

# **VIDYASAGAR UNIVERSITY**

**Midnapore, West Bengal**



***PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF***

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## **BACHELOR OF MEDICAL LABORATORY TECHNOLOGY -BMLT (HONOURS)**

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**4-YEAR UNDERGRADUATE PROGRAMME**

***(w.e.f. Academic Year 2023-2024)***

*Based on*

**Curriculum & Credit Framework for Undergraduate Programmes  
(CCFUP), 2023 & NEP, 2020**

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**VIDYASAGAR UNIVERSITY, PASCHIM MIDNAPORE, WEST BENGAL**

**VIDYASAGAR UNIVERSITY**  
**BACHELOR OF MEDICAL LABORATORY TECHNOLOGY -BMLT (HONOURS)**  
**(under CCFUP, 2023)**

| Level             | YR.             | SEM | Course Type             | Course Code | Course Title   | Credit | L-T-P     | Marks |     |            |
|-------------------|-----------------|-----|-------------------------|-------------|--|--------|-----------|-------|-----|------------|
|                   |                 |     |                         |             |  |        |           | CA    | ESE | TOTAL      |
| <b>SEMESTER-V</b> |                 |     |                         |             |  |        |           |       |     |            |
| BMLT<br>(Hons.)   | 3 <sup>rd</sup> | V   | Major-8                 | BMLTHMJ08   | T: Mycology and Virology; P: Practical                                     | 4      | 3-0-1     | 15    | 60  | 75         |
|                   |                 |     | Major-9                 | BMLTHMJ09   | T: Clinical Pathology-2 (Advanced urine and stool pathology); P: Practical | 4      | 3-0-1     | 15    | 60  | 75         |
|                   |                 |     | Major-10                | BMLTHMJ10   | T: Clinical Biochemistry -2; P: Practical                                  | 4      | 3-0-1     | 15    | 60  | 75         |
|                   |                 |     | Major Elective-01       | BMLTHDSE1   | T: Forensic Diagnosis/ Pharmacology and Toxicology                         | 4      | 3-1-0     | 15    | 60  | 75         |
|                   |                 |     | Minor-5                 | BMLTMIN05   | T: Molecular Biology; P: Practical   | 4      | 3-0-1     | 15    | 60  | 75         |
|                   |                 |     | <b>Semester-V Total</b> |             |  |        | <b>20</b> |       |     | <b>375</b> |

MJ = Major, MI = Minor Course, DSE = Discipline Specific Elective Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

## SEMESTER-V

### MAJOR (M.J)

#### **MJ-8: Mycology and Virology**

**Credits 04(FM: 75)**

**Course objective:** To explore the study of fungi and viruses, focusing on their identification, pathogenic mechanisms and diagnostic approaches for related infections..

**Course outcome:** Students will acquire expertise in the classification, pathogenic mechanisms, and diagnostic techniques for both fungal and viral infections.

#### **MJ-8T: Mycology and Virology (Theory)**

**Credits 03**

#### **Course content:**

##### **Mycology**

1. Medically important fungi, thermal dimorphism, the WHO fungal priority pathogen list
2. An outline of the following infectious fungi and their mode of transmission, sign and symptoms, laboratory diagnosis, prevention and treatment: (a) *Histoplasma* spp., (b) *Blastomyces* spp., (c) *Mucor* spp., (d) *Coccidioides* spp., (e) *Penicillium marneffei*, and (f) Dermatophytes.
2. Antifungal susceptibility testing, mode of action of the following antifungal drugs: Amphotericin B, ketoconazole, fluconazole, caspofungin, and flucytosine.

##### **Virology**

1. General structure of viruses, cultivation of viruses, basic concept of lytic and lysogenic life cycles, the WHO's viral priority pathogen list. mode of action of common antivirals
2. An outline of the following medically important viruses and their mode of transmission, sign and symptoms, laboratory diagnosis, prevention and treatment: (a) hepatitis B and C viruses, (b) herpes simplex virus 1 and 2, (c) varicella-zoster viruses, (d) human papillomavirus, (e) poliovirus, (f) rubella virus, (g) rotavirus, (h) chikungunya virus, (i) dengue fever virus, (j) influenza A and B viruses, (k)SARS virus, and (l) HIV 1 and 2.
3. Mode of action of the following antiviral agents: Amantadine, acyclovir, ritonavir, oseltamivir, and lamivudine.

