PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PROGRAMME REGULATIONS & CURRICULUM

2025-29

PRESIDENCY SCHOOL OF ALLIED HEALTH SCIENCES

B.SC. IN MEDICAL LABORATORY TECHNOLOGY (MLT)

PRESIDENCY UNIVERSITY
Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi | Approved By BCI
Bengaluru

Presidency School of Allied Health Sciences

B.Sc. in Medical Laboratory Technology (MLT)

Program Regulations and Curriculum

Based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Program: B.Sc. IN Medical Laboratory Technology

B.Sc. MLT

2025-2029

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PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 ***Vision of the University***

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 ***Mission of the University***

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Allied Health Sciences

To be a value-based, practice-oriented school committed to producing globally competent Allied Health Professionals who contribute to excellence in patient care, education, and community well-being.

1.4 Mission of Presidency School of Allied Health Sciences

- Foster a dynamic learning environment that integrates theoretical knowledge with hands-on clinical practice.
- Attract and develop highly qualified faculty committed to excellence in teaching, research, and healthcare innovation.
- Establish state-of-the-art laboratories and clinical training facilities to enhance practical learning experiences.
- Encourage interdisciplinary collaboration to promote holistic patient care and inter-professional education.
- Instil leadership, ethical values, and a spirit of community service among students to meet global healthcare challenges.

1.5 ***Vision of Program B.Sc. in Medical Laboratory Technology (MLT)***

To be a value-based, practice-oriented center of excellence in Medical Laboratory Technology, dedicated to producing globally competent and innovative laboratory professionals who advance healthcare through accurate diagnostics, research, and technological innovation, while upholding the highest standards in patient care, education, and community well-being.

1.6 ***Mission of Program B.Sc. in Medical Laboratory Technology (MLT)***

- To provide high-quality education in Medical Laboratory Technology through a comprehensive and scientifically rigorous curriculum.
- To develop competent laboratory professionals with strong technical skills and ethical values.
- To emphasize hands-on training and practical exposure in modern diagnostic laboratories.
- To prepare graduates to contribute effectively to patient care, medical research, and public health.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations, and it is to be followed as a requirement for the award of B.Sc. in Medical Laboratory Technology (MLT). The curriculum for the Medical Laboratory Technology (MLT) program is designed in alignment with the Choice Based Credit System (CBCS), emphasizing practical and career-oriented learning. It incorporates Social Project-Based Learning, Industrial Training, and Clinical Internships to ensure that students gain real-world experience in surgical settings. This practice-driven approach equips graduates with the necessary skills and competencies to pursue successful careers in hospitals, surgical centres, and healthcare industries, as well as opportunities for higher studies or entrepreneurship in the healthcare sector.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Science in Medical Laboratory Technology Degree Program Regulations and Curriculum 2025-2029.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Bachelor of Science Medical Laboratory Technology Degree Programs of the 2025-2029 batch, and to all other Bachelor of Science in Medical Radiology & Imaging Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Science in Medical Laboratory Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2025-2026.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;

b. *"Academic Council" means the Academic Council of the University;*

c. *"Academic Regulations" means the Academic Regulations, of the University;*

d. *"Academic Term" means a Semester or Summer Term;*

e. *"Act" means the Presidency University Act, 2013;*

f. *"NCAHP" National Commission for Allied and Healthcare Professions*

g. *"Basket" means a group of courses bundled together based on the nature/type of the course;*

h. *"BOE" means the Board of Examinations of the University;*

i. *"BOG" means the Board of Governors of the University;*

j. *"BOM" means the Board of Management of the University;*

k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*

l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

n. *"COE" means the Controller of Examinations of the University;*

o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*

p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*

q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"Dean" means the Dean / Director of the concerned School;*

u. *"Degree Program" includes all Degree Programs;*

v. "Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;

w. "Discipline" means specialization or branch of B.Sc. Degree Program;

x. "HOD" means the Head of the concerned Department;

y. "L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;

z. "MOOC" means Massive Open Online Courses;

aa. "MOU" means the Memorandum of Understanding;

bb. National Program on Technology Enhanced Learning (NPTEL)

cc. "Parent Department" means the department that offers the Degree Program that a student undergoes;

dd. "Program Head" means the administrative head of a particular Degree Program/s;

ee. "Program Regulations" means the Bachelor of Science Degree Program Regulations and Curriculum, 2025-2029;

ff. "Program" means the Bachelor of Science (B.Sc.) Degree Program;

gg. "PSoAHS" means the Presidency School of Apllied Health Science;

hh. "Registrar" means the Registrar of the University;

ii. "School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;

jj. "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;

kk. "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;

ll. "Statutes" means the Statutes of Presidency University;

mm. "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;

nn. "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;

oo. "SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.

pp. "UGC" means University Grant Commission;

qq. "University" means Presidency University, Bengaluru; and

rr. "Vice Chancellor" means the Vice Chancellor of the University.

5. Program Description

The Bachelor of Science (MLT) Degree Program Regulations and Curriculum 2025-2029 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Science (B.Sc.) Degree Programs of 2025-2029 offered by the Presidency School of Allied Health Sciences (PSoAHS):

1. Bachelor of Science in Anaesthesia and Operation Theatre Technology (AOTT)
2. Bachelor of Science in Medical Laboratory Technology (MLT)
3. Bachelor of Science in Cardiac Care Technology (CCT)
4. Bachelor of Science in Respiratory Care Technology (RCT)
5. Bachelor of Science in Medical Radiology and Imaging Technology (MRIT)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations.

6. Minimum and Maximum Duration

6.1 Bachelor of Science Medical Laboratory Technology (B.Sc. MLT)

The Bachelor of Science (Medical Laboratory Technology) Degree Program is a Four-Year, Full-Time, Semester-Based Program. The minimum duration of the program is four (04) years, comprising eight (08) semesters—each academic year consisting of two semesters (Odd and Even).

The academic structure includes:

- Theory Classes: 3808 Hours
- Practical Classes: 720 Hours
- Internship: 1440 Hours
- Total Hours: 5968 Hours

6.2 A student who, for any reason, is unable to complete the program within the prescribed minimum duration may be granted an additional two (02) years beyond the normal period to fulfill the mandatory minimum credit requirements.

In general, the maximum allowable duration for completion of the program is defined as 'N + 2' years, where 'N' denotes the normal duration (i.e., 4 years). Therefore, the maximum duration to complete the B.Sc. MLT program is 6 years.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause 16.1 of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7. Program Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be:

PEO No.	Program Educational Objectives (PEO)
PEO1	**Professional Competence: Professional Competence:** Graduates will demonstrate comprehensive knowledge and practical skills relevant to allied healthcare professions, enabling them to function effectively in diverse clinical settings.
PEO2	**Ethical and Responsible Practice:** Graduates will uphold professional ethics, ensure accuracy and reliability in laboratory reporting, and maintain patient confidentiality and safety in all diagnostic services.
PEO3	**Teamwork and Leadership:** Graduates will collaborate efficiently within multidisciplinary healthcare teams and exhibit leadership capabilities in laboratory operations and quality management.
PEO4	**Lifelong Learning and Career Advancement:** Graduates will engage in continuous learning, pursue higher education and certifications, and stay current with advancements in laboratory medicine and biomedical technology.
PEO5	**Research and Innovation:** Graduates will contribute to clinical research and the advancement of diagnostic science through innovative practices and application of evidence-based methodologies.

8. Program Outcomes (PO) and Program Specific Outcomes (PSO)

8.1 Program Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO No.	Program Outcomes (PO)
PO1	**Disciplinary Knowledge**: - Apply core knowledge of clinical laboratory sciences including hematology, microbiology, biochemistry, pathology, and immunology to support accurate diagnosis and patient care.
PO2	**Critical Thinking**: - Analyze laboratory results, identify discrepancies, and make informed decisions in test interpretations to ensure accurate and reliable patient outcomes.
PO3	**Effective Communication**: - Communicate effectively with healthcare professionals and patients to ensure clear reporting of lab results and laboratory procedures..
PO4	**Social Interaction**: Collaborate with pathologists, clinicians, and fellow lab professionals while demonstrating empathy, respect, and professionalism in all healthcare settings.
PO5	**Effective Citizenship**: - Contribute to the public healthcare system by understanding the responsibilities of a medical laboratory technologist in disease prevention, diagnosis, and health promotion.
PO6	**Ethics**: - Uphold professional and ethical standards in laboratory practices, ensuring patient confidentiality, data integrity, and accurate reporting.
PO7	**Environmental and Sustainability:** - Implement safe and eco-friendly biomedical waste disposal and laboratory practices to reduce environmental impact and support sustainability in healthcare.
PO8	**Self-Directed and Lifelong Learning**: - Engage in continuous learning and professional development to stay updated with advances in laboratory techniques, equipment, and quality assurance standards.
PO9	**Research-Related Skills**: - Conduct or assist in basic clinical laboratory research, applying findings to improve testing methods, disease diagnostics, and healthcare outcomes.
PO10	**Scientific Interpretation**: - Interpret scientific data and laboratory results using evidence-based practices to support clinical diagnoses and treatment decisions.
PO11	**Information and Digital Literacy**: - Utilize laboratory information systems (LIS), digital databases, and diagnostic software effectively to manage patient records, automate testing, and enhance workflow efficiency.

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO No.	Program Specific Outcome
PSO1	**Clinical Laboratory Practices:** Apply theoretical knowledge and technical skills to perform accurate and reliable diagnostic tests in areas such as hematology, microbiology, clinical biochemistry, immunology, and transfusion science.
PSO2	**Instrumentation and Quality Control:** Operate, maintain, and troubleshoot laboratory instruments such as biochemistry analyzers, hematology counters, microscopes, and centrifuges; ensure regular calibration and internal quality control (IQC); and accurately manage laboratory reagents and samples to maintain reliability and safety in diagnostic testing.
PSO3	**Specimen Handling and Reporting:-** Collect, label, transport, and process clinical specimens following standard biosafety protocols; ensure accurate documentation and timely reporting of laboratory results; and assist in urgent diagnostic testing to support critical care, emergency, and inpatient units effectively.
PSO4	**Documentation and Laboratory Safety:** Maintain accurate patient and procedural documentation while strictly adhering to infection control, biomedical waste disposal, and patient safety guidelines.

9. Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender, or nationality. All admissions shall be made based on merit in the qualifying examinations and an entrance examination conducted by the University. The admission criteria for the B.Sc. in Medical Laboratory Technology program are listed in the following sub-clauses:

9.1 An applicant who has passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian University or a duly constituted Board with Physics, Chemistry, and Biology (mandatory) or vocational course in MLS/MLT.

The candidate should have passed an individual subject and must have obtained at least 50% marks (45% in case of candidates belonging to SC/ST category) in the above subjects taken together.

9.2 Candidates who have studied abroad and have passed the equivalent qualification, as determined by the Association of Indian Universities, must have passed Physics, Chemistry, and Biology (mandatory) and Mathematics (optional) up to the 12th standard level.

9.3 Foreign Nationals (FN), Persons of Indian Origin (PIO), and Children of Indian

Workers in Gulf Countries (CIWGC) must have completed qualifying examinations considered equivalent by the Association of Indian Universities/Academic Council to be eligible for admission.

9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.6 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.7 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.8 The decision of the BOM regarding the admissions is final and binding.

10.Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Sc. in Medical Laboratory Technology degree program as per the provisions and/or regulations of the Government and the Ministry of Health and Family Welfare (MoFHW) pertaining to the "Lateral Entry" scheme. The general conditions and rules governing the provision of Lateral Entry to the B.Sc. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to the 2nd year (3rd Semester) of the B.Sc. Degree program shall be open to candidates who have completed a minimum of two (02) years full-time Diploma in Medical Laboratory Technology from a Government-recognized body and who have secured a pass in the qualifying diploma examination.

10.1.2 Provided that, such candidates must also have completed the Higher Secondary (10+2) or equivalent examination with Physics, Chemistry, and Biology as subjects.

10.1.3 Lateral Entry shall be permissible only if the subject studied at the Diploma level is the same as the one in which the admission is sought.

10.1.4 The number of students to be admitted under the Lateral Entry scheme shall not exceed twenty percent (20%) of the total annual intake for the B.Sc. Program.

10.1.5 Eligibility of candidates for Lateral Entry shall be based on performance in the

qualifying diploma examination and the entrance examination conducted or approved by the NCAHP, as applicable.

10.1.6 Candidates admitted under the Lateral Entry scheme must adhere to all program-specific rules and regulations applicable from the 3rd semester onwards, including curriculum structure and credit requirements.

10.1.7 Foreign Nationals and candidates qualified from foreign Universities/Boards must obtain equivalence certification from the NCAHP Commission prior to admission, confirming their qualification is equivalent to the Indian diploma standards.

10.1.8 All existing University regulations, including any bridge courses prescribed by the University for Knowledge Alignment, shall be binding on students admitted through the Lateral Entry scheme. Such bridge courses, if prescribed, will not be included in CGPA calculations.

10.1.9 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned Program shall be waived for the student(s) admitted to the concerned Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Sc. Degree in the concerned Program shall be prescribed / calculated as follows:

The *Minimum Credit Requirements* for the award of the Bachelor of Science (B.Sc.) Degree prescribed by the concerned Bachelor of Science Degree Program Regulations and Curriculum, 2025-2029, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Sc. Program. For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Science (B.Sc.) Degree as prescribed by the Regulations for B.Sc. (Medical Laboratory Technology) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Sc. in Medical Laboratory Technology for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.10. Further, no other waiver except the Courses prescribed for the 1st year of the B.Sc. Program of the University shall be permissible for students joining the B.Sc. Program through the provision of Lateral Entry.

10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B. Sc. Program of the University.\

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Sc., Three /Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the B.Sc. Program of the University as per the rules and guidelines

prescribed in the following Sub-Clauses:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1,10.1.2 and 10.1.3.

10.2.2 The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Sc. Program commencing on August 1 on the year concerned.

10.2.3 The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Sc. Three/Four-year Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Sc. Program of the University.

10.2.5 The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

11. Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

11.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

11.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of Academic regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

11.3 Format of the End-Term examination shall be specified in the Course Plan.

11.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)

- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic regulations) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

11.5 Assessment Components and Weightage

Nature of Course and Structure	Evaluation Component	Weightage	Minimum Performance Criteria
Lecture-based Course *L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)*	Continuous Internal Evaluation (CIE) (a) 50% of CIE from two notified formative written tests (b) 50% of CIE from internal assessments such as seminars, journal club presentations, case presentations, assignments, etc.	30% (CIE Total)	40% (in CIE to be eligible for ESE)
	End Semester Examination (ESE) University-conducted Theory exam with specified pattern, type, and weightage as per curriculum	70%	30% (in ESE)
Lab/Practice-based Course *P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.)*	Continuous Internal Evaluation (CIE) Laboratory work including records, performance, attendance, project reports, etc. along with two formative tests and internal assessments (seminars, case-based assessments)	30% (CIE Total)	40% (in CIE to be eligible for ESE)

	End Semester Examination (ESE) Practical exam: Spotters, equipment demonstration, case-based discussion, etc.	70%	30% (in ESE)
Skill-based Courses *Industry Internship, Capstone Project, Dissertation, Summer/Short Internship, Field Projects, Portfolio, etc., with non-L-T-P pedagogy*	Guidelines for the assessment components and recommended weightages will be specified in the concerned Program Regulations and Course Plans	As specified (typically 40%)	As per Program Regulations

The exact weightages of Evaluation Components shall be clearly specified in the respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

11.6 Minimum Performance Criteria:

11.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

11.6.2 The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

11.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is

scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Sub-Clause 8.9.1 and 8.9.2 of Academic regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

12. Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

12.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of Academic regulations) and approved by the Dean - Academics.

12.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

12.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

12.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause17.3(as per Academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective

Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

12.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 17.3 (as per Academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

12.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

12.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

12.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 12.3.2 above.

12.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

12.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall be forwarded to the COE for processing of results of the concerned Academic Term.

12.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11. in the Academic regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

12.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

12.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

12.3.11 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13.0), shall not be included in the calculation of the CGPA.

13 Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The B. Sc. in Medical Laboratory Technology (MLT) Program Structure (2025-2029) totalling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: B. Sc. in Medical Laboratory Technology (MLT) Summary of Minimum Credit Contribution from various Baskets

Sl. No.	Baskets/Category	Credit Contribution
1	Core Courses (CC)	82
2	Ability Enhancement Compulsory Course (AECC)	7
3	Discipline Specific Elective (DSE)	27
4	Research Project (PWR)	6
5	Skill Enhancement (SEC)	4
6	Internship (INT)	52
7	Value Added Course (VAC)	5
	Total Credits	**183**

14. Minimum Total Credit Requirements of Award of Degree

The minimum total credit requirements for the Award of Degree shall be as per the guidelines of NCAHP/MoFHW.

15. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University.

15.1 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

15.2 Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

15.3 Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause 19.2.1 of Academic Regulations;

15.4 No dues to the Univrsity, Departments, Hostels, Library, and any other such Centres/ Departments of the University; and

15.5 No disciplinary action is pending against her/him.

16.Curriculum Structure – Basket Wise Course List:

List here all the courses Basket/Category wise as per the Credit Distribution shown in the Table 3.

