. QUANTITATIVE

Basic approach : Concepts of preparation of buffered substrate, use of control serum in enzymatic estimations, enzyme calculations

Quantitative estimation by manual methods- Preparation of calibration curve & estimation of unknown analyte concentration.

- Total protein by Biuret method
- Albumin by Bromo Cresol Green method, Calculation of A/G ratio
- Total and conjugated Bilirubin by Malloy and Evelyn method
- Aspartate Transaminase (AST) and Alanine Transaminase (ALT) by Bergmeyer
- Alkaline phosphatase (ALP) by Kind and King method using 4-aminoantipyrine.
- Pancreatic amylase by Somogyi method
- Calcium in serum and urine by o-cresolphthalein complexone method and Phosphate in serum and urine by Fisk & Subbarow method. (Care and cleaning of tubes before and after the analysis)
- Serum Chloride by method of Schales and Schales.

III. PRACTICAL DEMONSTRATION

- Osazones of Galactose, Lactose and Fructose.
- Electrolyte and Arterial Blood Gas measurements
- Agarose gel electrophoresis for Serum proteins
- Automated analyzer
- Semi automated or automated method for following analytes.
 - a. Lipid profile – Cholesterol, HDL, LDL, Triglycerides
 - b. T3, T4, TSH
 - c. Troponin T or I, CK, CK-MB

IV. CASE REPORTS

- Inborn errors of Galactose, Pentose and Fructose
- Multiple myeloma, polyclonal gammopathy
- OGTT curves
- Jaundice – different types
- Electrophoretograms; normal and abnormal
- Thyroid disorders
- Cardiac markers
- Lipid disorders
- Tumour markers

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20
 Practicals: record and lab work 20

SCHEME OF EXAMINATION -THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry III shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Long essay	3 (attempt 2)	2 x 10	20
Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Biochemistry III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Quantitative estimation	30
Renal Calculi	20
Urine examination	20
Case Reports	10
Total	80

Split up fo marks for experiments:

Qualitative:

Carrying out color reactions of the given solution + Bench viva

II yr B.Sc.,	8 mks + 2 mks
III yr B.Sc.,	15 mks + 5 mks

Quantitative:

a. Writing principle & procedure before conducting the experiment

II yr B.Sc.,	3 mks
III yr B.Sc.,	5 mks

b. Standardisation of expt & determining unknown concentration+ Bench viva

II yr B.Sc.,	25mks + 2 mks
III yr B.Sc.,	40 mks + 5 mks

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

Course Title: Microbiology-III

Course Code: BMLT302

MICROBIOLOGY III
(Immunology, Virology and Mycology)

THEORY: 100 HOURS
PRACTICALS: 80 HOURS

I. IMMUNOLOGY

1. Infection 2 hrs

2. Immunity 4 hrs

- Innate immunity
- Acquired immunity (adaptive immunity)
- Active and passive immunity

3. Immune system

- Cell development
- B lymphocytes(general knowledge of their role)
- T lymphocytes
- Natural killer cells

4. Immune responses

- Humoral Immunity, Cell mediated immunity
- Antigen & Antibody
- Primary and secondary responses
- Theories of antibody productions
- Monoclonal Antibodies (production and applications)

5. Antigens

6. Antibodies

- Properties of Antibodies (immunoglobulins)
- Classes of immunoglobulins

7. Antigen-antibody reactions

Precipitation, Agglutination, ELISA, Immunofluorescence and miscellaneous tests.

8. Complement system

9. Hypersensitivity reactions

Immediate and delayed type

10. Autoimmunity

11. Transplantation and malignancy immunity

12. Immunodeficiency diseases

II. Virology

- General properties of virus, cultivation of viruses
- Pox viruses, Herpes viruses, Adenoviruses
- Picornaviruses, Orthomyxoviruses,
- Paramyxoviruses, Arboviruses, Rhabdoviruses
- Hepatitis viruses, Oncogenic viruses, HIV, Parvovirus

- Viral haemorrhagic fevers, SARS, Slow viruses
- Rotavirus, Norwalk virus, Astrovirus, Corona virus

iii. Mycology

1. Introduction of Mycology, Classification
2. Lab Diagnosis of Fungal Infections
3. Mycoses
 - a. Superficial Mycoses
Malsezzia furfur, T. nigra, T. pidera
 - b. Dermatophytes
 - c. Subcutaneous Mycoses
Mycetoma, Rhinosporidium, Sporotrichosis, Chromomycosis
 - d. Systemic Mycoses
Histoplasmosis, Blastomycosis, Coccidioidosis, Paracoccidiosis
 - e. Opportunistic fungi
Aspergillosis, Penicillosis, Zygomycosis, Pneumocystis
 - f. Candida, Cryptococcus
3. Mycotoxins and antifungal agents.