#### **Suggested Readings**

1. Ananthanarayan and Panikar's Textbook of Microbiology, 13e, (2024), Universities Press (India) Pvt. Ltd., ISBN- 13-9789393330659.
2. **Bailey and Scott's Diagnostic Microbiology, 12th edition (2007)**, Betty A. Forbes, Daniel F. Sahm and Alice S. Weissfeld; Mosby Elsevier Publishers, ISBN-13: 978-0808923640.

**Practical contents:**

1. Fungal culture techniques, media preparation, and preservation
2. Collection of human skin scraping, hair plucking, nail clipping for fungal culture
3. Laboratory isolation and identification of *Candida*, *Aspergillus*, *Penicillium*, *Mucor*, and Dermatophytes
4. Identification of fungal structures by KOH preparation and lactophenol cotton blue stain
5. Sample collection techniques for viral infections in viral transport medium (VTM): Nasopharyngeal, oropharyngeal, throat, and rectal swabs
6. Rapid diagnostic tests of viral infections directly from clinical specimens: HIV TRI-DOT, Triple H test, Combo test for viral gastroenteritis (rota, adeno, noro, and astrovirus). Combo test for COVID-19/Influenza A+B.
7. Demonstration on virus culture by plaque assay

**Suggested Readings**

1. Mackie & Mccartney Practical Medical Microbiology. 14e, (2006), J.G. Collee, A.G. Fraser, B.P. Marmion, A. Simmons; Elsevier, ISBN-9788131203934
2. Practical Medical Microbiology (2008), R. Panjarathinam; Jaypee Brothers Medical Publishers, ISBN- 13-9788184486988.

**MJ-9: Clinical Pathology-2 (Advanced urine and stool pathology)      Credits 04(FM: 75)**

**Course objective:** To enhance students' knowledge and skills in the advanced analysis of urine and stool samples for diagnosing various diseases and disorders.

**Course Outcome:** The Clinical Pathology course prepares students to accurately diagnose and interpret laboratory results for various diseases, enhancing their clinical decision-making and patient care skills.

**MJ-9T: Clinical Pathology-2 (Advanced urine and stool pathology) (Theory)      Credits 03****Course content:**

1. Renal function: enuresis, creatinine clearance test, free water clearance, GFR, nocturia, oliguria, osmolality, osmolar clearance, polyuria, polydipsia, renal blood flow, renal clearance, measurement of solute composition, osmolality, assessment of renal concentrating ability, osmolality vs specific gravity. Measurement of specific gravity by advance technique. Screening for albuminuria, myoglobinuria. Oral ammonium chloride test, clinical significance of urinary pH and its assessment.
2. Clinical significance of leukocyte esterase and its determination.
3. Proteinuria: nephrotic syndrome and its type, overflow proteinuria, post renal proteinuria, orthostatic proteinuria, pyuria, renal proteinuria, tubular proteinuria. Bence Jones protein in urine and its estimation. Microalbuminuria and its detection.
4. The description of crystals due to medications and its metabolites: ampicillin, sulfonamides, radiographic contrast media generated urinary crystal after X-ray.
5. Miscellaneous formed elements: mucus threads bacteria, yeast, fat, spermatozoa. Vaginal contaminants in urine sample.
6. Fecal contaminant in urine sample.
7. Fecal Fat - Significance and assessment.
8. Parasites of stools: *Trichomonus vaginalis*, *Enterobius vermicularis* (pinworm) intestinal ova and parasites. Concentration procedures of fecal materials for O&P exam.
9. Stool culture process and analysis for detection of pathogens.
10. Stool analysis for gastrointestinal infections (diarrhea, dysentery) and gastrointestinal disorders (malabsorption syndromes, GI bleeding, inflammatory bowel diseases, and colorectal cancer screening).