Table 3.1 Core Course (CC)

S. No	Course code	Course Name	L	T	P	C
1	BMLT001	Introduction to Healthcare Delivery System in India	4	0	0	4
2	BMLT002	Medical Terminology & Record Keeping	2	1	0	3
3	BMLT003	Anatomy	4	0	2	5
4	BMLT004	Physiology	4	0	2	5
5	BMLT007	General Clinical Microbiology	3	0	4	5
6	BMLT008	Basic Haematology	3	0	4	5
7	BMLT009	Systematic Bacteriology	3	0	4	5

8	BMLT010	Basics of Medical Laboratory Technology	3	0	4	5
9	BMLT011	Biochemical metabolism	3	0	4	5
10	BMLT012	Applied Haematology	3	0	4	5
11	BMLT014	Applied Bacteriology	3	0	4	5
12	BMLT015	Clinical Pathology	3	0	4	5
13	BMLT016	Diagnostic Biochemistry	3	0	4	5
14	BMLT017	Clinical Mycology	3	0	4	5
15	BMLT018	Immunology & Bacterial Serology	3	0	4	5
16	BMLT019	Cytopathology	3	0	4	5
17	BMLT020	Applied Clinical Biochemistry	3	0	4	5
Total No. of Credits						**82**

Table 3.2 Ability Enhancement Compulsory Course (AECC)

S. No	Course code	Course Name	L	T	P	C
1	BMLT006	Medical Law & Ethics, Principles of Management	4	0	0	4
2	AHP109	Communication Skills	3	0	0	3
Total No. of Credits						**7**

Table 3.3 Discipline Specific Elective (DSE)

S. No	Course code	Course Name	L	T	P	C
1	BMLT021	Medical Parasitology & Entomology	3	0	4	5
2	BMLT022	Clinical Virology	3	0	4	5
3	BMLT023	Histopathology	3	0	4	5

4	BMLT024	Applied Pathology	3	0	2	4
5	BMLT025	Blood Banking & Genetics	3	0	2	4
6	BMLT026	Immunopathology & Molecular Biology	3	0	2	4
					Total No. of Credits	28

Table 3.4 Research Project (PWR)

S. No	Course code	Course Name	L	T	P	C
1	BMLT015	Industrial Orientation & Visit	0	2	0	2
2	BMLT027	Research Methodology & Biostatistics	3	0	2	4
					Total No. of Credits	06

Table 3.5 Skill Enhancement (SEC)

S. No	Course code	Course Name	L	T	P	C
1	BMLT005	Healthcare Quality & Patient Safety	2	0	4	4
		Total No. of Credits				04

Table 3.6 Value Added Courses (VAC)

S. No	Course code	Course Name	L	T	P	C
1	AHP106	Introduction to Computing	2	0	2	3
2	AHP110	Environmental Sciences	2	0	0	2
					Total No. of Credits	5

Table 3.7 Internship (INT)

S. No	Course code	Course Name	L	T	P	C
1	AHP302	Internship Evaluation	0	0	8	4
2	BMLT404	Internship	0	0	96	48
					Total No. of Credits	**52**

17. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, are simply assigned the number of Credits based on the quantum of work / effort required to full fill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Sc. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

17.1 Internship

A student may undergo an internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters, subject to the following conditions:

17.2 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

17.2.1 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

17.2.2 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

17.2.3 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution

offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

17.2.4 A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

17.2 **Minor Project Work**

A student may opt to do a Minor Project Work for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) during the 3rd / 5th / 6th / 7th Semester as applicable, subject to the following conditions:

17.2.1 The Minor Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

17.2.2 The student may do the Minor project work in an Industry / Company or academic / research institution of her / his choice subject to the above-mentioned condition (Sub-Clause 17.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

17.3 **Research Project / Dissertation**

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

17.3.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

17.3.2 The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above-mentioned condition (Sub-Clause 17.3.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

18.List of MOOC (NPTEL) Courses

NPTEL - Discipline Elective Courses for B. Sc (Medical Laboratory Technology)

Sl. No.	Course ID	Course Name	Duration
1	noc25-hs77	English Studies, Cultural Studies	12 Weeks
2	noc25-ce09	Environmental Science	12 Weeks
3	noc25-bt34	Microsensors, Implantable Devices and Rodent Surgeries for Biomedical Applications	12 Weeks
4	noc25-ge20	Management of Medical Emergencies in Dental Practice	12 Weeks
5	noc25-ge36	Medical Law	12 Weeks
6	noc25-ge27	Qualitative Research Methods and Research Writing	12 Weeks

18 **Recommended Semester Wise Course Structure / Flow including the Program / Discipline Elective Paths / Options**

Semester I								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT001	Introduction to Healthcare Delivery System in India	4	0	0	4	4	CC
2	BMLT002	Medical Terminology & Record Keeping	2	1	0	3	3	CC
3	BMLT003	Anatomy	4	0	2	5	6	CC
4	BMLT004	Physiology	4	0	2	5	6	CC
5	BMLT005	Healthcare Quality & Patient Safety	2	0	4	4	6	SEC
6	AHP-106	Introduction to Computing	2	0	2	3	4	VAC
		Total	18	1	10	24	29	
CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project								

Semester II								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT006	Medical Law & Ethics, Principles of Management	4	0	0	4	4	AECC
2	BMLT007	General Clinical Microbiology	3	0	4	5	7	CC
3	BMLT008	Basic Haematology	3	0	4	5	7	CC
4	AHP-109	Communication Skills	3	0	0	3	3	AECC
5	AHP110	Environmental Sciences	2	0	0	2	2	VAC
		Total	15	-	8	19	23	
CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project								

Semester III								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT009	Systematic Bacteriology	3	0	4	5	7	CC
2	BMLT010	Basics of Medical Laboratory Technology	3	0	4	5	7	CC
3	BMLT011	Biochemical metabolism	3	0	4	5	7	CC
4	BMLT012	Applied Haematology	3	0	4	5	7	CC
5	BMLT013	Industrial Orientation & Visit	0	2	0	2	2	PWR
		Internship Evaluation -summer	0	0	8	4	4	PWR
		Total	12	2	24	26	34	
CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project								

Semester IV								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT014	Applied Bacteriology	3	0	4	5	7	CC
2	BMLT015	Clinical Pathology	3	0	4	5	7	CC
3	BMLT016	Diagnostic Biochemistry	3	0	4	5	7	CC
4	BMLT017	Clinical Mycology	3	0	4	5	7	CC

		Total	12	0	16	20	28	

CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project

Semester V								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT018	Immunology & Bacterial serology	3	0	4	5	7	CC
2	BMLT019	Cytopathology	3	0	4	5	7	CC
3	BMLT020	Applied Clinical Biochemistry	3	0	4	5	7	CC
4		Blood Banking & Genetics	3	0	2	4	5	DSE
5		Immunopathology & Molecular Biology	3	0	2	4	5	DSE
		Total	15	0	16	23	31	

CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project

Semester 6th								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT021	Medical Parasitology & Entomology	3	0	4	5	7	DSE
2	BMLT022	Clinical Virology	3	0	4	5	7	DSE
3	BMLT023	Histopathology	3	0	4	5	7	DSE
4	BMLT024	Applied Pathology	3	0	2	4	5	DSE
5		Research methodology and Biostatistics	3	0	2	4	5	Project/Training
		Total	15	0	16	23	31	

CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project,

Semester 7th								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT403	Internship - I	0	0	48	24	48	INT
		Total	0	0	48	24	48	
CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project, INT= Internship								

Semester 8th								
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Contact Hours**	**Basket**
1	BMLT403	Internship - II	0	0	48	24	48	INT
		Total	0	0	48	24	48	
CC= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, DSE= Discipline Specific Elective, GE= Generic Elective, VAC= Value Added Course. PWR= Research Project, INT= Internship								

20. Course Catalogue

SEMETER -1

Course Code: BMLT001	**Course Title: Basics of Healthcare Delivery System in India** **Type of Course: CC**	**L-T-P-C**	4	0	0	4
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course introduces students to the Indian healthcare delivery system, including its structure, community and private sector involvement, and national health policies and Programs. Students will explore India's health scenario over time, learn about the AYUSH systems of medicine, and understand core epidemiological concepts. Designed to be conceptual and analytical, the course enhances critical thinking, policy evaluation, and healthcare analysis skills.					
Course Objective	● To provide an overview of the Indian healthcare delivery system and its key components. ● To compare India's healthcare system with those of other countries. ● To analyze the role of public, private, and community participation in healthcare delivery. ● To understand the objectives, structure, and functioning of the National Health Mission and National Health Policy. ● To examine the background, aims, and operations of various national health Programs. ● To familiarize students with the AYUSH medical system and its role in healthcare. ● To understand demographic indicators, vital statistics, and trends in India's health scenario. ● To introduce basic epidemiological concepts, disease transmission methods, and surveillance systems for infectious and non-communicable diseases.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:**					

	• Describe the structure and functions of primary, secondary, and tertiary healthcare delivery systems in India. • Evaluate the extent and effectiveness of community participation in the Indian healthcare system. • Compare and contrast the healthcare system in India with those in developed countries. • Analyze the role of the private sector in healthcare provision and service delivery in India. • Explain the objectives, action plans, and outcomes of various national health Programs in India.			
Course Content:				
Module 1	**Introduction to National Healthcare Delivery System**	Assignment/ Quiz		**15 Sessions**
• **Introduction to National Healthcare Delivery System** ▪ Healthcare delivery system in India at primary, secondary and tertiary care ▪ Community participation in healthcare delivery system ▪ Health system in developed countries. ▪ Private Sector ▪ National Health Mission ▪ National Health Policy ▪ Issues in Health Care Delivery System in India				
Module 2	**National Health Program**	Assignment/ Quiz	Memory Recall based Quizzes	**15 Sessions**
• National Health Program- Background objectives, action plan, targets, operations, achievements and constraints in various National Heath Program.				
Module 3	**Introduction to AYUSH system of medicine.**	Assignment/ Quiz	Memory Recall-based Quizzes	**15 Sessions**
Introduction to AYUSH system of medicine. • Introduction to Ayurveda. • Yoga and Naturopathy • Unani				

- Siddha
- Homeopathy
- Need for integration of various system of medicine

Module 4	**Demography & Vital Statistics**	Assignment/ Quiz	**10 Sessions**

Demography & Vital Statistics-

a) Demography – its concept
b) Vital events of life & its impact on demography
c) Significance and recording of vital statistics
d) Census & its impact on health policy

Module 5	**Health Scenario of India**	Assignment/ Quiz	**25 Sessions**

Epidemiology

a) Principles of Epidemiology
b) Natural History of disease
c) Methods of Epidemiological studies
d) Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Targeted Application & Tools that can be used:

- Health Policy Analysis Tools
- National Health Mission Dashboards
- Demographic Analysis Software (e.g., SPSS, Epi Info)
- Surveillance and Data Collection Portals (e.g., IDSP, HMIS)

Project Work/ Assignment:

1. Article review: Critical summary of assigned article related to Indian health system or policy.

2. Presentation: Group discussion on a selected national health Program or AYUSH practice.

3. Case Study: Real-world scenario involving health delivery or epidemiological intervention with comprehensive analysis.

Text Book(s):

1. **Sundar Lal, Adarsh & Pankaj (2023).** *Textbook of Community Medicine.* CBS Publishers.
2. **Park, K. (2023).** *Park's Textbook of Preventive and Social Medicine.* Banarsidas Bhanot Publishers.
3. **Taneja, D. K. (2023).** *Foundations in Community Medicine.* Jaypee Brothers Medical Publishers.

Reference Book (s):

1. Sundar Lal, Adarsh & Pankaj (2023). *Textbook of Community Medicine*. CBS Publishers.
2. ICMR Publications – *National Health Programs Guidelines*
3. GOI Reports – *National Health Policy 2017*, *NHM Annual Reports*

Online Resources (e-books, notes, ppts, video lectures etc.):

1. https://presidencyuniversity.linways.com
2. https://nhm.gov.in – National Health Mission
3. https://niti.gov.in – NITI Aayog Health Policy Resources
4. https://www.mohfw.gov.in – Ministry of Health and Family Welfare
5. https://nptel.ac.in – Video lectures on Epidemiology and Health Policy

Topics relevant to "SKILL DEVELOPMENT":

- Analyzing healthcare policies and Programs
- Using demographic data for health planning
- Conducting epidemiological investigations
- Community engagement strategies for health delivery
- AYUSH integration and evaluation techniques
- Analyzing healthcare policies and Programs
- Using demographic data for health planning
- Conducting epidemiological investigations
- Community engagement strategies for health delivery
- AYUSH integration and evaluation techniques

Course Code: BMLT002	**Course Title: Medical Terminology and Record keeping** **Type of Course: Core Course**	**L-T-P-C**	2	1	0	3
Version No.						

Course Pre-requisites	NONE
Anti-requisites	NONE
Course Description	This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes. Topics include: origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests.
Course Objective	• To introduce the basic components and formation of medical terminology including roots, prefixes, and suffixes. • To develop skills in interpreting common medical abbreviations and symbols used in healthcare. • To train students in the accurate measurement and recording of vital signs. • To familiarize students with electronic health record (EHR) systems and their use in clinical documentation. • To emphasize the importance of precise medical record keeping for effective communication and patient care. • To enhance the ability to interpret and document clinical data and medical orders accurately. • To build competence in handling confidential patient information and maintaining data security. • To provide practical experience through case studies and simulation exercises related to medical documentation.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Describe the formation and use of medical terms including roots, prefixes, and suffixes. • Interpret common medical abbreviations and symbols used in healthcare documentation. • Explain the procedures for accurate measurement and recording of vital signs.

<table>
<tr><td></td><td colspan="3">Demonstrate the use of electronic health record systems for data entry and management.
Analyze the importance of clear and accurate medical documentation in patient care and communication.</td></tr>
<tr><td>Course Content:</td><td colspan="3"></td></tr>
<tr><td>Module 1</td><td>Introduction to Medical Terminology</td><td>Assignment/ Quiz</td><td>5 Sessions</td></tr>
<tr><td colspan="4">Derivation of medical terms, Define word roots, prefixes, and suffixes, Conventions for combined morphemes and formation of plurals</td></tr>
<tr><td>Module 2</td><td>Building and Understanding Medical Terms</td><td>Assignment/ Quiz</td><td>10 Sessions</td></tr>
<tr><td colspan="4">Basic medical terms, Form medical terms using roots, prefixes, suffixes, and combining forms, Interpret basic medical abbreviations and symbols</td></tr>
<tr><td>Module 3</td><td>System-Based Terminology</td><td>Assignment/ Quiz</td><td>5 Sessions</td></tr>
<tr><td colspan="4">Use diagnostic, surgical, and procedural terms and abbreviations related to the integumentary, musculoskeletal, respiratory, cardiovascular, nervous, and endocrine systems</td></tr>
<tr><td>Module 4</td><td>Medical Documentation</td><td>Assignment/ Quiz</td><td>10 Sessions</td></tr>
<tr><td colspan="4">Interpret medical orders and reports</td></tr>
<tr><td>Module 5</td><td>Health Information Management</td><td>Assignment/ Quiz</td><td>10 Sessions</td></tr>
<tr><td colspan="4">Data entry and management using electronic health record (EHR) systems</td></tr>
<tr><td colspan="4">Targeted Application & Tools that can be used:
Quizlet – for learning medical terms using flashcards and games.
Practice Fusion (EHR) – for hands-on practice with electronic health records.
Visible Body – to visually connect terminology with human anatomy.
Dragon Medical One – for practicing medical dictation and transcription.
Taber’s Medical Dictionary App – for quick reference of medical terms and abbreviations.</td></tr>
<tr><td colspan="4">Project Work/ Assignment:</td></tr>
<tr><td colspan="4">1. Terminology practice: Identify and construct medical terms using roots, prefixes, and suffixes through interactive exercises.</td></tr>
</table>

2. Abbreviation decoding: Interpret common medical abbreviations and symbols in clinical documents.
3. System-based presentation: Group presentation on medical terms and procedures related to a specific body system.
4. EHR simulation: Practice data entry and interpretation using an electronic health record system.

Text Book(s):

1. Gylys, B. A., & Wedding, M. E. (2021). Medical Terminology: Systems Approach. F. A. Davis Company.
2. Marcinko, D., & Hetico, H. O. (2022). Medical Records and Health Information Management. CRC Press.
3. Dean, D. H. (2020). Introduction to Medical Terminology. Elsevier Health Sciences.

Reference Book (s):

- Gartee, R. (2021). Electronic Health Records: Understanding and Using Computerized Medical Records. Pearson Education.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://medlineplus.gov/mplusdictionary.html
- https://www.khanacademy.org/science/health-and-medicine
- https://openstax.org/details/books/anatomy-and-physiology
- https://www.coursera.org/courses?query=medical%20terminology
- https://www.healthit.gov/topic/health-it-basics/electronic-health-records

Topics relevant to "SKILL DEVELOPMENT":

- Medical term construction and usage
- Interpretation of medical abbreviations and symbols
- Accurate measurement and recording of vital signs
- Practical use of electronic health record (EHR) systems
- Performing and interpreting basic clinical tests (ECG, spirometry)
- Documentation and reporting of patient data
- Communication skills for healthcare documentation
- Handling confidential patient information securely

Course Code: BMLT003	**Course Title: Anatomy** **Type of Course: CC**	**L-T-P-C**	4	0	2	5
Version No.						

Course Pre-requisites	
Anti-requisites	
Course Description	This course provides students with a foundational understanding of human anatomy essential for laboratory-based healthcare roles. It introduces basic anatomical terminology and offers an in-depth study of key systems including osteology (bones), muscular, thoracic, excretory, digestive, and nervous systems. Special focus is given to the structure and function of the gastrointestinal tract and central nervous system, which are crucial for interpreting clinical and diagnostic tests.
Course Objective	• To familiarize students with anatomical structures and terminology. • To enable identification and description of bones, muscles, and internal organs. • To understand the anatomical basis of physiological functions. • To apply anatomical knowledge in clinical and diagnostic settings. • To interpret surface and radiological anatomy for practical use in clinical diagnostic settings.
Basic skill sets required for the laboratory:	The students shall be able to develop: 1. An attitude of enquiry 2. Confidence and ability to tackle new problems 3. Ability to interpret events and results 4. Ability to work as a leader and as a member of a team 5. Assess errors and eliminate them 6. Observe and measure anatomical phenomena 7. Write structured reports 8. Select suitable models, mannequins, and anatomical tools 9. Locate anatomical faults or abnormalities in systems 10. Manipulative skills for handling anatomical models and tools 11. Ability to follow dissection/simulation procedures 12. Awareness of safety precautions in labs 13. Judgment of anatomical proportions and orientation without measurement
Course Outcomes	**On successful completion of the course the students shall be able to:**

	• Describe the basic anatomical terminology and identify major bones of the upper and lower limbs, including the vertebral column. • Explain the anatomical structure of the thorax including intercostal space, pleura, thoracic cage, and major thoracic bones. • Describe the anatomical components of the respiratory system with emphasis on the lungs, trachea, and bronchial tree. • Illustrate the surface anatomy, chambers, valves, and blood vessels of the heart along with the pericardium and coronary arteries. • Identify and describe the major skeletal muscles of the thorax and upper limb, focusing on the origin, insertion, and action of flexor and extensor groups. • Explain the structure and function of the excretory system including kidneys, ureters, and urinary bladder. • Discuss the anatomy and physiology of the digestive system, including oral cavity, gastrointestinal tract, digestion, absorption, and common disorders. • Describe the structure and function of neurons and outline the organization of the central and peripheral nervous systems, including cranial and spinal nerves		
Course Content:			
Module 1	**Introduction to Anatomy**	Assignment	**10 Sessions**
1. **Topics:** Introduction to Anatomy: Basic Anatomical terminology a. Osteology- i. Upper limb – clavicle, scapula, humerus, radius, ulna, ii. Lower limb - femur, hipbone, sacrum, tibia, fibula &Vertebral column b. Thorax – Intercostal space, pleura, bony thoracic cage, ribs sternum &thoracic vertebrae Lungs – Trachea, bronchial tree.			
Module 2	**Heart**	Assignment	**15 Sessions**
Topics: Heart – Surface anatomy of heart, chambers of the heart, valves of the heart, and major blood vessels of heart, pericardium, and coronary arteries			
Module 3	**Skeleton-muscular system**	Assignment	**15**