Practicals

1. Immunology: Serological tests
Principle, procedure, normal values, significant titer, interpretation and limitation of the following tests
WIDAL, Brucella
VDRL, RPR
ASO, CRP, RF
ELISA for HbsAg, HIV
2. Virology
Demonstration of embryonated egg inoculation/ animals/inclusion bodies
Virology exercise
ELISA (HIV, HBV)
Western blot
Spot test (tridot/immuno comb test)
3. Mycology
Slide culture techniques
KOH mount
Identification of fungal culture
Macroscopic and microscopic examination of candida, Cryptococcus, Dermatophytes, aspergillus, rhizopus, mucor, penicillium

204

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work	20

SCHEME OF EXAMINATION -THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology III shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Long essay	3 (attempt 2)	2 x 10	20
Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Microbiology III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Virology exercise	10
Mycology 2 exercise	15
Serology(Widal/ Brucella)	15
Serology (ASO/ CRP RPR/ RF)	10
Spotters	20
Record	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

Course Title: Pathology-III

Course Code: BMLT303

BSC MLT (Third year) –THEORY

Hematology---25 hrs

- 1) Leukemias- general concept and types of leukemias.
- 2) FAB and WHO classification of acute leukemias.
- 3) Cytochemistry in acute leukemias.
- 4) CML-pathogenesis and laboratory approach. Differentiation of CML from Leukemoid reaction.
- 5) Multiple myeloma- pathogenesis and lab.approach.
- 6) Immunophenotyping-principle, technique and its application with special reference to acute leukemias.
- 7) HPLC and Electrophoresis-Principle, technique and their applications.

Histopathology—15 hrs

- 1) Special stains for staining of carbohydrates, Connective tissue, nervous tissue, collagen fibres, Elastic fibres, Reticulin lipids, bacteria, fungi, Extracellular and intracellular material with special reference to melanin.
- 2) Electron Microscopy-Principle, maintenance of electron microscope.
- 3) Museum techniques:
 - a. Reception of specimens for mounting.
 - b. Mountants –various types of mountants and techniques used in mounting of specimens.
 - c. Microphotography and its applications.
 - d. Maintenance of records and filing of slides.

Cytology---20 hrs

- 1) Normal cell structure and function.
- 2) Types of specimens, methods of collection and preparation of cell block.
- 3) Different fixatives and methods of fixation of cytological smears.
- 4) Different stains used for staining cytological smears:
 - a) May Grunward Giemsa
 - b) Shorr's stain
 - c) Aceto-orcin stain

- d) PAS
- e) Papanicolaou's stain
- 5) Sex Chromatin-Preparation of buccal smear, sex chromatin from buccal smears and blood films.
- 6) Collection of nipple discharge and female genital tract specimens for routine staining.
- 7) FNAC-Principle and Procedure.
- 8) Cytological criteria of malignancy.
- 9) Cervical cytology---Normal cervical epithelium
- 10) Morphology of cells in cervical smears(normal, infections and neoplastic)..

Immunohistory chemistry and immunocytochemistry: ----20 hrs

- 1) Introduction to IHC
- 2) Reagents and equipments used in IHC.
- 3) Ideal fixative for IHC and their preparation.
- 4) Principle and methods of IHC with special reference to antigen retrieval.
- 5) Processing of paraffin and frozen sections for IHC.
- 6) Immunocytochemistry-Processing of cytological preparation for Immunocytochemistry.
- 7) Quality control in IHC.

Molecular Pathology and Cytogenetics.----20 hrs

- 1) Introduction to cytogenetics.
- 2) Classification and nomenclature of human chromosomes as per international nomenclature.
- 3) Methods of karyotypic analysis.
- 4) Characterization of human chromosomes by various banding techniques with special reference to haematological malignancies.
- 5) Culture of bone marrow cells and peripheral blood lymphocytes
- 6) Principle of molecular techniques and their applications:
 - a) PCR
 - b) ISH
 - c) FISH
 - d) BLOTS
 - e) Microarray
- 7). Cell culture and its application.

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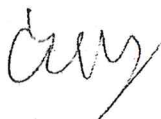
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MSM

BSC MLT 3rd year- Practical 80 hrs

- 1) Identification of cells in normal bone marrow.
- 2) Special stains in acute leukemias:
 - i. MPO
 - ii. SBB
 - iii. PAS
 - iv. NSE
 - v. CAE
- 3) PBF in Chronic Myeloid Leukemia
- 4) Special stains in histopathology for demonstration of:
 - i. Carbohydrates
 - ii. Connective Tissue
 - iii. Nervous tissue
 - iv. Collagen
 - v. Elastic fibres
 - vi. Lipids
 - vii. Amyloid
 - viii. Bacteria and fungi
 - ix. Intracellular and extracellular pigment (Melanin, hemozoin and hemosiderin)
- 5) Stains used in cytology:
 - i. MGG
 - ii. Shorr's stain
 - iii. PAP
 - iv. PAS
 - v. Aceto-orcin stain
- 6) Demonstration of PCR, HPLC, Electrophoresis, LBC and Flowcytometry.



Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Pathology III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Pap stain	20
Blood grouping and typing	10
Cross matching	15
Coomb's test	15
Spotters	10
Record	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

Course Title: Medical Ethics (Subsidiary Subject)

Course Code: BMLT304

Professionalism and medical ethics-----3rd year

1. Introduction to professionalism and ethics.
2. Value and dignity of human life.
3. Principles of medical ethics.
4. Introduction to communication ,skills for interacting with colleagues, clinicians, patients and their attendants.
5. Relationship of paramedics and patient.
6. How to communicate diagnostic results and Confidentiality.
7. Negligence, malpractice, legal implications and law suits in medical practice.
8. Consumer protection and insurance for professional health hazard.
9. Time management.
- 10.Stress management.
- 11.Leadership qualities and team work in health care professional.

(Signature)
7/2/22