**MJ-9P: Clinical Pathology-2 (Advanced urine and stool pathology) (Practical)      Credits 01**

1. Specific gravity measurement of urine by urinometer and refractometer (for extremely small volume of sample).
2. Diazo tab test.
3. Classic Ehrlich's reaction for urobilinogen screening
4. Bilirubin, urobilinogen, porphobilinogen detection in urine.
5. Preparation of and identification of specific components in urinary sediments by following staining techniques: Supra vital stain, acetic stain, fat or lipid stain, prussian blue reaction, hans stain

6. Identification of casts, crystals and other microscopic components under microscope.
7. Use of urine microscopy atlas, readily made fixed slide to compare above microscopic identification.
8. Bence Jones protein in urine and its estimation.
9. Microalbuminuria and its detection.
10. Renal clearance, measurement of solute composition.
11. Fecal fat analysis using Sudan III staining.
12. Fecal material concentration technique, sedimentation and flotation technique.
13. Permanent stained smear of intestinal protozoa.
14. Cellophane Tape collection method of pinworm.

**MJ-10: Clinical Biochemistry (Advanced)****Credits 04(FM: 75)**

**Course objective:** To provide students with a comprehensive understanding of biochemical principles and techniques used to diagnose and monitor various clinical conditions and metabolic disorders.

**Course Outcome:** This syllabus provides a comprehensive understanding of advanced concepts in clinical biochemistry, emphasizing laboratory skills and clinical applications to enhance patient care and diagnostic accuracy.

**MJ-10T: Clinical Biochemistry (Advanced) -Theory****Credits 03****Course content:**

1. Isoform of clinically important enzymes.
2. Disorders of lipid metabolism: Hyperlipidemia, atherosclerosis, NAFLD, NASH, alcoholic fatty liver disease.
3. Diabetes types, Biochemical complications of diabetes (ketoacidosis, hyperglycemia- Significance of C-peptide, leptin, ghrelin, adiponectin and assessment).
4. Types of jaundice and Pathophysiology.
5. Significance of ceruloplasmin, Serum ferritin, transferrin, TIBC.
6. Inborn errors of metabolism (e.g., phenylketonuria, maple syrup urine disease).
7. Pulmonary Function Tests:
  - (a) Arterial blood gases interpretation in respiratory failure.
  - (b) Advanced tests for diffusion capacity for carbon monoxide.
8. D-Dimer Test: Clinical significance of the D-Dimer test in diagnosing thrombosis-related conditions (e.g., deep vein thrombosis, pulmonary embolism).

**MJ-10P: Clinical Biochemistry (Advanced) -Practical****Credits 01**

1. Insulin tolerance test.
2. TIBC, Ferritin, Transferrin
3. Cerruloplasmin
4. D-Dimer Test. Interpretation of D-Dimer results and their role in conditions such as disseminated intravascular coagulation (DIC).
5. Measurement of vitamin C, D, B12, folate in serum sample.

## **MAJOR ELECTIVE (DSE)**

### **Major Elective (MJ DSE) -1**

**(Forensic Diagnosis / Pharmacology and Toxicology)**

**Credits 04 (Full Marks: 75)**

#### **MJDSE-1T: Forensic Diagnosis (Theory)**

**Objective:** To provide students with fundamental knowledge of medico-legal aspects, forensic pathology, toxicology, and scientific methods used in crime and death investigations.

**Course Outcome:** The broad goal of teaching Forensic Medicine is to produce a medical professional who is well informed about medico-legal responsibilities in the practice of medicine. He / She will be capable of making accurate observations and drawing logical conclusions to assist in the investigation of criminal cases and medico-legal issues. The student will acquire sound knowledge of the law as it relates to medical practice, medical negligence, and ethical conduct, enabling him/her to act responsibly and uphold professional integrity in all medico-legal situations.