			Sessions
Topics: Skeleton-muscular system – Muscles of thorax, muscles of upper limb(arm & fore arm) Flexor and extensor group of muscles (origin, insertion, action)			
Module 4	**Excretory system**	Assignment	**10 Sessions**
Topics: Excretory system – Kidneys, ureters, bladder.			
Module 5	**Digestive System**	Assignment	**15 Sessions**
Digestive System: • Structure and function of the digestive system Oral cavity and digestive enzymes • Anatomy and function of the gastrointestinal tract Absorption and digestion of nutrients • Common digestive disorders			
Module 6	**Nervous System**	Assignment	**20 Sessions**
Topics: Nervous System: • Structure and function of neurons • Organization of the central nervous system (brain and spinal cord) Peripheral nervous system and its divisions • Cranial nerves and spinal nerves Basic principles of neurophysiology			
List of Laboratory Tasks: **Experiment No. 1:** Gross Anatomy (Using Models and Charts) **Experiment No. 2:** Identification of bones – upper limb: clavicle, scapula, humerus, radius, ulna **Experiment No. 3:** Identification of bones – lower limb: femur, hip bone, sacrum, tibia, fibula **Experiment No. 4:** Vertebral column – structure and types **Experiment No. 5:** Surface anatomy – anatomical landmarks and orientations **Experiment No. 6:** Heart, lungs, kidneys – external morphology and internal structures **Experiment No. 7:** Digestive tract and accessory organs – liver, stomach, intestines **Experiment No. 8:** Nervous system – brain, spinal cord, cranial nerves (models/charts) **Experiment No. 9:** Radiological anatomy – interpretation of X-ray (Chest PA view) **Experiment No. 10:** Identification of reproductive organs – male and female (models)			
Targeted Application & Tools that can be used: • Anatomical mannequins and charts			

- Plastic and 3D printed bone and organ models
- Dissection videos and simulation software
- Radiological films and digital X-ray interpretation tools
- Surface anatomy tracing and virtual 3D anatomy apps (e.g., Visible Body, Kenhub)

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course:

- **Create a labeled 3D model or diagram of the human heart, demonstrating its surface anatomy, chambers, valves, and major blood vessels.**
  (Type: Individual / Group Model-based Assignment)
- **Develop a detailed anatomical chart or digital presentation illustrating the bones of the upper and lower limbs with correct anatomical terminology and orientation.**
  (Type: Individual Visual Assignment)
- **Prepare a comparative chart on the structure and function of the central vs. peripheral nervous system, including cranial and spinal nerves.**
  (Type: Research-based Assignment / Poster Presentation)
- **Design a digestive system flowchart that maps the process of digestion and absorption along with the associated organs and enzymes.**
  (Type: Diagrammatic / Concept Mapping Assignment)

Text Book

1. *Anatomy and Physiology for Allied Health* by Kevin T. Patton
2. *Human Anatomy* by Marieb, Wilhelm & Mallatt

References

I. *Gray's Anatomy for Students* by Richard Drake
II. *Clinically Oriented Anatomy* by Keith L. Moore
III. *Atlas of Human Anatomy* by Frank H. Netter

Online learning resources:

1. https://www.visiblebody.com
2. https://www.kenhub.com
3. https://www.aheducation.co.in
4. https://www.anatomyzone.com

Topics relevant to "SKILL DEVELOPMENT":

- Skill development through experiential learning via anatomical model handling and surface tracing
- Identification and differentiation of human bones and organs
- Radiological anatomy interpretation

• Application of anatomical knowledge in real-life clinical environments such as operating theatres and diagnostic labs.

Course Code: BMLT004	**Course Title: Physiology** **Type of Course: CC**	**L-T-P-C**	4	0	2	5
Version No.						
Course Pre-requisites						
Anti-requisites						
Course Description	This course provides a comprehensive understanding of human physiology, focusing on the structure and function of major body systems. Students will explore key physiological processes related to blood composition, cardiovascular, respiratory, excretory, reproductive, central nervous, endocrine, and gastrointestinal systems. The course emphasizes the practical skills required in clinical settings, including measuring vital signs, interpreting electrocardiograms (ECGs), and performing basic respiratory examinations.					
Course Objective	• To familiarize students with anatomical structures and terminology. • To enable identification and description of bones, muscles, and internal organs. • To understand the anatomical basis of physiological functions. • To apply anatomical knowledge in clinical and diagnostic settings. • To interpret surface and radiological anatomy for practical use in operation theatres.					
Basic skill sets required for the laboratory:	The students shall be able to develop: 1. An attitude of enquiry 2. Confidence and ability to tackle new problems 3. Ability to interpret events and results 4. Ability to work as a leader and as a member of a team 5. Assess errors and eliminate them 6. Observe and measure anatomical phenomena 7. Write structured reports 8. Select suitable models, mannequins, and anatomical tools 9. Locate anatomical faults or abnormalities in systems 10. Manipulative skills for handling anatomical models and tools 11. Ability to follow dissection/simulation procedures					

	12. Awareness of safety precautions in labs 13. Judgment of anatomical proportions and orientation without measurement		
Course Outcomes	**On successful completion of the course the students shall be able to:** • Describe the composition and functions of blood, including plasma proteins, hemoglobin, clotting, and blood groups. • Explain acid-base balance and recognize conditions like acidosis and alkalosis. • Identify key aspects of cardiovascular physiology, including the cardiac cycle, ECG, and blood pressure. • Illustrate the process of respiration, including ventilation, oxygenation, and lung volume measurements. • Describe renal functions such as urine analysis, GFR, electrolyte balance, and pH regulation. • Explain the roles of major endocrine glands and their hormones in body regulation. • Illustrate digestion and absorption in the gastrointestinal tract and the role of bile. • Identify the sensory functions related to vision, hearing, taste, smell, balance, and proprioception.		
Course Content:			
Module 1	**Introduction to the Cell**	Assignment	**4 Sessions**
Acid base balance and disturbances of acid base balances (Alkalosis, Acidosis)			
Module 2	**The Blood**	Assignment	**10 Sessions**
Composition of blood, functions of the blood and plasma proteins, classification of proteins, blood cascade, bleeding and clotting time, pathological and physiological variation of RBC, function of hemoglobin, erythrocyte sedimentation rate, WBC total count (TC), differential count (DC) and functions, platelet formation, normal level and functions, blood groups and Rh factor.			
Module 3	**Cardio-Vascular System:**	Assignment	**7 Sessions**
heart sounds, cardiac cycle, cardiac output, auscultation, arterial pressures, blood pressure, hypertension, electrocardiogram (ECG).			
Module 4	**Respiratory system**	Assignment	**5 Sessions**

Respiratory ventilation, oxygenation, definitions and normal values of lung volumes and lung capacities.			
Module 5	**Excretory system**	Assignment	**7 Sessions**
Renal system, urine volume and specific gravity measurements, renal function tests including assessment of glomerular filtration rate (GFR), analysis of renal tubular function, study of renal handling of electrolytes and water, assessment of acid-base balance and renal regulation of pH.			
Module 6	**Digestive System**	Assignment	**7 Sessions**
Physiological anatomy of the GIT, food digestion in the mouth, stomach, and intestine, absorption of foods, role of bile in digestion.			
Module 7	**Reproductive System**	Assignment	**14 Sessions**
Formation of semen and spermatogenesis, brief account of menstrual cycle, central nervous system, functions of cerebrospinal fluid (CSF), endocrine system, functions of the pituitary, thyroid, parathyroid, adrenal, and pancreatic hormones.			
Module 8	**Special Senses**	Assignment	**6 Sessions**
Formation of semen and spermatogenesis, brief account of menstrual cycle, central nervous Vision testing and assessment of visual acuity, auditory tests and assessment of hearing function, study of taste and olfaction perception, analysis of vestibular system and balance control, assessment of proprioception and kinesthetic sense.			

List of Laboratory Tasks:

Experiment No. 1: Determination of blood groups using antigen-antibody testing.

Experiment No. 2: Measurement of vital signs—blood pressure, heart rate, respiratory rate, and temperature.

Experiment No. 3: Recording and interpretation of ECG to assess heart activity.

Experiment No. 4: Performing spirometry to measure lung volumes and capacities.

Experiment No. 5: Examination of the respiratory system to count respiratory rate and observe breathing phases.

Targeted Application & Tools that can be used:

- Anatomical mannequins and charts
- Plastic and 3D printed bone and organ models
- Dissection videos and simulation software
- Radiological films and digital X-ray interpretation tools
- Surface anatomy tracing and virtual 3D anatomy apps (e.g., Visible Body, Kenhub)

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course:

- **Create a labeled 3D model or diagram of the human heart, demonstrating its surface anatomy, chambers, valves, and major blood vessels.**
  (Type: Individual / Group Model-based Assignment)
- **Develop a detailed anatomical chart or digital presentation illustrating the bones of the upper and lower limbs with correct anatomical terminology and orientation.**
  (Type: Individual Visual Assignment)
- **Prepare a comparative chart on the structure and function of the central vs. peripheral nervous system, including cranial and spinal nerves.**
  (Type: Research-based Assignment / Poster Presentation)
- **Design a digestive system flowchart that maps the process of digestion and absorption along with the associated organs and enzymes.**
  (Type: Diagrammatic / Concept Mapping Assignment)

Text Book

1. *Anatomy and Physiology for Allied Health* by Kevin T. Patton
2. *Human Anatomy* by Marieb, Wilhelm & Mallatt

References

- *Gray's Anatomy for Students* by Richard Drake
- *Clinically Oriented Anatomy* by Keith L. Moore
- *Atlas of Human Anatomy* by Frank H. Netter

Online learning resources:

1. EBook: https://presiuniv.knimbus.com/user#/home
2. https://puniversity.informaticsglobal.com/
3. https://www.visiblebody.com
4. https://www.kenhub.com
5. https://www.aheducation.co.in
6. https://www.anatomyzone.com

Topics relevant to "SKILL DEVELOPMENT":

- Skill development through experiential learning via anatomical model handling and surface tracing
- Identification and differentiation of human bones and organs
- Radiological anatomy interpretation
- Application of anatomical knowledge in real-life clinical environments such as operating theatres and diagnostic labs.

Course Code: BMLT005	**Course Title: Healthcare Quality & Patient Safety** **Type of Course: SEC**	**L-T-P-C**	2	0	4	4
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course introduces principles of healthcare quality and patient safety. Students learn about error prevention, risk management, quality improvement methods, and patient safety culture. The course prepares students to identify risks, implement safety strategies, and promote continuous improvement in healthcare.					
Course Objective	• To understand the fundamental concepts of healthcare quality and patient safety. • To analyze common causes of medical errors and adverse events in healthcare settings. • To learn methods and tools for quality improvement and risk management. • To develop skills in reporting, investigating, and preventing patient safety incidents. • To promote a culture of safety and continuous improvement within healthcare organizations. • To familiarize students with regulatory standards and accreditation related to patient safety. • To apply strategies for enhancing communication and teamwork to improve care quality. • To evaluate the impact of quality and safety initiatives on patient outcomes.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Develop a quality improvement plan for a healthcare facility. • Evaluate the effectiveness of patient safety protocols in reducing errors. • Analyse medical errors and propose preventive measures.					

	• Recall key patient safety concepts like adverse events and reporting. • Apply quality management principles to assess healthcare outcomes. • Explain the role of patient safety in reducing harm.			
Course Content:				
Module 1	**Quality assuranceand Management**	Assignment/ Quiz	Numerical solving Task	**5 Sessions**
Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Quality ImprovementTools & Introduction to current NABH guidelines				
Module 2	**Basics of emergency care and Life support**	Assignment/ Quiz	Memory Recall based Quizzes	**6 Sessions**
Vital signs and primary assessment, Basic emergency care, first aid and triage, Ventilations including use of bag- valve masks (BVMs), Choking, rescue breathing methods, One- and Two-rescuer CPR, Using an AED (Automated external defibrillator) & Managing an emergency including moving a patient.				
Module 3	**Bio medical waste management and environment safety**	Assignment/ Quiz	Memory Recall-based Quizzes	**5 Sessions**
Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals/ Chemicals / Drug waste, BMW Management & methods of disinfection, Modern technology for handling BMW, Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices)				
Module 4	**Infection prevention**	Assignment/ Quiz	Numerical solving Task	**4 Sessions**
Use of Personal protective equipment (PPE) & Monitoring & controlling of cross infection (Protective devices) Prevention & control of common healthcare associated infections, Components of an effective infection control program, and Latest Guidelines (NABH and JCI) for Hospital Infection Control.				
Module 5	**Antibiotic Resistance**	Assignment/ Quiz	Numerical solving Task	**5 Sessions**

Antibiotic Resistance- History of antibiotics How resistance happens and spreads, Types of resistance- intrinsic, acquired, passive, Trends in drug resistance &Actions to fight resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance & Antimicrobial Stewardship – Barriers and opportunities, tools and models in hospitals

Module 6	**Disaster Management**	Assignment/ Quiz	Numerical solving Task	**5 Sessions**

Fundamentals of emergency management, Psychological impact management, Resource management, Preparednessand risk reduction & Key response functions (including public health, logistics and governance, recovery

List of Laboratory Tasks:

Experiment No. 1: Case study analysis of quality improvement projects.

Experiment No. 2: Workshop on creating a quality improvement plan.

Experiment No. 3: First aid drill – wound dressing, bandaging, and splinting.

Experiment No. 4: CPR simulation – practice one- and two-rescuer CPR on dummies.

Experiment No. 5: Choking relief simulation using Heimlich maneuver and bag-valve-mask (BVM).

Experiment No. 6: AED training – hands-on use of AED on mannequins.

Experiment No. 7: BMW segregation exercise – categorize waste using color-coded bins.

Experiment No. 8: Disposal simulation – safe handling of sharps and pharmaceutical waste.

Experiment No. 9: PPE training – correct donning and doffing of personal protective equipment.

Experiment No. 10: Handling of liquid and radioactive BMW using appropriate tools.

Experiment No. 11: Infection control program creation and implementation.

Experiment No. 12: Monitoring cross-infection using hospital-acquired infection (HAI) surveillance systems.

Experiment No. 13: PPE for infection control – practice donning and doffing gloves, masks, gowns, and eye protection.

Experiment No. 14: Disaster simulation – role-play emergency response in mass casualty or natural disaster events.

Experiment No. 15: Psychological first aid – training in crisis response for patients and healthcare workers.

Targeted Application & Tools that can be used:

- Quality improvement tools – PDCA cycle, Root Cause Analysis (RCA), Fishbone diagram
- Simulation manikins – for CPR, choking relief, and AED training
- BMW segregation bins – for biomedical waste management exercises
- PPE kits – for training in infection control and safety procedures

- Surveillance and reporting tools – for tracking healthcare-associated infections (HAIs)

Project Work/ Assignment:

1. **Quality Audit Report**: Conduct a mock quality audit in a clinical/lab setting and prepare a report with findings and recommendations.
2. **Patient Safety Culture Survey**: Design and analyze a survey on safety culture among healthcare workers.
3. **Root Cause Analysis (RCA)**: Choose a real or hypothetical clinical error and conduct a detailed RCA.
4. **Infection Control Plan**: Develop a comprehensive infection prevention and control strategy for a healthcare facility.

Text Book(s):

- Goel, S.L. (2022). **Health Care System and Safety**. Deep & Deep Publications.
- Juran, J.M., & Godfrey, A.B. (2021). **Juran's Quality Handbook**. McGraw-Hill Education.

Reference Book (s):

- WHO. (2021). **Patient Safety Curriculum Guide: Multi-professional Edition**. World Health Organization.
- Gawande, A. (2011). **The Checklist Manifesto: How to Get Things Right**. Metropolitan Books.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://www.qualityleadersacademy.com/free-resources
- https://www.ahrq.gov/patient-safety/resources/index.html
- https://www.ihi.org/resources
- https://cpps-tricks.com/free-courses

Topics relevant to "SKILL DEVELOPMENT":

- Vital signs monitoring
- Infection prevention and control
- Basic life support and first aid
- Biomedical waste management
- Use of hospital information systems
- Quality indicators and auditing
- Patient communication
- Safety checklists and protocols

• Simulation-based training • Teamwork and leadership in healthcare

Course Code: AHP-106	**Course Title: Introduction to Computing** **Type of Course: VAC**	**L-T-P-C**	2	0	2	3
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course introduces students to computer technology, covering topics such as computer organization, operating systems, software applications like MS Word, Excel, and PowerPoint, computer networks, and internet applications. It also explores the use of computers in healthcare settings. Additionally, the course includes fundamental language and communication skills, including grammar, business communication, writing techniques, and oral presentations.					
Course Objective	• To familiarize students with basic computer concepts and components. • To understand operating systems and common software applications. • To develop skills in using MS Word, Excel, and PowerPoint effectively. • To introduce computer networks and internet applications. • To explore the role of computing in healthcare and other professional settings. • To enhance fundamental language and communication skills, including writing and presentations.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Design a simple software application or website. • Assess the effectiveness of computing technologies in solving problems. • Analyse the societal impact of technologies like AI and cloud					

	computing. • Recall essential hardware, software, and programming concepts. • Apply computational thinking to solve problems with programming solutions.			
Course Content:				
Module 1	**Introductionto computer**	Assignment/ Quiz	Numerical solving Task	**6 Sessions**
Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. Input output devices: input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic cardreader, voice recognition devices, vision-input devices), outputdevices (monitors, pointers, plotters, screen image projector, voice response systems).				
Module 2	**Processor and memory**	Assignment/ Quiz	Memory Recall based Quizzes	**8 Sessions**
The Central Processing Unit (CPU), main memory. Storage Devices: sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. Introduction to MS-Word: introduction, components of a wordwindow, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.				
Module 3	**Introductionto Excel**	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creatinggraphs. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancingtext, slide with graphs. Introduction of Operating System: introduction, operating system concepts, types of operating system. Introduction to MS-DOS: History of DOS, features of MS-DOS, MS-DOSCommands (internal and external).				

Module 4	**Introduction of windows**	Assignment/ Quiz	Numerical solving Task	**8 Sessions**

History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).

Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring,bus, mesh, tree, hybrid), components of network.

Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. Application of Computers in various fields: Medical, Education, Railway, Defense, Industry, Management, Sports,Commerce, Internet.

List of Laboratory Tasks:

Experiment No. 1: Use basic DOS commands.

Experiment No. 2: Use external DOS commands.

Experiment No. 3: Create an email account.

Experiment No. 4: Use web browsers for searching and surfing.

Experiment No. 5: Create and format documents in MS Office.

Experiment No. 6: Use autocorrect, autotext, and spell check in MS Office.

Experiment No. 7: Create tables and insert objects in MS Word.

Experiment No. 8: Use mail merge options in MS Office.

Experiment No. 9: Create Excel worksheets and use formulas.

Experiment No. 10: Create graphs using data in MS Excel.

Experiment No. 11: Create PowerPoint presentations using auto content wizard.

Experiment No. 12: Use clip art, animation effects, and word art in presentations.

Experiment No. 13: Apply transitions and set timings for slide shows.

Targeted Application & Tools that can be used:

- MS-DOS or Command Prompt
- Microsoft Outlook or Gmail (for email creation)
- Web browsers (Google Chrome, Mozilla Firefox, Microsoft Edge)
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint
- Grammarly or built-in spell checkers
- Mail Merge tools within MS Word
- Excel formula and chart tools
- Presentation design tools within PowerPoint (clip art, animations, transitions)

Project Work/ Assignment:

1. Document Creation Assignment: Create and format a professional document in MS Word including tables and inserted objects.
2. Excel Workbook Project: Develop an Excel workbook with formulas and charts based on provided data sets.
3. Presentation Design Task: Design a PowerPoint presentation using animations, transitions, and multimedia elements.
4. Email Setup and Communication: Set up an email account and demonstrate effective email communication skills.

Text Book(s):

- Shelly, G. B., & Vermaat, M. E. (2023). *Discovering Computers: Fundamentals*. Cengage Learning.
- Microsoft Corporation. (2023). *Microsoft Office User Guides*. Microsoft Press.

Reference Book (s):

- Hales, C. (2023). *Computer Fundamentals and Applications*. Pearson Education.
- ITL Education Solutions Limited. (2023). *Computer Fundamentals*. Pearson India.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://media.readthedocs.org/pdf/clickpython/latest/clickpython.pdf
- https://nptel.ac.in/courses/106/106/106106145/
- https://www.geeksforgeeks.org/computer-science-tutorial/
- https://www.codecademy.com/learn/computer-science

Topics relevant to "SKILL DEVELOPMENT":

- Communication skills (verbal, non-verbal, listening, presentation, writing)
- Critical thinking and problem solving
- Time management and organizational skills
- Teamwork and collaboration
- Digital literacy (basic computer skills, internet usage, social media etiquette)
- Adaptability and flexibility
- Technical skills relevant to the field
- Emotional intelligence (self-awareness, empathy, relationship management)
- Career development skills (resume writing, interview preparation, networking)
- Financial literacy (budgeting, personal finance)
- Entrepreneurship and innovation basics
- Health and safety awareness (workplace safety, first aid)

SEMESTER-2

Course Code: BMLT006	**Course Title:** Medical Ethics & Legal Aspects **Type of Course: AECC**	**L-T-P-C**	4	0	0	4
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course delves into the legal and ethical issues that arise in medical practice. Medical ethics, confidentiality, informed consent, euthanasia, organ transplantation, medico-legal implications of medical data, and professional indemnity insurance are among the topics covered.					
Course Objective	• To introduce students to the fundamental principles of medical ethics and their application in healthcare. • To understand the moral responsibilities and professional conduct expected from healthcare providers. • To provide knowledge of key legal provisions related to medical practice in India. • To develop the ability to identify and analyze ethical and legal issues in clinical scenarios. • To understand patient rights, informed consent, confidentiality, and professional negligence. • To promote ethical decision-making and adherence to legal standards in healthcare practice.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Demonstrate understanding of fundamental principles of medical ethics including autonomy, beneficence, non-maleficence, and justice. • Analyze ethical issues and dilemmas encountered in clinical practice with appropriate ethical reasoning. • Identify the legal responsibilities and duties of healthcare professionals in relation to patient care and documentation.					

	• Interpret the implications of relevant laws such as the Consumer Protection Act, Medical Termination of Pregnancy (MTP) Act, and the Biomedical Waste Management Rules in healthcare settings. • Apply ethical and legal principles in real-life case scenarios including issues of consent, confidentiality, negligence, and end-of-life decisions. • Exhibit professional behavior and accountability in accordance with national and institutional codes of conduct and legal standards.			
Course Content:				
Module 1	**Introduction to medicalethics**	Assignment/ Quiz	Numerical solving Task	**10 Sessions**
Medical ethics – Definition, Goal, Scope, Introduction to Code of Conduct, Basic Principles of Medical Ethics, Confidentiality				
Module 2	**Malpractice, Negligence, Autonomy, Terminal Care, & Indemnity**	Assignment/ Quiz	Memory Recall based Quizzes	**14 Sessions**
Malpractice and Negligence, Rational and Irrational Drug Therapy, Autonomy and Informed Consent, Rights of Patients, Care of the Terminally Ill, Euthanasia, Development of Standardized Protocol to Avoid Near Miss or Sentinel Events				
Module 3	**Organ Transplantation & Medico-legal Aspects of Records**	Assignment/ Quiz	Memory Recall-based Quizzes	**18 Sessions**
Organ Transplantation, Medico-Legal Aspects of Medical Records, Medico-Legal Cases and Types, Records and Documents Related to MLC, Ownership of Medical Records, Confidentiality, Privileged Communication, Release of Medical Information, Unauthorized Disclosure, Retention of Medical Records, Other Various Aspects, Ethics in the Profession of Medical Laboratory Science				
Module 4	**Legal and Ethical Foundations of Healthcare**	Assignment/ Quiz	Numerical solving Task	**18 Sessions**
Autonomy, Beneficence, Non-malfeasance, Justice, and Confidentiality, Informed Consent, Medical Privacy, End-of-Life Care, Reproductive Rights, and Healthcare Disparities				

Targeted Application & Tools that can be used:

- Case-Based Learning Platforms
- Virtual Simulations
- Learning Management Systems (LMS)
- Online Assessment Tools
- Policy Reference Tools
- Interactive e-Modules and MOOCs
- Ethics Consultation Apps
- Document Management Systems
- Video-Based Tools for Discussion
- Legal Databases and Journals

Project Work/ Assignment:

- Medical Negligence Case Study: Analyze and present a real or hypothetical case highlighting ethical and legal breaches in healthcare.
- Informed Consent Form Development: Create a detailed and legally compliant informed consent form for a specific medical procedure.
- Patient Rights Presentation: Prepare and deliver a presentation explaining fundamental patient rights and ethical responsibilities of healthcare providers.
- Organ Transplant Law Research Report: Compile a report on the legal and ethical framework surrounding organ transplantation in India.
- Sentinel Event Protocol Design: Develop a standardized protocol to prevent sentinel events and promote patient safety in clinical settings.

Text Book(s):

• Sharma, B. M. (2022). *Medical Ethics – Concepts and Issues*. CBS Publishers & Distributors.

• Fremgen, B. F. (2021). *Medical Law and Ethics*. Pearson Education.

• Aggrawal, A. (2020). *Textbook of Forensic Medicine and Toxicology*. Avichal Publishing Company.

• Little, M., & Kerridge, I. (2019). *Ethics in Clinical Practice*. Cambridge University Press.

Reference Book (s):

• Beauchamp, T. L., & Childress, J. F. (2020). *Principles of Biomedical Ethics*. Oxford University Press.

• Avery, G. (2021). *Law and Ethics in Nursing and Healthcare*. SAGE Publications.

• Medical Council of India. (2016). *Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations*. MCI/NMC Official Publication.

• Pozgar, G. D. (2022). *Legal Aspects of Health Care Administration*. Jones & Bartlett Learning.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://nmc.org.in/rules-regulations/professional-conduct-regulations/
- https://www.who.int/ethics/en/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7144173/
- https://www.coursera.org/learn/medical-ethics
- https://www.swayam.gov.in/
- https://www.youtube.com/playlist?list=PLrD2fD6sWRlKHOvS8IleT9ohE6SP1Pttw
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=medical+ethics
- https://bioethics.nih.gov/

Topics relevant to "SKILL DEVELOPMENT":

- Ethical Decision-Making in Clinical Practice
- Effective Patient Communication and Consent Handling
- Documentation and Record-Keeping Skills
- Handling Medico-Legal Cases Professionally
- Teamwork and Interdisciplinary Ethical Discussions
- Maintaining Confidentiality in Healthcare Settings
- Critical Thinking for Resolving Ethical Dilemmas
- Professionalism and Code of Conduct Adherence
- Responding to Sentinel Events and Near Misses
- Understanding and Implementing Patient Rights
- Legal Reporting and Documentation Skills for MLC
- Developing Standard Operating Procedures (SOPs)
- Using Digital Tools for Ethics Training and Legal Compliance
- Role-play and Simulation of Ethical Scenarios
- Conflict Resolution and Negotiation in Healthcare Teams

Course Code: BMLT007	**Course Title: General & Clinical Microbiology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					

Course Description	This course covers microbiology fundamentals, microscopy techniques, and sterilization methods, emphasizing essential skills for healthcare settings. Additionally, it provides knowledge in immunology, infection control, and biomedical waste management, ensuring comprehensive understanding and practical application.
Course Objective	To provide foundational knowledge of microorganisms, their classification, structure, and functions. • To understand the growth, metabolism, and genetics of microbes relevant to human health. • To introduce methods of sterilization, disinfection, and infection control in clinical settings. • To develop skills in handling, culturing, and identifying clinically significant microorganisms. • To explore the role of microorganisms in disease causation, diagnosis, and prevention. • To understand the principles of host-pathogen interaction, immunity, and microbial resistance. • To familiarize students with laboratory safety, biosafety levels, and quality assurance in microbiological practices. • To correlate microbiological findings with clinical conditions for effective disease management.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Create a microbiological chart to classify pathogens and their effects. • Evaluate microbial infections and their treatments based on laboratory findings. • Analyze the growth and behavior of microorganisms in various environments. • Recall basic concepts of microbiology, including bacterial structures and functions. • Apply microbiological knowledge to diagnose infections and diseases. • Understand the role of microbes in health, disease, and the environment.
Course Content:	

Module 1	**General Microbiology**	Assignment/ Quiz	Numerical solving Task	**15 Sessions**
Introduction and History of Microbiology – History, classification, nomenclature, and taxonomy, **Microscopy** – Different types of microscopes used in the laboratory, **Sterilization and Disinfection** – Sterilizing agents (physical and chemical agents), testing of disinfectants, sterilization and disinfection in a healthcare setting, **Culture Media** – Types of media, and special media employed in the laboratory, **Culture Methods** – Aerobic and anaerobic culture methods, methods of isolating pure cultures of bacteria.				
Module 2	**Immunology**	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**
Immunity – Innate or native immunity, Acquired or adaptive immunity, types, Measurement of immunity **Antigen and antibody** – Definitions, types, biological classes of antigens and antibodies. **Hypersensitivity** – Classification and types **Auto immunity** – Definition and Mechanisms, Classification of autoimmune diseases				
Module 3	**Infection Control**	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Health-care associated infections – Types, sources, modes of transmission, methods to control infection **Infection** – Classification, Sources, Methods of transmission, predisposing factors, types of infectious diseases				
Module 4	**BMW**	Assignment/ Quiz	Numerical solving Task	**6 Sessions**
Biomedical waste management – Types and General principles, use of equipment's for sterilization, chemicals used in disinfection				
Module 5	**Virology**	Assignment/ Quiz	Numerical solving Task	**6 Sessions**

General properties of viruses, diseases caused and prevention of following viruses, Hepatitis, HIV, Rabies and Poliomyelitis.

List of Laboratory Tasks:

Experiment No. 1: Demonstration of microscope and its parts.

Experiment No. 2: Demonstration of glassware used in microbiology.

Experiment No. 3: Demonstration of autoclave and sterilization of glassware.

Experiment No. 4: Demonstration of hot air oven and sterilization of glassware.

Experiment No. 5: Perform Gram staining.

Experiment No. 6: Perform Acid-fast staining (Ziehl-Neelsen staining).

Experiment No. 7: Perform Indian ink staining.

Experiment No. 8: Perform hanging drop method.

Experiment No. 9: Demonstrate agglutination reaction.

Experiment No. 10: Perform RA test.

Experiment No. 11: Perform WIDAL test.

Experiment No. 12: Perform RPR test.

Experiment No. 13: Perform CRP test.

Targeted Application & Tools that can be used:

- **Microscopy Tools** – Light microscope, Phase-contrast microscope, Dark-field microscope, Fluorescence microscope.
- **Staining Kits** – Gram staining kit, Acid-fast staining kit, Capsule staining reagents, Spore staining kit.
- **Sterilization Equipment** – Autoclave, Hot air oven, Incinerator, Filtration units (membrane filters).
- **Culture Media Preparation Tools** – Media dispensers, Weighing balance, pH meter, Magnetic stirrer, Water bath.
- **Incubation Tools** – Incubator (aerobic and anaerobic), Candle jars, Anaerobic jars.
- **Glassware and Plasticware** – Petri dishes, Test tubes, Conical flasks, Beakers, Inoculation loops, Pipettes.
- **Diagnostic Kits** – RA, CRP, WIDAL, RPR test kits, Latex agglutination kits.
- **Software Tools** – Virtual microscope simulators, Digital lab logs, Microbiology database tools (e.g., Bergey's Manual online).
- **Biohazard Safety Tools** – Biosafety cabinet, PPE kits, Autoclave bags, Disinfectants (e.g., sodium hypochlorite, phenol-based solutions).
- **Record Keeping Tools** – Laboratory notebooks, LIMS (Laboratory Information Management Systems), Electronic lab logs.

Project Work/ Assignment:

- **Gram Staining Report**- Perform Gram staining on bacterial samples and interpret results with microscopy images.

- **Antibiotic Sensitivity Testing (AST)**- Conduct disc diffusion tests to assess bacterial resistance or sensitivity to antibiotics.
- **Study of Microbial Growth Curve**- Plot a bacterial growth curve using broth culture and optical density measurements.
- **Culture Media Preparation and Bacterial Isolation**- Prepare common culture media and isolate bacteria from environmental or clinical samples.
- **Comparative Study of Sterilization Methods**- Evaluate the effectiveness of autoclave, dry heat, and chemical sterilization techniques.

Text Book(s):

• **Pelczar, M. J., Chan, E. C. S., & Krieg, N. R.** (2022). *Microbiology: Application Based Approach*. McGraw-Hill Education.

• **Tortora, G. J., Funke, B. R., & Case, C. L.** (2023). *Microbiology: An Introduction*. Pearson Education.

• **Ananthanarayan, R., & Paniker, C. K. J.** (2022). *Textbook of Microbiology*. Universities Press.

Reference Book (s):

• **Prescott, L. M., Harley, J. P., & Klein, D. A.** (2022). *Microbiology*. McGraw-Hill Education.

• **Cappuccino, J. G., & Welsh, C.** (2023). *Microbiology: A Laboratory Manual*. Pearson Education.

• **Willey, J. M., Sherwood, L., & Woolverton, C.** (2021). *Prescott's Microbiology*. McGraw-Hill.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://openstax.org/books/microbiology/pages/1-introduction — OpenStax Microbiology (Free e-Book)
- https://www.microbiologyinfo.com/ — Microbiology Info (Notes, Diagrams, Culture Media, Staining)
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=microbiology — Slideshare (Microbiology PPTs)
- https://www.youtube.com/playlist?list=PLD5BC727C84F5D620 — Dr. Najeeb Lectures (Microbiology Video Lectures)
- https://swayam.gov.in/nd1_noc24_bt20/preview — SWAYAM / NPTEL General Microbiology Course (Free Online Course)

Topics relevant to "SKILL DEVELOPMENT":

- Microscope Handling and Maintenance
- Preparation of Culture Media and Sterilization Techniques
- Aseptic Techniques for Microbial Culture and Isolation
- Staining Procedures **– Gram staining, Acid-fast staining, Capsule staining**
- Bacterial Identification and Characterization
- Antibiotic Sensitivity Testing (AST) and Interpretation
- Use of Autoclave, Hot Air Oven, and Other Sterilization Equipment
- Serological Diagnostic Tests **– WIDAL, RA, CRP, RPR tests**
- Microbial Growth Curve Analysis
- Laboratory Safety and Biohazard Management
- Handling and Disposal of Biomedical Waste
- Use of Laboratory Information Management Systems (LIMS)
- Data Recording and Reporting in Microbiology Labs

Course Code: BMLT008	**Course Title:** Basic Haematology **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course covers fundamental concepts of haematology, including blood composition, blood cell morphology, and common hematological disorders. It emphasizes essential laboratory techniques such as blood sampling, preparation of blood smears, and the use of microscopes. The course also includes knowledge of hematology equipment, safety measures, and quality control to ensure accurate diagnosis and effective patient care.					
Course Objective	• To understand the fundamental concepts of blood and its components. • To identify and describe the morphology of different blood cells using microscopy. • To develop practical skills in preparing and analyzing blood smears and other hematological specimens. • To familiarize students with important haematology laboratory equipment and their proper use.					

<table>
<tr><td></td><td colspan="4">To apply laboratory safety protocols and quality control measures in haematology testing.
To recognize common hematological disorders and their laboratory findings.
To enhance the ability to interpret hematology test results for clinical decision-making.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:

1. Demonstrate the basic equipment used in haematology and explain composition of blood
2. Apply knowledge on blood and anticoagulant
3. Simplify the Hemopoiesis
4. Explain Haemostasis and urine analysis
5. Apply Knowledge on quality assurance Haematology
6. Discuss recently used techniques of blood collection procedures</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Hematology</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Introduction to Haematology: Definition, importance, key equipment, and lab organization with safety measures. Overview of microscopes (monocular and binocular), their parts, care, maintenance, and corrective actions in light microscopy.</td></tr>
<tr><td>Module 2</td><td>Blood and Anticoagulant</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Blood Composition & Function: Blood cells formation (erythropoiesis, leucopoiesis, thrombopoiesis), functions, and morphology (normal & abnormal). Anticoagulants: types, uses, actions, pros, and cons. Hemoglobin: definition, types, structure, synthesis, and breakdown.</td></tr>
<tr><td>Module 3</td><td>Sample Collection, Transportation</td><td>Assignment/ Quiz</td><td>Memory Recall-based Quizzes</td><td>7 Sessions</td></tr>
</table>

Specimen Handling: Collection, transport, preservation, and processing of clinical samples. Blood collection methods (venipuncture, capillary, arterial), Vacutainer types and uses, and sample acceptance/rejection criteria.

Module 4	**Hemoglobin Essentials**	Assignment/ Quiz	Numerical solving Task	**12 Sessions**

Hemoglobin & Blood Counts: Hemoglobin structure, types, estimation methods, and blood parameter variations. Hemocytometry using Neubauer chamber for RBC, WBC, platelets, and eosinophil counts—principles, procedures, calculations, and precautions.

Module 5	**Smear Preparation and Quality Measures**	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Blood Smears & QA: Preparation and staining of smears, blood cell morphology, manual/automated differential counts, and variations. Quality assurance with controls, protocols, and statistical analysis (SD, CV, accuracy).

List of Laboratory Tasks:

Experiment No. 1: Capillary and venous blood collection.

Experiment No. 2: Preparation of anticoagulated bottles.

Experiment No. 3: Learning general laboratory safety rules.

Experiment No. 4: Preparing EDTA, sodium citrate, and sodium fluoride anticoagulants and bulbs/vials.

Experiment No. 5: Separating serum and plasma.

Experiment No. 6: Determining hemoglobin by various methods.

Experiment No. 7: Determining total leukocyte count (TLC).

Experiment No. 8: Preparing thick and thin blood smears.

Experiment No. 9: Determining differential leukocyte count (DLC).

Experiment No. 10: Determining total red blood cell count (RBC).