#### **Course contents:**

1. Medico-legal aspects of a disease, Essential forensic pathology, and clinical forensic medicine to include recognition and interpretation of wounds and other injuries. Medical and scientific investigation of fires.
2. Explosions and similar causes of non-natural deaths, Child deaths and child abuse; Investigation of sexual offenses.
3. Principles of forensic toxicology, Drugs and poisons including drugs of abuse and the related law; Alcohol – scientific and legal aspects, Forensic DNA, Basics of Forensic Odontology.
4. Basics of forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations.

**OR**

## **MJ DSE-1T: Pharmacology and Toxicology (Theory)**

### **Course Objective:**

To understand how drugs act, how the body handles drugs, and the basic principles of toxicology.

### **Course Outcome:**

The broad goal of teaching this course is to enable students to understand the fundamental principles of pharmacodynamics and pharmacokinetics. They will gain knowledge of drug-receptor interactions, mechanisms of drug action, and biotransformation processes. Students will also learn about toxins, dose-response relationships ( $LD_{50}$ ,  $ED_{50}$ , NOEL), safety factors, and the factors affecting toxicity. This knowledge will help them interpret and evaluate pharmacotoxic effects for safe and effective drug use in clinical practice.

### **Course contents:**

1. Pharmacodynamics & pharmacokinetics.
2. Bio-transformation of drug.
3. Drug receptor.
4. Concept of toxins & toxicology.
5. Basic idea about  $LD_{50}$ ,  $ED_{50}$ , safety factor, NOEL.
6. Factor affecting toxicity of toxins.
7. Pharmacotoxicity.

## **MINOR (MI)**

### **MI – 5: Molecular Biology**

**Credits 04(FM: 75)**

#### **Course Objective:**

To introduce students to molecular biology concepts focusing on gene structure, function, regulation and their role in health and disease.

**Course Outcome:** Students will understand molecular diagnostics and gain practical skills in techniques, preparing them for careers in research or further studies.

### **MI – 5T: Molecular Biology**

**Credits 03**

#### **Course contents:**

1. Structure, function and types of DNA and RNA.
2. Central dogma of molecular biology (Replication, Transcription, Post-transcription modification, and Translation).
3. DNA Repair Mechanism and its types
4. Basics of Genetic code- Codon library, Wobble Phenomenon.
5. Types of mutations: point mutations, insertions, deletions.
6. Basic steps of DNA and RNA extraction methods: Cell lysis, removal of cellular components, removal of contaminants, and nucleic acid recovery.
7. Nucleic acid amplification and detection: Conventional PCR, qRT-PCR,
8. Agarose gel electrophoresis and gel documentation
9. Blotting techniques in clinical applications: Southern blot and Northern blot.

#### **Suggested Readings:**

1. Fundamental Molecular Biology, Lizabeth A. Allison, 1e (2007), Blackwell Publishing, ISBN-13-9781405103794.
2. Techniques in molecular biology, 1e (2008), Suraksha Agarwal, International Book Distributing Co., ISBN- 978811891518.

### **MI – 5P: Molecular Biology (Practical)**

**Credits 01**

#### **Practical contents:**

1. Collection and preparation of human blood, stool, rectal swabs (only for demonstration), Oral ((buccal cavity) nasopharyngeal swabs, urine, and fresh/frozen tissue samples (on consenting volunteers) for nucleic acid extraction.
2. Extraction of DNA and/or RNA from the specified samples in Sl. No. 1.
3. Demonstration on conventional PCR and qRT-PCR reaction set-up and thermal cycle condition.
4. Preparation of agarose gel for electrophoresis and detection of nucleic acids by UV-transilluminator/Gel-Doc.
5. Demonstration on Southern blot and Northern blot techniques.

**Suggested Readings:**

1. Molecular biology techniques laboratory manual (2011), Shelley O' Grady, M.S., Linnea Fletcher, Patricia Phelps. Springer. ISBN-BITC2441F2011.
2. Techniques in molecular biology, 1e (2008), Suraksha Agarwal, International Book Distributing Co., ISBN- 978811891518.