Experiment No. 11: Determining total platelet count.

Experiment No. 12: Determining absolute leukocyte count.

Targeted Application & Tools that can be used:

- Blood cell analysis and hematological testing
- Diagnostic procedures in haematology
- Microscopes (monocular and binocular)
- Hemocytometers (manual and automated)
- Anticoagulants (EDTA, sodium citrate, sodium fluoride)
- Staining kits (Romanowsky dyes)

- Automated cell counters

Project Work/ Assignment:

• Blood Smear Preparation – Prepare and stain blood smears; identify normal and abnormal cells.
• Anticoagulant Study – Prepare anticoagulants and assess their effects on blood samples.
• Hemoglobin Estimation – Measure hemoglobin by different methods and compare results.
• Differential Leukocyte Count – Perform manual and automated DLC; analyze variations.
• Haematology Quality Control – Design a QA plan with controls and basic statistical analysis.

Text Book(s):

• **"Textbook of Hematology"** – Dacie and Lewis, 13th Edition, Elsevier, 2017
• **"Fundamentals of Hematology"** – Swaminathan, 2nd Edition, Jaypee Brothers, 2015

Reference Book (s):

• **"Williams Hematology"** – Kaushansky et al., 9th Edition, McGraw-Hill, 2015
• **"Hematology: Basic Principles and Practice"** – Hoffman et al., 7th Edition, Elsevier, 2018

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://medicalstudyzone.com/lecture-notes-haematology-10th-edition-pdf-free-download/ — Haematology Lecture Notes (Free PDF)
• https://open.umn.edu/opentextbooks/textbooks/772 — A Laboratory Guide to Clinical Hematology (Free e-Book)
• https://medtube.net/hematology — MEDtube Hematology Video Library (Video Lectures)
• https://www.ninjanerd.org/lecture-category/hematology/ — Ninja Nerd Hematology Lectures (Video Lectures)
• https://www.hematology.org/education/trainees/hematology-review-series — ASH Hematology Review Series (Free Online Lectures)

Topics relevant to "SKILL DEVELOPMENT":

- Blood sample collection techniques (venous, capillary, arterial)
- Preparation and staining of blood smears
- Use and maintenance of microscopes (monocular and binocular)
- Performing hemoglobin estimation by various methods
- Manual and automated blood cell counting (RBC, WBC, platelets)

• Differential leukocyte counting and interpretation • Preparation and use of anticoagulants • Quality control procedures in haematology laboratories • Safe handling and processing of clinical specimens • Data recording, analysis, and reporting of hematological test results.

Course Code: AHP-109	**Course Title: Communication Skills** **Type of Course: AECC**	**L-T-P-C**	3	0	0	3
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	The course aims to provide students with a foundational understanding of effective communication principles, focusing on verbal, non-verbal, and written communication in both personal and professional contexts. By the end of the course, students should be able to demonstrate improved interpersonal communication, active listening, clarity in message delivery, and the ability to communicate confidently and professionally in academic, healthcare, and workplace environments..					
Course Objective	• To enhance participants' understanding of the importance of first impressions and body language. • To develop effective communication skills, including verbal, nonverbal, written, and active listening. • To learn how to deliver bad news and handle difficult conversations professionally. • To understand the significance of etiquette and manners in healthcare settings. • To develop critical thinking and self-management skills for professional success.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:**					

	• Compose professional emails, presentations, and reports to effectively convey information. • Critique the effectiveness of various communication techniques in achieving specific objectives. • Analyze verbal and non-verbal communication styles across different contexts. • Recall and apply core communication principles such as active listening, empathy, and clarity. • Implement communication strategies to enhance teamwork, collaboration, and client interactions. • Describe the significance of communication in maintaining professionalism and workplace efficiency.			
Course Content:				
Module 1	**First Impressions and Body Language and The Importance of Communication**	Assignment/ Quiz	Numerical solving Task	**7 Sessions**
First Impressions and Body Language • The power of first impressions • Nonverbal communication cues (body language, facial expressions, gestures) • The impact of body language on perceived credibility and professionalism **The Importance of Communication** • Effective communication as a key to success • Types of communication (verbal, nonverbal, written) • Barriers to effective communication and how to overcome them				
Module 2	**Phonetics, Pronunciation, Active Listening & Reading Skills**	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**
Phonetics and Pronunciation • Consonant sounds and pronunciation • Vowel sounds and pronunciation • Syllables and syllable stress • Improving pronunciation and articulation **Active Listening**				

- The importance of active listening
- Techniques for effective listening
- Providing feedback and clarifying understanding

Communication Skills: Reading

- Effective reading techniques
- Comprehension strategies
- Critical reading and analysis

Module 3	**Questioning, Written Communication & Difficult Conversation**	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**

Questioning Skills

- Types of questions (open-ended, closed-ended, probing)
- Effective questioning techniques
- Active listening and questioning

Written Communication

- Effective writing styles and formats
- Business writing principles
- Email etiquette and professionalism

Delivering Bad News or Handling Difficult Conversations

- Strategies for delivering difficult news
- Handling objections and resistance
- Resolving conflicts and finding common ground

Module 4	**Healthcare Etiquette, Manners & Bedside Manne**	Assignment/ Quiz	Numerical solving Task	**8 Sessions**

Healthcare Success: Mastering Etiquette and Manners

- Importance of etiquette and manners in healthcare settings
- Professional demeanor and behavior
- Cultural sensitivity and awareness

Bedside Manners

- Communicating effectively with patients and their families
- Empathetic listening and understanding
- Building rapport and trust

Module 5	**Team Dynamics, Critical Thinking & Self-Management**	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Understanding Team Dynamics and Developing Critical Thinking

- Team roles and dynamics
- Effective teamwork and collaboration
- Critical thinking skills for problem-solving and decision-making

Self-Management: Building Inner Strength

- Time management and prioritization
- Stress management techniques
- Building resilience and emotional intelligence

Targeted Application & Tools that can be used:

- Email platforms (e.g., Gmail, Outlook) – for composing and managing professional correspondence.
- MS Word, MS PowerPoint – for preparing reports, official documents, and impactful presentations.
- Google Meet, Zoom, MS Teams – for practicing virtual communication and professional meetings.
- Speech analysis tools (e.g., Orai, Speeko) – for improving verbal delivery and confidence.
- Collaborative platforms (e.g., Google Docs, Trello) – for enhancing teamwork and written communication.
- Feedback and peer review tools – for evaluating communication effectiveness and making improvements.

Project Work/ Assignment:

- Prepare and deliver a 5-minute presentation on a professional or healthcare-related topic.
- Draft a professional email addressing a workplace scenario or client inquiry.
- Create a group report based on a role-play activity simulating a team meeting or patient interaction.
- Analyze a recorded video of a communication event and evaluate the verbal and non-verbal cues used.
- Conduct a mock interview with peer feedback to assess body language, tone, and

message clarity.

- Write a reflective journal on communication challenges faced during group assignments and how they were overcome.

Text Book(s):

- Meenakshi Raman & Sangeeta Sharma. (2020). *Technical Communication: Principles and Practice*. Oxford University Press.
- Leena Sen. (2015). *Communication Skills*. PHI Learning Pvt. Ltd.

Reference Book (s):

- Courtland L. Bovee, John V. Thill. (2021). *Business Communication Today*. Pearson Education.
- S.K. Mandal. (2011). *Effective Communication and Public Speaking*. Jaico Publishing House.
- Sharma, R.C., & Mohan, K. (2017). *Business Correspondence and Report Writing*. Tata McGraw-Hill.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://nptel.ac.in/courses/109/105/109105115/
- https://www.mooc.org/learn/communication-skills
- https://www.coursera.org/specializations/improve-english
- https://www.youtube.com/playlist?list=PLZfuPwA_hUaeDJ2IhdQpUfsC6x_dKXYTy
- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=communication+skills

Topics relevant to "SKILL DEVELOPMENT":

- Professional email and letter writing
- Verbal and non-verbal communication
- Presentation and public speaking skills
- Active listening and feedback techniques
- Group discussion and teamwork communication
- Telephone and virtual communication etiquette
- Interview communication and body language
- Conflict resolution and assertiveness
- Report writing and documentation skills
- Cross-cultural and workplace communication

Course Code: AHP-110	**Course Title: Environmental Sciences** **Type of Course: VAC**	**L-T-P-C**	2	0	0	2
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	The course aims to provide students with a foundational understanding and address environmental issues, promoting sustainability through knowledge of ecological systems, human impacts, and effective conservation and management practices.					
Course Objective	• To understand the basic concepts and principles of environmental science. • To study the structure and function of ecosystems and biodiversity. • To analyze the impact of human activities on the environment. • To explore methods of natural resource management and conservation. • To learn about environmental pollution, its types, causes, and control measures. • To develop awareness about sustainable development and environmental policies. • To enhance skills in environmental monitoring and assessment. • To promote responsible behaviour towards environmental protection and conservation.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** 1. Design sustainable solutions for environmental issues related to healthcare. 2. Evaluate the environmental impact of healthcare practices and propose alternatives. 3. Analyze the relationship between human health and environmental factors. 4. Recall basic environmental science concepts, such as ecosystems and pollution.					

	5. Apply environmental science principles to promote sustainability in healthcare settings. 6. Understand the importance of environmental protection for public health.			
Course Content:				
Module 1	**Components of Environment**	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Hydrosphere, lithosphere, atmosphere, biosphere – definitions and examples, interaction of man and environment, basic concepts of ecosystem, components of ecosystem, trophic levels, food chains and food webs, ecological pyramids, ecosystem functions, energy flow in ecological systems, characteristics of terrestrial, freshwater and marine ecosystems				
Module 2	**Global Environmental Problems**	Assignment/ Quiz	Memory Recall based Quizzes	**6 Sessions**
Greenhouse effect, acid rain, El Niño phenomenon, ozone depletion, deforestation, desertification, salination, biodiversity loss, chemical and radiation hazards				
Module 3	Environmental Pollution and Degradation	Assignment/ Quiz	Memory Recall-based Quizzes	**6 Sessions**
Pollution of air, water and land – causes, nature, impact and control strategies, pollution perspectives in urban, industrial and rural areas, habitat pollution by chlorinated hydrocarbons (DDT, PCBs, dioxin), endocrine-disrupting chemicals, nutrient pollution				
Module 4	Environmental Management and Protection	Assignment/ Quiz	Numerical solving Task	**6 Sessions**
Concept of health and sanitation, infectious and pollution-related diseases, disease control, health hazards from pesticides and metals, waste and solid waste management, environmental standards, Environmental Protection Act and laws, national movements and ethics, IUCN's role, UN declarations and human rights, implementation debates, Environmental Protection Agency (EPA)				
Module 5	Bioremediation and Waste	Assignment/ Quiz	Numerical solving Task	**4 Sessions**

		Treatment			

Oil spills, wastewater treatment, chemical degradation, heavy metals remediation

Targeted Application & Tools that can be used:

- Geographic Information Systems (GIS) for mapping and spatial analysis
- Remote sensing tools for environmental monitoring
- Environmental Impact Assessment (EIA) software
- Pollution monitoring instruments (air quality monitors, water testing kits)
- Bioremediation techniques and microbial assays
- Statistical software (e.g., R, SPSS) for environmental data analysis
- Waste management and recycling technologies
- Online databases for biodiversity and conservation (e.g., IUCN Red List)
- Modeling tools for climate change and ecosystem simulation
- Field survey equipment (soil testers, GPS devices, sampling kits)

Project Work/ Assignment:

• Study and report on local ecosystem and biodiversity

• Analyze causes and effects of a specific environmental pollution case

• Survey waste management practices in your community

• Prepare a presentation on major global environmental problems

• Monitor air or water quality in a selected area and analyze results

• Research the role of an international organization (e.g., IUCN, EPA) in environmental protection

Text Book(s):

• Cunningham, W.P., & Cunningham, M.A. (2017). *Environmental Science: A Global Concern*. McGraw-Hill Education.

• Odum, E.P. (2004). *Fundamentals of Ecology*. Brooks/Cole.

Reference Book (s):

• Agarwal, K.C. (2015). *Environmental Biology*. Nidi Publ. Ltd.

• Trivedi, R.K., & Goel, P.K. (1986). *Introduction to Air Pollution*. Techno-Science Publications.

• Sharma, B.K. (2019). *Environmental Chemistry*. Goel Publishing House.

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://nptel.ac.in/courses/120/104/120104009/

• https://www.khanacademy.org/science/biology/ecology

• https://openstax.org/details/books/environmental-science

•

https://www.slideshare.net/search/slideshow?searchfrom=header&q=environmental+science • https://www.youtube.com/playlist?list=PL9bw4S5ePsEEqjcY0b5e3-YfUo7T0Eftf
Topics relevant to "SKILL DEVELOPMENT": • Field sampling and data collection techniques • Use of GIS and remote sensing tools • Environmental impact assessment (EIA) methods • Pollution monitoring and analysis • Waste management practices • Water and soil testing procedures • Application of bioremediation techniques • Interpretation of ecological data and report writing • Use of statistical tools for environmental data • Awareness and implementation of environmental laws and regulations

SEMETER-3

Course Code: BMLT009	**Course Title:** Systematic Bacteriology **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course provides a comprehensive study of bacteria classification, identification, and taxonomy based on their morphology, physiology, biochemical characteristics, and genetic					

<table>
<tr><td></td><td colspan="4">relationships. It covers major bacterial groups, their clinical significance, and methods used in laboratory diagnosis. Emphasis is placed on understanding bacterial diversity and applying systematic approaches for accurate identification and characterization.</td></tr>
<tr><td>Course Objective</td><td colspan="4">• To understand the principles of bacterial classification and taxonomy.
• To identify major bacterial groups based on morphological, physiological, and biochemical characteristics.
• To learn laboratory techniques for isolation, culture, and identification of bacteria.
• To recognize the clinical significance of different bacterial species.
• To apply systematic approaches for accurate bacterial identification and characterization.
• To develop skills in interpreting bacteriological test results for diagnosis and research.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:

• Remember key concepts, terminology, and classifications of bacteria.
• Understand bacterial identification and classification methods.
• Apply laboratory techniques for bacterial isolation, identification, and culture.
• Analyze bacterial cultures and test results to identify pathogens.
• Evaluate diagnostic methods and treatment options for bacterial infections.
• Create clear laboratory reports documenting bacterial identification and clinical relevance</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Bacterial culture and Staining</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Instruments and techniques for seeding culture media and culture procedures. Key staining methods in bacteriology including simple, negative, Gram, Albert’s, Neisser’s, Ziehl–Neelsen, capsule, flagella, spore, and Fontana stains, with principles, reagent preparation, procedures, and interpretation.</td></tr>
</table>

Module 2	Biochemical tests for identification of different bacteria.	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**
Principles, procedures, and interpretation of key biochemical tests for bacterial identification, including Catalase, Coagulase, Indole, Methyl Red, Voges-Proskauer, Urease, Citrate, Oxidase, TSIA, Nitrate Reduction, Carbohydrate Fermentation, Hugh and Leifson, Bile Solubility, H_2S Production, Motility, Decarboxylase tests, CAMP, Hippurate Hydrolysis, Nagler's reaction, and Cholera Red reaction.				
Module 3	Key Bacterial Pathogens: Staphylococcus, Streptococcus, Pneumococcus, and Neisseria	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria: Staphylococcus, Streptococcus, Pneumococcus, Neisseria gonorrhoea and Neisseria meningitis.				
Module 4	Overview of Key Bacterial Pathogens	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Definition, classification, characteristics (morphological, cultural, biochemical), pathogenesis, laboratory diagnosis of Enterobacteriaceae (*Escherichia coli*, *Klebsiella*, *Salmonella*, *Shigella*), *Vibrio* species, *Clostridia* (wound infections), *Mycobacterium tuberculosis*				
Module 5	Pathogenesis, Diagnosis & Advanced Techniques	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Definition, classification, characteristics, pathogenesis, laboratory diagnosis of Spirochetes (*Treponema*, *Borrelia*, *Leptospira*), *Bordetella*, *Brucella*, *Rickettsia*, *Chlamydia*, *Actinomyces*, *Pseudomonas*, specimen collection from different body sites, advanced bacteriology instruments (CMIA, VITEK, BacT Alert 3D system)				
List of Laboratory Tasks: **Experiment No. 1:** Seeding culture media and plate culture techniques. **Experiment No. 2:** Basic staining methods – simple, Gram, Ziehl–Neelsen, capsule, and spore staining. **Experiment No. 3:** Key biochemical tests part 1 – Catalase, Coagulase, Indole, Methyl				

Red, Voges-Proskauer, Urease, Citrate.

Experiment No. 4: Key biochemical tests part 2 – Oxidase, TSIA, Nitrate reduction, carbohydrate fermentation, motility.

Experiment No. 5: Additional biochemical tests – CAMP, Hippurate hydrolysis, Nagler's reaction.

Experiment No. 6: Study of major pathogens – *Staphylococcus*, *Streptococcus*, *Neisseria*.

Experiment No. 7: Study of Enterobacteriaceae and *Mycobacterium tuberculosis*.

Experiment No. 8: Study of spirochetes and other important bacteria – *Treponema*, *Borrelia*, *Pseudomonas*.

Experiment No. 9: Specimen collection techniques for bacterial diagnosis.s.

Targeted Application & Tools that can be used:

- Clinical diagnosis of bacterial infections
- Antimicrobial susceptibility testing
- Use of staining and culture techniques for pathogen identification
- Application of biochemical tests for bacterial differentiation
- Automated diagnostic tools: VITEK, BacT/ALERT 3D, CMIA
- Use of safety tools: Biosafety cabinets, autoclaves, PPE
- Specimen collection tools: Swabs, transport media, culture bottles

Project Work/ Assignment:

- **Prepare a report** on isolation and identification of a bacterial pathogen from a clinical sample.
- **Case study analysis** of a bacterial infection outbreak and its laboratory diagnosis.
- **Comparative study** of manual vs. automated bacterial identification methods (e.g., VITEK vs. conventional).
- **Create a chart** or presentation on staining techniques with principles, reagents, and interpretation.
- ☐ **Design a specimen collection protocol** for various clinical samples with biosafety considerations.

Text Book(s):

• Ananthanarayan, R., & Paniker, C.K.J. (2021). *Textbook of Microbiology*. Universities Press.

• Baveja, C.P. (2023). *Textbook of Microbiology for Nurses and Allied Health Sciences*. Arya Publications.

Reference Book (s):

• Greenwood, D., Slack, R., & Peutherer, J. (2019). *Medical Microbiology: A Guide to Microbial Infections*. Elsevier.
• Willey, J.M., Sherwood, L.M., & Woolverton, C.J. (2022). *Prescott's Microbiology*. McGraw Hill.
• Brooks, G.F., Carroll, K.C., Butel, J.S., & Morse, S.A. (2021). *Jawetz, Melnick & Adelberg's Medical Microbiology*. McGraw Hill.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://nptel.ac.in/courses/102103044
- https://www.cdc.gov/labtraining/training-courses.html
- https://microbiologyonline.org/
- https://www.pathoma.com/
- ☐ https://www.youtube.com/c/Osmosis

Topics relevant to "SKILL DEVELOPMENT":

- Aseptic techniques and safe handling of clinical specimens
- Preparation and interpretation of bacterial culture and staining
- Performing and analyzing biochemical tests for bacterial identification
- Specimen collection and transport procedures
- Use of advanced diagnostic tools (VITEK, BacT/ALERT 3D, CMIA)
- Documentation and interpretation of lab results for clinical correlation
- Adherence to biosafety and infection control protocols
- Communication of laboratory findings in a healthcare setting

Course Code: BMLT010	**Course Title:** Basics of Medical Laboratory Technology **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course introduces students to the fundamental principles and practices of medical laboratory work. It covers basic laboratory techniques, specimen collection, safety protocols, and an overview					

	of key departments like hematology, biochemistry, and microbiology. Students will gain hands-on skills and learn to follow standard procedures and maintain laboratory safety.			
Course Objective	• To understand the structure of healthcare systems and the role of laboratories at various levels. • To gain basic knowledge of key laboratory departments and emerging techniques in medical lab science. • To identify the roles and responsibilities of a Medical Laboratory Technician in patient care. • To learn global best practices, including GCLP and OSHA safety guidelines. • To uphold patients' rights and ensure ethical, safe specimen collection. • To understand pre-analytical processes including collection, labeling, and quality control. • To develop basic skills in using laboratory equipment and performing analytical procedures. • To improve skills in observing, reporting, and interdepartmental communication.			
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Identify levels of healthcare delivery and types of laboratory facilities. • Describe functions and significance of core laboratory departments. • Explain the responsibilities and work scope of Medical Laboratory Technicians. • Apply standard laboratory safety and infection control practices. • Demonstrate correct specimen collection, labeling, and storage procedures. • Operate and maintain common laboratory instruments. • Follow quality control procedures during laboratory testing. • Record, interpret, and report basic laboratory test results			
Course Content:				
Module 1	Introduction to Healthcare and Laboratory Systems	Assignment/ Quiz	Numerical solving Task	**7 Sessions**
Overview of healthcare delivery, Hospital and diagnostic center functions, Laboratory				

structure at national/state/district levels, Role and scope of MLTs, Career opportunities, Interdisciplinary collaboration.				
Module 2	Laboratory Departments and Emerging Trends	Assignment/ Quiz	Memory Recall based Quizzes	**9 Sessions**
Overview of lab departments, Purpose of each department, Advanced lab techniques, Future trends in laboratory science, Automation in diagnostics.				
Module 3	Laboratory Practices and Patient Rights	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Good Clinical Laboratory Practices (GCLP), OSHA guidelines, International laboratory standards, Patients' rights and ethics, Ensuring patient comfort and safety.				
Module 4	Pre-Analytical and Analytical Testing Process	Assignment/ Quiz	Numerical solving Task	**13 Sessions**
Hygiene in specimen collection, Pre-analytical procedures, Specimen labeling and transport, Phlebotomy equipment, Analytical procedures, Equipment calibration and maintenance, Quality control, Error prevention.				
Module 5	Reporting and Communication	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Observation of results, Report interpretation, Documentation procedures, Intra- and inter-department communication, Data accuracy and reporting standards.				

Targeted Application & Tools that can be used:

- Hematology Analyzers – For complete blood counts, hemoglobin estimation, and differential leukocyte counts.
- Biochemistry Analyzers (Semi-auto and Fully Automated) – For testing liver, kidney, lipid, and metabolic profiles.
- Microscopes – For examination of blood smears, microbiology cultures, and histopathology samples.
- Centrifuges and pH Meters – For plasma/serum separation and analysis of body fluid pH.
- Phlebotomy Kits and Specimen Collection Tubes – For safe and accurate blood and fluid collection.

• Laboratory Information Management Systems (LIMS) – For data management, report generation, and quality control tracking.
• Personal Protective Equipment (PPE) Kits – For laboratory safety and infection control.
• Autoclaves and Incubators – For sterilization and culture growth in microbiology.
• Analytical Balances and Micropipettes – For precise measurement and sample handling.
• Educational Lab Simulation Software – For virtual training and skill development.

Project Work/ Assignment:

• Report on healthcare delivery levels and laboratory types.
• Presentation on Medical Laboratory Technician roles and responsibilities.
• Demonstration and documentation of specimen collection and handling.
• Operation and maintenance log of basic laboratory equipment.
• Analysis of common lab errors and strategies to prevent them.

Text Book(s):

• K. Sembulingam & Prema Sembulingam, *Essentials of Medical Physiology*, 7th Edition, Jaypee Brothers
• Mukherjee, *Medical Laboratory Technology: Methods and Interpretations*, 4th Edition, Tata McGraw-Hill

Reference Book (s):

• Ananthanarayan & Paniker, *Textbook of Microbiology*, 11th Edition, Universities Press
• Henry's Clinical Diagnosis and Management by Laboratory Methods, 23rd Edition, Elsevier
• Bishop, Fody & Schoeff, *Clinical Chemistry: Principles, Techniques, and Correlations*, 7th Edition, Lippincott Williams & Wilkins
• Barbara H. Estridge & Mary Ann Van Dongen, *Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications*, 3rd Edition, Delmar Cengage Learning

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://archive.org/details/manualofmedicall0000unse
- https://archive.org/details/smtebooks.commedicallaboratorysciencereview4thediti on
- https://elearning.ndu.edu.ng/files/virtual-library/Download_PDFS/textbook_of_medical_laboratory_technology.pdf
- https://alison.com/course/medical-laboratory-technician-training

• https://arup.utah.edu/education/videoIndex.php • https://www.youtube.com/playlist?list=PLvWDObGOvzfQo06hxtafDD2ceQ8XZrZ-C
Topics relevant to "SKILL DEVELOPMENT": • Understanding and practicing specimen collection techniques • Operating and maintaining laboratory equipment • Applying quality control measures in laboratory processes • Effective communication and reporting within healthcare teams • Adhering to laboratory safety and ethical standards

Course Code: BMLT011	**Course Title:** Biochemical Metabolism **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	The course aims to provide students with a foundational understanding of the principles and concepts of biochemistry, focusing on the chemical processes and molecular interactions that occur within living organisms. By the end of the course, students should be able to comprehend the structure and function of biomolecules, the metabolic pathways involved in energy production and cellular processes, and the biochemical basis of genetic information transfer.					
Course Objective	• To understand the fundamental principles of clinical biochemistry and the composition of body fluids. • To learn common biochemical pathways and their relevance to human health. • To develop practical skills in specimen collection, handling, and preparation for biochemical analysis. • To become proficient in using biochemical laboratory instruments and equipment. • To apply laboratory safety protocols and maintain quality control in clinical biochemistry testing.					

	• To recognize common metabolic and biochemical disorders through laboratory findings. • ☐ To interpret biochemical test results to support clinical diagnosis and patient care.			
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Develop a biochemical pathway chart illustrating metabolic processes. • Critique enzyme roles and the effects of enzyme inhibitors on metabolism. • Analyze metabolic pathways involved in energy production. • Memorize key enzymes and intermediates in major metabolic pathways. • Apply metabolic principles to understand metabolic disorders. • Describe energy conversion processes in the body.			
Course Content:				
Module 1	**Introduction to Biochemistry and Carbohydrates**	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Introduction to Biochemistry: Definition, scope, branches, importance, bioelements, biomolecules, and career opportunities. **Carbohydrates**: Classification, properties, functions, key derivatives (sugars, amino sugars, acids), and structures (amylose, amylopectin, glycogen, etc.) with their biological significance.				
Module 2	**Lipids, Proteins, and Nucleic Acids**	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**
Lipids: Introduction, Classification and functions of lipids; Classification and functions of fatty acids; and Clinical aspects of lipids. Protein: Introduction, classification, and structures. Nucleic Acids: Introduction, structures and Clinical aspects				
Module 3	**Enzymes and Hormones**	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**

Enzymes: Chemical nature, classification, properties, factors affecting activity, enzyme inhibition, and diagnostic enzymes.
Hormones: Classification, chemical nature, general functions, mechanisms of action, and clinical significance.

Module 4	**Vitamins & Minerals**	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Vitamins: Characteristics, Classification, and functions; Dietary sources; and Clinical aspects
Minerals: Key minerals and their importance

Module 5	**Metabolic profiles**	Assignment/ Quiz	Numerical solving Task	**8 Sessions**

Carbohydrate metabolism(glycolysis),Krebs cycle, Glycogenesis, lipid metabolism, amino acid metabolism, urea cycle

List of Laboratory Tasks:

Experiment No. 1: Introduction to the biochemistry laboratory – familiarization with glassware, equipment, chemicals, and reagents.

Experiment No. 2: Learning and applying general laboratory safety rules and guidelines.

Experiment No. 3: Understanding bioethical considerations and laboratory waste management.

Experiment No. 4: Handling and adherence to SOPs for laboratory instruments and safety protocols.

Experiment No. 5: Handling hazardous chemicals, emergency procedures, and usage of safety equipment.

Experiment No. 6: Application of various sterilization techniques – heat, chemical, and pressure-based methods.

Experiment No. 7: Preparation and dilution of chemical reagents and solutions, minimizing errors in measurements.

Experiment No. 8: Qualitative test for carbohydrates – identification of known and unknown samples.

Experiment No. 9: Investigative analysis of unknown carbohydrates using chemical reagents.

Experiment No. 10: Qualitative test for proteins – identification of known and unknown samples.

Experiment No. 11: Investigative analysis of unknown proteins using chemical methods.

Experiment No. 12: Comprehensive practical analysis to identify unknown macronutrients in samples.

Targeted Application & Tools that can be used:

- **Colorimeter and Spectrophotometer** – For estimation of biomolecules like glucose, urea, creatinine, and enzyme activities.
- **Semi-auto and Fully Automated Biochemistry Analyzers** – For routine clinical testing of liver, kidney, lipid, and metabolic profiles.
- **Centrifuge and pH Meter** – For sample preparation (plasma/serum separation) and pH analysis of body fluids.
- **Diagnostic Test Kits and Reagents** – Glucose, urea, creatinine, cholesterol, bilirubin, and electrolyte kits used in routine lab testing.
- **Glassware and Micropipettes** – Test tubes, cuvettes, beakers, and micropipettes for accurate sample handling and measurements.
- **Point-of-Care Devices (e.g., Glucometer, Urine Strip Analyzer)** – For rapid bedside or field-level biochemical tests.

Project Work/ Assignment:

• **Blood Glucose Estimation** – Estimate blood glucose using the colorimetric GOD-POD method; interpret and report findings.
• **Buffer Preparation and pH Measurement** – Prepare buffer solutions and measure their pH using a pH meter; understand buffering capacity.
• **Serum Urea and Creatinine Analysis** – Perform urea and creatinine estimation; compare values and assess renal function.
• **Liver Function Test (LFT) Panel** – Estimate bilirubin, AST, ALT, and ALP; prepare a complete LFT report with interpretation.
• **Use of Semi-Auto Analyzer** – Operate a semi-auto biochemistry analyzer for selected tests; record and interpret automated results.
• **Glucometer Accuracy Assessment** – Measure glucose using a glucometer and compare with lab-based colorimetric results; analyze accuracy and clinical relevance.

Text Book(s):

• **Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K.** (2022). *Textbook of Biochemistry for Medical Students*. Jaypee Brothers Medical Publishers.
• **Ambika Shanmugam.** (2023). *Fundamentals of Biochemistry for Medical Students*. Wolters Kluwer.
• **Pankaja Naik.** (2021). *Biochemistry for Nurses*. Jaypee Brothers Medical Publishers.

Reference Book (s):

• **Satyanarayan, U., & Chakrapani, U.** (2023). *Essentials of Biochemistry*. Elsevier Health Sciences.
• **Thomas M. Devlin.** (2022). *Textbook of Biochemistry with Clinical Correlations*. Wiley.

• **Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W., & Weil, P. A.** (2023). *Harper's Illustrated Biochemistry*. McGraw-Hill Education. **Online Resources (e-books, notes, ppts, video lectures etc.):** • https://openstax.org/books/biochemistry/pages/1-introduction • https://www.biologydiscussion.com/biochemistry • https://www.slideshare.net/search/slideshow?searchfrom=header&q=clinical+biochemistry • https://www.youtube.com/playlist?list=PLD5BC727C84F5D620 • https://swayam.gov.in/nd1_noc24_bt17/preview
Topics relevant to "SKILL DEVELOPMENT": • Preparation and Standardization of Buffers • Operation and Maintenance of Colorimeter and Spectrophotometer • Estimation of Blood Glucose, Urea, and Creatinine • Liver Function Test (LFT) Parameter Estimation and Interpretation • Use of Semi-Auto and Fully Automated Biochemistry Analyzers • Performing and Interpreting Point-of-Care Tests (e.g., Glucometer) • Sample Collection, Handling, and Processing Techniques • Laboratory Safety and Biomedical Waste Disposal in Biochemistry Labs ☐Recording and Reporting of Biochemical Test Results

Course Code: BMLT012	**Course Title: Applied Haematology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course offers essential knowledge and practical skills in blood cell morphology, hematopoiesis, and common hematological disorders. It focuses on diagnostic techniques like complete blood counts, peripheral smears, and coagulation tests. Students will learn to interpret hematological findings and apply quality control measures, preparing them for roles in clinical diagnosis and patient care.					

<table>
<tr><td>Course Objective</td><td colspan="4">• To understand the structure, function, and development (hematopoiesis) of blood cells.
• To identify and classify common hematological disorders based on morphological and physiological findings.
• To perform and interpret routine hematological tests such as complete blood counts and peripheral smear examinations.
• To develop competency in specialized techniques for diagnosing anemia, leukemia, and coagulation disorders.
• To apply quality control practices in hematology laboratories for accurate and reliable results.
• To correlate hematological findings with clinical conditions to support patient diagnosis and care.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:
• Remember key concepts and techniques in hematology, including blood cell types and functions.
• Understand the principles of hematological tests like CBC and coagulation studies.
• Apply hematological techniques for tests such as blood smears and hemoglobin analysis.
• Analyze results to diagnose conditions like anemia and leukemia.
• Evaluate hematological methods and their clinical relevance.
• Create accurate laboratory reports to support clinical decision-making.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>RBCs and Anaemia: Formation,Characteristics , And Management Strategies</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>Sessions</td></tr>
<tr><td colspan="5">RBCs, formation, morphology, cytoskeleton, anisocytosis, poikilocytosis, metabolism, role of 2, 3- BPG and oxygen dissociation curve. Anaemia and its classification, Morphological and etiological, pathogenesis, laboratory investigations and management, Iron deficiency</td></tr>
</table>

anaemia, metabolism of iron, pathogenesis, laboratory investigations and management, principle and procedure of special test. Megaloblastic anaemia, pernicious anaemia, pathogenesis, laboratory investigations

Module 2	Hemoglobin: Synthesis, Types, and Hemolytic Anemia Mechanism	Assignment/ Quiz	Memory Recall based Quizzes	**Sessions**

Complete blood count, determination by automated method, significance of each parameter, reticulocyte count, haemoglobin, its synthesis and types, normal and abnormal hemoglobins, extravascular and intravascular hemolysis, ABO and Rh blood group system, haemolytic anaemia, pathogenesis and laboratory investigations, principle and procedure of special tests, G-6-PD.

Module 3	Leukopoiesis, Leukocyte Maturation, And Hematological Abnormalities	Assignment/ Quiz	Memory Recall-based Quizzes	**Sessions**

Leukopoiesis, stages of leukocyte maturation, features of cell identification, leucocytosis and leucocytopenia, neutrophilia, eosinophilia, basophilia, monocytosis, lymphocytosis, neutropenia, lymphopenia, causes and significance, toxic granulation, morphological alterations in neutrophils, effect of HIV on blood cell parameters.

Module 4	Hemostasis & Coagulation: Platelet Development, Processes, Fibrinolysis	Assignment/ Quiz	Numerical solving Task	**Sessions**

Overview of hemostasis and coagulation, stages of platelet development, primary and secondary hemostasis, role of platelets, role of coagulation factors, coagulation inhibitory system, fibrinolysis.

Module 5	Hematology Diseases	Assignment/ Quiz	Numerical solving Task	**Sessions**

General blood picture, estimation of iron, TIBC, transferrin, ferritin, plasma haemoglobin, vitamin B12, folic acid, FIGLU test, Schilling test, parietal cell antibodies, G-6-PD, osmotic fragility test, Heinz bodies, Perls' Prussian blue staining, platelet count, platelet aggregation test, PT, INR, APTT, mixing experiments in PT and APTT, thrombin time.

List of Laboratory Tasks:

Experiment No. 1: To perform bleeding time.

Experiment No. 2: To perform clotting time.

Experiment No. 3: To perform blood grouping by slide method.

Experiment No. 4: To perform blood grouping by tube method.

Experiment No. 5: Determination of haemoglobin by various methods.

Experiment No. 6: Determination of total RBC count.

Experiment No. 7: Determination of packed cell volume (PCV).

Experiment No. 8: Determination of red cell indices.

Experiment No. 9: Demonstration of hypochromic microcytic slide.

Experiment No. 10: General blood picture.

Experiment No. 11: Determination of G-6-PD.

Experiment No. 12: Differential leucocyte count.

Experiment No. 13: Absolute leucocyte count.

Experiment No. 14: Demonstration of toxic granulation of neutrophils.

Experiment No. 15: To perform Prothrombin Time (PT) and calculate INR.

Experiment No. 16: To perform Activated Partial Thromboplastin Time (APTT).

Experiment No. 17: To perform sickling test.

Experiment No. 18: Determination of plasma hemoglobin.

Experiment No. 19: To perform reticulocyte count.

Targeted Application & Tools that can be used:

- **Automated Hematology Analyzer** – For performing Complete Blood Count (CBC), red cell indices, and flagging abnormal parameters.
- **Microscope with Oil Immersion Objective** – For peripheral blood smear examination, identifying morphological abnormalities in red and white blood cells.
- **Hemoglobinometer (e.g., Sahli's or Cyanmethemoglobin method)** – For quantitative estimation of hemoglobin concentration.
- **Coagulometer or Manual PT/APTT Kits** – For evaluating clotting pathways via Prothrombin Time (PT), International Normalized Ratio (INR), and Activated Partial Thromboplastin Time (APTT).
- **Slide and Tube Blood Grouping Kits** – For determining ABO and Rh blood groups using standard serological methods.

Project Work/ Assignment:

- • Prepare a brief report on types of anaemia and related diagnostic tests.
  • Perform and interpret a reticulocyte count in different anaemic conditions.
  • Compare manual and automated hematology analyzers with pros and cons.
  • Conduct a mini-project on bleeding disorders using PT, APTT, and platelet count.
  • Present a short case study on G-6-PD deficiency or sickle cell anaemia with test interpretation

Text Book(s):

• **Rodak's Hematology: Clinical Principles and Applications**, 6th Edition – Elsevier.

• **Dacie and Lewis Practical Haematology**, 12th Edition – Elsevier.

Reference Book (s):

• **Bain B.J. – Blood Cells: A Practical Guide**, 5th Edition – Wiley-Blackwell.

• **Ramnik Sood – Laboratory Technology (Methods and Interpretations)**, 7th Edition – Jaypee Brothers.

• **Barbara J. Bain – Essential Haematology**, 7th Edition – Wiley-Blackwell.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://archive.org/details/HematologyClinicalPrinciplesAndApplicationsRodak
- https://easybiologyclass.com/microbiology-lecture-notes-study-materials-online-tutorials-for-students-teachers/
- https://www.readanybook.com/ebook/applied-bacteriology-an-introductory-handbook-for-the-use-of-students-of-439520
- https://mgkmicro.com/BIOL257/lectures.html
- https://www.youtube.com/watch?v=pB26B2CXi2U
- https://slideplayer.com/slide/11860742/

Topics relevant to "SKILL DEVELOPMENT":

- Blood sample collection, anticoagulants, and transport techniques
- Preparation and staining of peripheral blood smears
- Identification and interpretation of abnormal blood cell morphology
- Hemoglobin estimation and red cell indices determination
- Coagulation testing methods (PT, APTT, INR)
- Screening tests for haemolytic anaemia (e.g., G-6-PD, osmotic fragility)
- Platelet count and evaluation of platelet function
- Reticulocyte count and its clinical significance
- Automation in haematology: usage and interpretation of analyzer results
- Quality control and assurance in haematology laboratory procedures

SEMESTER- 4

Course Code: BMLT014	**Course Title: Applied Bacteriology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						

Course Pre-requisites	NONE
Anti-requisites	NONE
Course Description	This course offers in-depth knowledge and practical exposure to bacterial structure, classification, cultivation, and identification. It emphasizes the clinical significance of pathogenic bacteria, diagnostic bacteriological techniques, antimicrobial resistance, and infection control practices. Students will develop skills necessary for handling clinical specimens, interpreting culture results, and applying bacteriological knowledge in clinical and public health laboratories..
Course Objective	• To understand the morphology, physiology, and classification of medically important bacteria. • To learn methods of bacterial cultivation, staining, and identification in clinical specimens. • To acquire knowledge of bacterial pathogenesis and host interactions. • To apply standard bacteriological techniques for diagnosis and treatment guidance. • To recognize the mechanisms and implications of antimicrobial resistance. • To practice infection control measures and biosafety in bacteriological work.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in bacteriology, including bacterial classification and morphology. • Understand bacterial identification principles and their role in infections. • Apply techniques for isolating, identifying, and testing bacterial pathogens. • Analyze bacterial cultures and identify pathogens using diagnostic methods. • Evaluate bacteriological techniques for accuracy and clinical relevance. • Create clear laboratory reports documenting bacterial identification

	and susceptibility.			
Course Content:				
Module 1	Diagnostic Strategies for Infective Syndromes	Assignment/ Quiz	Numerical solving Task	**12 Sessions**
Samples of choice, sample collection, transportation, processing of samples, diagnosis of septicemia, bacteremia, URTI, LRTI, wound infections, skin infections, deep sepsis, UTIs, genital tract infections, meningitis, GI infections, enteric fever, tuberculosis (pulmonary and extra-pulmonary)				
Module 2	Antibiotic Susceptibility Testing	Assignment/ Quiz	Memory Recall based Quizzes	**8 Sessions**
Definition of antibiotics, culture media for AST, preparation of inoculum, standardization of inoculum, control bacterial strains, antibiotic selection, MIC, MBC, determination methods, Stokes method, Kirby-Bauer method				
Module 3	Automation & Molecular Techniques	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Automation in bacterial culture, automated AST systems, PCR basics, nucleic acid-based diagnostics, resistance genes in diarrhea, role of microbiota in gene dissemination				
Module 4	Environmental Specimen Examination	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Water sample collection and transport, presumptive coliform count, Eijkman test, indicator bacteria, membrane filtration, milk grading, bacteriological tests of milk, air bacteriology significance, settle plate method, air sampling instruments, air sample collection and reporting				
Module 5	Nosocomial Infections & Epidemiology	Assignment / Quiz	Numerical solving Task	**8 Sessions**

Introduction to nosocomial infections, infection sources and types, hospital environment surveillance, microbiology lab role, epidemiological markers, serotyping, phage typing, bacteriocin typing, lyophilization basics

List of Laboratory Tasks:

Experiment No. 1: Inoculation of different culture media and observation of bacterial growth patterns.

Experiment No. 2: Isolation of pure cultures using streak plate technique.

Experiment No. 3: Processing of clinical samples (Blood, Throat swab, Sputum, Pus, Urine, Stool, CSF) for bacterial culture and identification.

Experiment No. 4: Performing antimicrobial susceptibility testing using standard methods.

Experiment No. 5: Preparation and standardization of inoculum for antibiotic testing.

Experiment No. 6: Determination of MIC and MBC for a known bacterium using broth dilution method.

Experiment No. 7: Antibiotic susceptibility testing of clinical isolates using Stokes method.

Experiment No. 8: Antibiotic susceptibility testing of clinical isolates using Kirby-Bauer disk diffusion method.

Experiment No. 9: Collection, transportation, and processing of water, milk, food, and air samples for bacteriological examination.

Experiment No. 10: Demonstration of sterility testing for intravenous fluids with controls.

Experiment No. 11: Demonstration of bacterial serotyping and bacitracin sensitivity testing.

Experiment No. 12: Demonstration of bacterial preservation by lyophilization.

Experiment No. 13: Demonstration of standard reference bacterial strains and their characteristics.

Experiment No. 14: Demonstration of Polymerase Chain Reaction (PCR) for bacterial DNA detection.

Experiment No. 15: Demonstration of automation in bacterial culture and susceptibility testing.

Targeted Application & Tools that can be used:

- **Inoculating Loops and Bunsen Burner** – For aseptic transfer and culturing of bacteria.
- **Incubators and Anaerobic Jars** – For providing optimal growth conditions for aerobic and anaerobic bacteria.
- **Autoclave and Hot Air Oven** – For sterilization of media, glassware, and equipment.

- **Microscopes (Light & Phase Contrast)** – For observing bacterial morphology, Gram staining, and motility.
- **Laminar Air Flow Cabinet** – For safe and sterile processing of samples in microbiology.
- ☐ **Culture Media (Selective, Differential, Enriched)** – For isolation and identification of bacterial species.

Project Work/ Assignment:

- **Prepare a detailed report on bacterial pathogens responsible for hospital-acquired infections (HAIs)** including sample collection and diagnostic strategy.
- **Design and conduct an antibiotic susceptibility testing experiment** on a known bacterial strain using both Stokes and Kirby-Bauer methods.
- **Create a comparative chart of manual vs. automated bacterial culture methods**, highlighting their advantages, limitations, and applications.
- **Develop a mini-project on water/milk/air bacteriological analysis**, including sample collection, processing, and result interpretation.
- **Prepare a case study on the role of PCR in detecting bacterial resistance genes**, detailing its principle, steps, and interpretation.

Text Book(s):

- **Ananthanarayan & Paniker** – *Textbook of Microbiology*, 11th Edition, Universities Press.
- **Prescott, Harley & Klein** – *Microbiology*, McGraw Hill Education.

Reference Book (s):

- **Cappuccino & Sherman** – *Microbiology: A Laboratory Manual*, Pearson Education.
- **Koneman** – *Color Atlas and Textbook of Diagnostic Microbiology*, Lippincott Williams & Wilkins.
- **Mackie & McCartney** – *Practical Medical Microbiology*, Elsevi

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://archive.org/details/HematologyClinicalPrinciplesAndApplicationsRodak
- https://easybiologyclass.com/microbiology-lecture-notes-study-materials-online-tutorials-for-students-teachers/

• https://www.readanybook.com/ebook/applied-bacteriology-an-introductory-handbook-for-the-use-of-students-of-439520 • https://mgkmicro.com/BIOL257/lectures.html • https://www.youtube.com/watch?v=pB26B2CXi2U • https://slideplayer.com/slide/11860742/
Topics relevant to "SKILL DEVELOPMENT": • Sample collection and transport techniques • Preparation and inoculation of culture media • Isolation and identification of bacterial pathogens • Antibiotic susceptibility testing methods (Kirby-Bauer, Stokes) • Use of molecular techniques like PCR in bacterial diagnosis • Sterility testing and quality control procedures • Handling and processing of environmental samples (water, milk, air) • Interpretation of laboratory results and reporting • Automation in bacterial culture and antimicrobial susceptibility testing • Application of epidemiological typing methods (serotyping, phage typing)

Course Code: BMLT015	**Course Title: Clinical Pathology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	Clinical Pathology focuses on the laboratory analysis of bodily fluids and tissues to diagnose and monitor diseases. It covers principles and techniques used in hematology, clinical chemistry, microbiology, immunology, and transfusion medicine. The course emphasizes the interpretation of laboratory results to aid clinical decision-making and patient care.					
Course Objective	• To understand the principles and applications of clinical laboratory testing.					

	• To learn methods for proper collection, handling, and analysis of clinical specimens. • To acquire skills in hematology, clinical chemistry, microbiology, and immunology tests. • To interpret laboratory results for disease diagnosis and patient management. • To apply quality control, safety protocols, and good laboratory practices.			
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in clinical pathology, including specimen collection and processing. • Understand the principles of clinical pathology tests like urinalysis and body fluids analysis. • Apply clinical pathology methods for accurate sample analysis and result interpretation. • Analyze results to diagnose diseases such as infections and metabolic disorders. • Evaluate clinical pathology methods for their diagnostic value. • Create clear reports documenting findings and their clinical significance.			
Course Content:				
Module 1	Urine Analysis	Assignment/ Quiz	Numerical solving Task	**12 Sessions**
URINE: Urine meter, Esbachl's Albuminometer, preparation ofvarious reagents. Composition, collection and preservation of urine for various tests, physical chemical and microscopic examination of urine, estimation of total albumin, Specific gravity, litmus paper, tests for albumin, sugar, blood, bile salts and pigments, urobilinogen, ketones bodies etc.				
Module 2	Body Fluids	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**

CEREBROSPINAL FLUID: Pandy's test, Cell count, cell type differential count and malignant cells.

BODIES FLUID: Cells start; sell morphology and detection of malignant cells in peritoneal fluid, pleured fluid, pericardial fluid, and synovial fluid. Differences between transuded and exudates.

SPUTUM: Sample collection, stain and study of A.F.B.

Module 3	Stool Analysis	Assignment/ Quiz	Memory Recall-based Quizzes	**7 Sessions**

STOOL: Sample collection, physical, chemical and microscopicexamination.

Module 4	Semen Analysis	Assignment/ Quiz	Numerical solving Task	**6 Sessions**

SEMEN: Sample collections microscopic examination for countand malignant and morphology.

Module 5	Museum Techniques	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Museum: Mounting of specimens, labeling, maintenance ofspecimens and catalogue etc. Post mortem/ Autopsy: Maintenance of the records of the Dead Bodies and specimens received, Autopsy techniques, Autopsy instruments, cold storage plants, legal aspects etc.

List of Laboratory Tasks:

Experiment No. 1: Collection procedures of urine and important precautions for sample collection.

Experiment No. 2: Physical, chemical, and microscopic examination of urine samples.

Experiment No. 3: Urine testing for reducing sugar, protein, blood, and ketone by strip method.

Experiment No. 4: Microscopic examination of urine sediments.

Experiment No. 5: Physical examination and total count of body fluids.

Experiment No. 6: Differential count on stained smears of body fluids.

Experiment No. 7: Collection procedures and precautions for stool, CSF, semen, and other body fluids.

Experiment No. 8: Preparation of stains and reagents used for clinical diagnostic purposes.

Targeted Application & Tools that can be used:

• Microscopes – For detailed examination of urine sediments, body fluids, and stained smears.
• Urine Test Strips – For rapid detection of chemical components like glucose, protein, blood, and ketones.
• Centrifuge – To concentrate urine sediments and body fluids for microscopic analysis.
• Automated Analyzers – For physical and chemical analysis of urine and other body fluids.
• Staining Kits and Reagents – For preparing and staining smears for differential cell counts and pathogen identification.

Project Work/ Assignment:

• Case study analysis of urine reports for diagnosing renal and systemic conditions.
• Preparation and presentation of a urine analysis report with physical, chemical, and microscopic findings.
• Comparative study of different body fluids (CSF, pleural fluid, ascitic fluid) with diagnostic interpretation.
• Practical demonstration on preparation of clinical reagents and stains used in pathology.
• Interpretation and documentation of fluid cytology and cell counts from real or simulated samples

Text Book(s):

- **Ananthanarayan & Paniker** – *Textbook of Microbiology*, 11th Edition, Universities Press.
- **Prescott, Harley & Klein** – *Microbiology*, McGraw Hill Education.

Reference Book (s):

- **Cappuccino & Sherman** – *Microbiology: A Laboratory Manual*, Pearson Education.
- **Koneman** – *Color Atlas and Textbook of Diagnostic Microbiology*, Lippincott Williams & Wilkins.
- **Mackie & McCartney** – *Practical Medical Microbiology*, Elsevi

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://archive.org/details/clinicalpathology
- https://www.ncbi.nlm.nih.gov/books/NBK558937/

• https://www.youtube.com/playlist?list=PLD6w1BYkQOpSZ86tO8gxIXLdxUnUetoxf • https://www.medilib.ir/Topic/2174 • https://www.pathologyoutlines.com/
Topics relevant to "SKILL DEVELOPMENT": • Accurate collection, labeling, and preservation of clinical specimens • Physical, chemical, and microscopic examination of urine • Analysis and interpretation of body fluids (CSF, pleural, ascitic, synovial) • Stool and semen sample examination and reporting • Use of diagnostic reagents, staining techniques, and microscope handling • Identification of normal vs. pathological findings in clinical samples • Reporting and documentation following laboratory quality protocols • Correlation of clinical findings with pathological results • Understanding of biosafety and infection control in sample processing • Effective communication and documentation of laboratory findings

Course Code: BMLT016	**Course Title: Diagnostic Biochemistry** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course focuses on the biochemical basis of diseases and the diagnostic use of biochemical tests. It covers the analysis of blood, urine, and other body fluids to assess organ function, detect metabolic disorders, and monitor disease progression. Emphasis is placed on test interpretation, quality control, and the use of automated and point-of-care diagnostic tools.					
Course Objective	• To understand the principles and applications of biochemical investigations in clinical diagnostics.					

<table>
<tr><td></td><td colspan="4">To learn methods for proper collection, handling, and analysis of blood, urine, and other body fluids.
To acquire skills in performing tests related to liver, kidney, carbohydrate, lipid, and protein metabolism.
To interpret biochemical test results for the diagnosis, prognosis, and monitoring of diseases.
To apply concepts of quality control, biosafety, and good laboratory practices in biochemical testing.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:
Remember key concepts and techniques in diagnostic biochemistry and the role of biochemical markers.
Understand the principles and clinical applications of biochemical tests.
Apply laboratory techniques for biochemical analyses such as enzyme assays and metabolic testing.
Analyze test results to identify abnormalities and assist in diagnosis.
Evaluate the effectiveness and relevance of biochemical methods in clinical practice.
Create clear laboratory reports with accurate findings and clinical interpretations.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Spectrophotometryand colorimetry</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Introduction, Theory of spectrophotometry and colorimetry, Lambert`s law and Beer`s law, Applicationsof colorimetry and spectrophotometry</td></tr>
<tr><td>Module 2</td><td>Photometry</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>7 Sessions</td></tr>
</table>

Introduction, General principles of flame photometry,Limitations of flame photometry, Instrumentation, applications of flame photometry, atomic absorption Spectroscopy – Principle & applications

Module 3	Chromatography	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**

Introduction, Types of chromatography, Paper Chromatography: Introduction, principle, types, details for qualitative and quantitative analysis, application, Thin layer chromatography: Introduction, experimental techniques, application of TLC, limitations, High performance thin layer chromatography, Column chromatography: Introduction, principle column efficiency, application of column chromatography

Module 4	Advanced Chromatography	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Gas chromatography: Introduction principle, instrumentation, application, Ion exchange chromatography: Introduction, Definition and principle, cation and anion exchangers, application, Gel Chromatography: Introduction Principle and method, application and advantages

Module 5	Electrophoresis	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Introduction, Principle, Instrumentation, Applications, Types of electrophoresis, Paper electrophoresis, Gel electrophoresis

List of Laboratory Tasks:

Experiment No. 1: Determination of unknown concentration using Beer-Lambert's Law.

Experiment No. 2: Estimation of hemoglobin using colorimetry.

Experiment No. 3: Determination of sodium and potassium in serum using flame photometry.

Experiment No. 4: Quantitative estimation of calcium using Atomic Absorption Spectroscopy (AAS).

Experiment No. 5: Separation of amino acids using paper chromatography.

Experiment No. 6: Separation of plant pigments using Thin Layer Chromatography (TLC).

Experiment No. 7: Purification of a mixture using column chromatography.

Experiment No. 8: Separation of volatile compounds using Gas Chromatography (GC).

Experiment No. 9: Separation of serum proteins using paper electrophoresis.

Experiment No. 10: DNA separation using gel electrophoresis.

Targeted Application & Tools that can be used:

- **Spectrophotometry & Colorimetry**: Used for estimation of biochemical substances like hemoglobin, glucose, urea, and proteins in clinical samples.
- **Flame Photometry & Electrolyte Analysis**: Essential for detecting and monitoring serum sodium and potassium levels in electrolyte imbalance cases.
- **Chromatographic Techniques (Paper, TLC, Column, Gas Chromatography)**: Applied for separation and identification of amino acids, pigments, drugs, and volatile compounds in diagnostic investigations.
- **Electrophoresis (Paper & Gel)**: Used for separation and analysis of serum proteins and nucleic acids in genetic and metabolic disorder diagnosis.
- □ **Automated Biochemistry Analyzer & AAS (Atomic Absorption Spectroscopy)**: Employed for high-throughput, accurate quantitative analysis of calcium and trace elements in body fluids.

Project Work/ Assignment:

- Comparative analysis of glucose levels using different biochemical methods (GOD-POD vs. Hexokinase method).
- Project on correlation between serum electrolytes and kidney function in clinical cases.
- Assignment on standardization and quality control in automated biochemistry analyzers.
- Study and report on biochemical markers in liver and renal function tests.
- Case-based assignment: Interpretation of diagnostic biochemical reports for metabolic disorders (e.g., diabetes, jaundice, renal failure).

Text Book(s):

- **Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K.** – *Textbook of Biochemistry for Medical Students*, Jaypee Brothers Medical Publishers.
- **Satyanarayana, U., & Chakrapani, U.** – *Essentials of Biochemistry*, Elsevier.

Reference Book (s):

- **Pankaja Naik** – *Biochemistry for Medical Laboratory Technology Students*, Jaypee Brothers.
- **Tietz Textbook of Clinical Chemistry and Molecular Diagnostics** – *Carl A. Burtis & David E. Bruns*, Elsevier.

- **Bharat Biotech Manual of Clinical Biochemistry** – *In-house reference manual for laboratory practice*.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://archive.org/details/textbookofbiochemistry
- https://www.youtube.com/playlist?list=PLG9aCp4uE-s3TrN09d4Q7vscH3QzQfMKN
- https://elearning.ndu.edu.ng/files/virtual-library/Download_PDFS/textbook_of_medical_laboratory_technology.pdf
- https://www.khanacademy.org/science/biology/macromolecules
- https://nptel.ac.in/courses/102/103/102103044/

Topics relevant to "SKILL DEVELOPMENT":

- Specimen collection, handling, and processing techniques
- Operation of biochemistry analyzers (colorimeter, spectrophotometer, flame photometer, etc.)
- Mastery of diagnostic biochemical tests for blood, serum, and urine
- Analytical thinking and clinical data interpretation
- Calibration, quality control, and troubleshooting of instruments
- Maintenance of laboratory safety, ethics, and documentation standards
- Application of biochemical principles in disease diagnosis and monitoring

Course Code: BMLT017	**Course Title: Clinical Mycology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course focuses on the biology and clinical significance of medically important fungi. It covers the identification, isolation, and					

	culture of fungal pathogens from clinical specimens. Emphasis is placed on laboratory diagnostic techniques, antifungal susceptibility testing, and the interpretation of results for effective management of fungal infections.			
Course Objective	• To understand the biology, classification, and clinical relevance of medically important fungi. • To learn proper collection, handling, and processing of clinical specimens for fungal diagnosis. • To acquire skills in fungal culture, identification, and antifungal susceptibility testing. • To interpret laboratory findings for accurate diagnosis and management of fungal infections. • To apply biosafety measures, quality control, and good laboratory practices in mycological diagnostics.			
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in clinical mycology, including fungal classification and morphology. • Understand the principles of fungal infections and their clinical diagnosis. • Apply mycological methods to isolate and identify fungal pathogens. • Analyze fungal cultures to identify pathogens using diagnostic techniques. • Evaluate mycological methods for accuracy and clinical relevance. • Create clear laboratory reports documenting fungal identification and susceptibility.			
Course Content:				
Module 1	Overview of Mycology	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Introduction to Medical Mycology, Basic concepts about superficial and deep Mycoses, Morphological, cultural characteristics of common fungal laboratory contaminants.				

Module 2	Taxonomy and classification	Assignment/ Quiz	Memory Recall based Quizzes	**8 Sessions**
Taxonomy and classification and general characteristics ofvarious medically important fungi, Normal fungal flora,				
Module 3	Chromatography	Assignment/ Quiz	Memory Recall-based Quizzes	**11 Sessions**
Medical mycology laboratory, processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids. Techniques used for isolation and identification of medically important fungi and Methods for identification of yeasts and moulds.				
Module 4	Dimorphism and Antifungal Susceptibility Tests inFungi	Assignment/ Quiz	Numerical solving Task	**10 Sessions**
Dimorphism in fungi. Antifungal susceptibility tests. Preservation of fungal cultures. Routine myco-serological testsand skin tests.				
Module 5	Recent Pandemic Outbreaks: Specimen Collection and Diagnosis	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
Recent pandemic outbreaks fungal infections- clinical specimen collection and diagnosis				

List of Laboratory Tasks:

Experiment No. 1: To prepare culture media routinely used in mycology.

Experiment No. 2: To perform KOH preparation for fungal detection.

Experiment No. 3: To perform Gram staining of fungal samples.

Experiment No. 4: To perform Potassium Hydroxide - Calcofluor White method and India Ink preparation.

Experiment No. 5: To perform Modified Kinyoun Acid Fast Stain for Nocardia identification.

Experiment No. 6: To prepare Lactophenol Cotton Blue (LCB) mount for fungal

observation.

Experiment No. 7: To identify a given yeast culture using various identification techniques.

Experiment No. 8: To identify a given mould culture using various identification techniques.

Experiment No. 9: To demonstrate dimorphism in fungi.

Experiment No. 10: To collect and process clinical samples for fungal diagnosis from skin, nail, hair, body fluids, and secretions

Targeted Application & Tools that can be used:

- Clinical mycology laboratory diagnosis and research
- Preparation and use of fungal culture media
- Microscopic techniques: KOH mount, Gram stain, Calcofluor White staining, India Ink preparation
- Special staining methods such as Modified Kinyoun Acid Fast stain
- Identification tools for yeasts and molds (morphological, biochemical tests)
- Sample collection and processing for fungal infections from skin, nails, hair, and body fluids
- Use of Lactophenol Cotton Blue for fungal morphology examination
- ☐ Laboratory biosafety and contamination control tools

Project Work/ Assignment:

- Preparation and evaluation of various fungal culture media for growth characteristics.
- Performing KOH mount and Calcofluor White staining on clinical samples to identify fungal elements.
- Comparative study of staining techniques (Gram stain, India Ink, Modified Kinyoun Acid Fast stain) for fungal detection.
- Identification and characterization of isolated yeast and mold cultures using morphological and biochemical methods.
- Collection, processing, and microscopic examination of clinical samples (skin, nail, hair, body fluids) for fungal infection diagnosis.
- ☐ Documentation and presentation of a case study on dimorphic fungi and their clinical relevance.

Text Book(s):

- K. C. Aneja, *Experiments in Microbiology, Plant Pathology and Biotechnology*, New Age International Publishers.
- Jagdish Chander, *Textbook of Medical Mycology*, Mehta Publishers.

Reference Book (s):

- C. R. Prasad & Anita Chopra, *Medical Mycology: A Laboratory Manual*, Jaypee Brothers Medical Publishers.
- Ramani & Dhaliwal, *Medical Mycology*, CBS Publishers & Distributors.
- Dharam Veer Singh, *Introductory Practical Microbiology*, Jaypee Brothers Medical Publishers.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://www.ncbi.nlm.nih.gov/books/NBK11032/
- https://www.cdc.gov/fungal/index.html
- https://www.mycology.adelaide.edu.au/tutorials/index.html
- https://www.khanacademy.org/science/health-and-medicine/infectious-diseases
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=clinical+mycology

Topics relevant to "SKILL DEVELOPMENT":

- Preparation and sterilization of culture media for fungal growth
- Microscopic techniques: KOH preparation, Gram staining, India Ink, Calcofluor White staining
- Identification and differentiation of yeast and mold cultures
- Dimorphism demonstration in fungi
- Collection, handling, and processing of clinical samples (skin, nail, hair, body fluids) for fungal diagnosis
- Application of specialized staining techniques (Modified Kinyoun Acid Fast Stain)
- Use of laboratory safety protocols and aseptic techniques in mycological testing
- Interpretation of fungal culture results and laboratory reports

SEMESTER-5

Course Code: BMLT018	**Course Title: Immunology & Bacterial Serology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course covers the basics of the immune system and its role in disease. It focuses on key immunology concepts and laboratory techniques for bacterial serology, including detection of bacterial infections through serological tests.					
Course Objective	• To understand the fundamental concepts of the immune system and its components. • To learn the mechanisms of immune response against bacterial infections. • To acquire skills in performing bacterial serological tests for diagnosis. • To interpret serological test results for clinical applications. • To apply laboratory safety and quality control in immunological testing.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in immunology and serology. • Understand immune responses and antigen-antibody interactions in diagnosis. • Apply techniques for serological tests like ELISA and agglutination. • Analyze results to identify bacterial infections and immune responses. • Evaluate the effectiveness of immunological and serological tests. • Create accurate reports documenting findings and their clinical relevance.					

Course Content:				
Module 1	History and introduction toimmunology &concept of Immunity	Assignment/ Quiz	Numerical solving Task	**7 Sessions**
History and introduction to immunology. Immunity, innate,Acquired immunity, Basic concepts about their mechanisms System in India				
Module 2	Antigens, Antibodies & Antigen- Antibody reactions	Assignment/ Quiz	Memory Recall based Quizzes	**9 Sessions**
Definition, types of antigens and determinants of antigenicity. Definition, types, structure and properties of immunoglobulin, Antigen-Antibody reactions Definition, Classification, Generalfeatures and mechanisms, Applications of various antigen antibody reactions				
Module 3	Antibody reactions, Serological tests and complementsystem	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**
Complement fixation test, Immuno- fluorescence, ELISA, SDS-PAGE & Western blotting ,Widal, VDRL, ASO, CRP, Brucella tube agglutination, Rose-Waaler. Complement system: Definition, Basic concepts about its components & Complement activation pathways				
Module 4	Immune response andRecent diagnosis in immunology and serology	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Immune response: Introduction, Basic concepts of Humoral and Cellular immune responses, Hypersensitivity: Definition,Types of hypersensitivity reactions . All testsof rapid lateral flow immunoassays reliable in diagnosing SARS-CoV-2 infection.				
Module 5	Autoimmunity, Automation & Vaccines hours:	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Basic concepts of autoimmunity and brief knowledge aboutautoimmune diseases: Automation in diagnostic serology: Vaccines: Definition, Types, Vaccination schedule & Brief knowledge about ‗Extended Program ofimmunization' (EPI) in India

List of Laboratory Tasks:

Experiment No. 1: To collect blood sample by vein puncture, separate, and preserve serum.

Experiment No. 2: To perform haemolysin titration for Rose-Waaler test.

Experiment No. 3: To prepare buffers: phosphate buffer, verinol buffer, ASO buffer, Richardson's buffer, buffers of different pH and molarity, and Tris buffer.

Experiment No. 4: To standardize cell concentration using spectrophotometer.

Experiment No. 5: To perform serological tests: Widal test, Brucella tube agglutination, VDRL including antigen preparation, ASO test, C-Reactive Protein (CRP) latex agglutination, Rheumatoid Factor (RF) latex agglutination, and Rose Waaler test.

Targeted Application & Tools that can be used:

- Blood collection and serum separation tools (syringes, centrifuge)
- Spectrophotometer for cell concentration standardization
- Incubators and water baths for antigen-antibody reactions
- Micropipettes and microtiter plates for titration and agglutination tests
- Reagents and buffers (Phosphate buffer, ASO buffer, Tris buffer, etc.)
- Slide and tube agglutination test kits (Widal, Brucella, VDRL, ASO, CRP, RF)
- Microscopes for slide examination
- Laboratory safety and biosafety equipment

Project Work/ Assignment:

- Perform and report on the Widal test for typhoid diagnosis using simulated or clinical samples.
- Conduct Haemolysin titration and interpret Rose-Waaler test results for rheumatoid arthritis detection.
- Prepare and standardize different buffers used in serological assays, documenting their preparation and applications.
- Evaluate the sensitivity and specificity of latex agglutination tests for CRP and Rheumatoid Factor in inflammatory diseases.
- ☐ Design a protocol for collection, separation, and preservation of serum samples ensuring sample integrity and quality.

Text Book(s):

• Kuby, T. J., Goldsby, R. A., & Osborne, B. A., *Kuby Immunology*, W.H. Freeman & Company.

• Jawetz, Melnick & Adelberg, *Medical Microbiology*, McGraw Hill Education.

Reference Book (s):

• Coico, R., & Sunshine, G., *Immunology: A Short Course*, Wiley-Blackwell.

• Apurba Sastry & Sandhya Bhat, *Essentials of Medical Microbiology*, Jaypee Brothers Medical Publishers.

• Chakrabarty, A. K., *Textbook of Microbiology & Immunology*, New Central Book Agency.

Online Resources (e-books, notes, ppts, video lectures etc.):

☐ https://www.khanacademy.org/science/biology/immunology

☐ https://www.ncbi.nlm.nih.gov/books/NBK10757/ (Immunology textbook by NCBI)

☐ https://openstax.org/details/books/biology-2e (Biology 2e - covers immunology basics)

☐ https://www.pathologyoutlines.com/immunology.html

☐ https://www.youtube.com/playlist?list=PL8dPuuaLjXtOfse2ncvffeelTrqvhrz8H

Topics relevant to "SKILL DEVELOPMENT":

- Collection and handling of blood samples for serological testing
- Preparation and standardization of reagents and buffers
- Performing and interpreting serological tests (Widal, ASO, VDRL, CRP, RF)
- Haemolysin titration and Rose-Waaler test techniques
- Use of spectrophotometry for cell concentration standardization
- Quality control and troubleshooting in immunological assays
- Application of serological methods in diagnosis of infectious and autoimmune diseases
- Laboratory safety and biosafety practices in immunology labs

Course Code: BMLT019	**Course Title: Cytopathology** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					

Anti-requisites	NONE			
Course Description	This course covers the principles and techniques of cytopathology, focusing on the collection, staining, and microscopic examination of cells. It emphasizes the identification of normal and abnormal cell morphology for diagnosing infections, inflammation, and cancers, along with quality control and safety practices in cytology labs.			
Course Objective	• To understand the fundamentals and diagnostic applications of cytopathology. • To learn techniques for collection, preparation, and staining of cytological specimens. • To identify normal and abnormal cellular morphology in various tissues and fluids. • To apply cytological methods in the diagnosis of infections, inflammations, and malignancies. • To follow biosafety measures and quality control in cytopathology laboratories.			
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts, terminology, and techniques in cytopathology. • Understand the principles of cytological techniques and their role in disease diagnosis. • Apply techniques for preparing and analyzing cytological specimens. • Analyze cytological findings to identify abnormal cells and assist in diagnosis. • Evaluate the accuracy and clinical relevance of cytopathological methods. • Create clear reports documenting cytological findings and their significance			
Course Content:				
Module 1	Introduction to cytopathology Cryostat section	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Define Cytopathology, and its purpose.
Cryostat sectioning, its applications in diagnostic cytopathology. EnzymeCytochemistry: Diagnostic applications and Demonstration of Phosphatases, Dehydrogenases, Oxidases& Peroxidases.

Module 2	Aspiration cytology	Assignment/ Quiz	Memory Recall based Quizzes	**7 Sessions**

Aspiration cytology: Principle, indications & utility of the technique with special emphasis on role of cytotechnologist inFNAC clinics

Module 3	Automationand Advance technique in cytology	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**

Vital staining for Sex Chromatin and Automation in cytology. Telepathology/Telecytology (Digital Cytopathology), Molecular Techniques ,Immunocytochemistry, Fish TechniqueIn Cytology Complement system: Definition, Basic concepts about its components & Complement activation pathways

Module 4	Exfoliative cytology	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Exfoliative cytology (Papanicolaou technique for the staining of cervical smears): Cervical cytology, Fluid Cytology, Urine,CSF and Body Fluids (Pleural, Pericardial, Ascitic)

Module 5	Liquid based cytology	Assignment/ Quiz	Numerical solving Task	**10 Sessions**

Liquid based cytology: Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune-cytochemistry

List of Laboratory Tasks:

Experiment No. 1: To perform Papanicolaou's stain on cervical smear.

Experiment No. 2: To perform Guard's staining for demonstration of sex chromatin (Barr bodies) on a buccal smear.

Experiment No. 3: To cut frozen sections of gynecological tissue for cytological examination.

Experiment No. 4: To perform Giemsa staining for cytological analysis.

Experiment No. 5: To perform Hematoxylin and Eosin (H&E) staining on cytological

specimens.

Experiment No. 6: To perform PAP stain and interpret cytological findings.

Targeted Application & Tools that can be used:

- Light microscope for slide examination
- Cytocentrifuge for sample preparation
- Cryostat for frozen tissue sectioning
- PAP smear kits and microtome
- Special stains (PAP, H&E, Giemsa, Guard's stain)
- Automated stainers and digital pathology software for slide analysis and reporting

Project Work/ Assignment:

- **Case Study Analysis:** Evaluate and report on cytological slides from cervical smears, including PAP-stained slides with normal and abnormal findings.
- **Slide Preparation Project:** Prepare, stain, and document cytology slides using PAP, Giemsa, and H&E stains.
- **Comparative Study:** Compare staining techniques (e.g., PAP vs. Giemsa) for their effectiveness in cellular detail visualization.
- **Report Writing:** Prepare a detailed report on the cytological diagnosis of common gynecological conditions.
- **Specimen Handling Audit:** Conduct an assignment on best practices in cytological specimen collection, preservation, and labeling in clinical settings.

Text Book(s):

- **K. C. Aneja**, *Experiments in Microbiology, Plant Pathology and Biotechnology*, New Age International Publishers.
- **Bibbo M., and Wilbur D.**, *Comprehensive Cytopathology*, Elsevier

Reference Book (s):

- **Koss L. G.**, *Koss' Diagnostic Cytology and Its Histopathologic Bases*, Lippincott Williams & Wilkins.
- **Orell S. R., Sterrett G. F.**, *Fine Needle Aspiration Cytology*, Churchill Livingstone.
- **Ramzi Cotran, Vinay Kumar, Stanley Robbins**, *Robbins Basic Pathology*, Elsevier.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks and cytopathology chapters (NCBI Bookshelf)

- https://www.pathologyoutlines.com/ – Free online reference for pathology and cytology topics
- https://www.youtube.com/user/armandohasudungan – Illustrated medical lectures including cytopathology basics
- https://open.umn.edu/opentextbooks – Free academic textbooks including health and biology-related resources
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=cytopathology – PPTs on cytopathology for academic presentations and teaching

Topics relevant to "SKILL DEVELOPMENT":

- Preparation and staining of cytological smears (Papanicolaou, Giemsa, H&E, Guard's stain)
- Collection and handling of cytological specimens (cervical smears, buccal smears, tissue sections)
- Microscopic examination and interpretation of stained cytology slides
- Performing frozen section cutting for rapid tissue diagnosis
- Identification and differentiation of normal, reactive, and malignant cells in cytological samples
- Quality control and troubleshooting staining procedures
- Documentation and reporting of cytopathology findings
- ☐ Application of biosafety and infection control measures during specimen handling

Course Code: BMLT020	**Course Title: Applied Clinical Biochemistry** **Type of Course: CC**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course covers the practical aspects of biochemical analysis in clinical laboratories. It focuses on the principles, techniques, and interpretation of biochemical tests used to assess metabolic functions and diagnose diseases. Students learn specimen collection, sample processing, and the use of modern analytical instruments. Emphasis is placed on quality control, data interpretation, and					

<table>
<tr><td></td><td colspan="4">correlation of biochemical results with clinical conditions for effective patient management.</td></tr>
<tr><td>Course Objective</td><td colspan="4">• To understand the principles and applications of biochemical tests in clinical diagnostics.
• To learn proper techniques for specimen collection, handling, and analysis.
• To acquire skills in performing routine and specialized biochemical assays.
• To interpret biochemical test results in relation to disease diagnosis and patient care.
• To apply quality control measures and maintain safety protocols in the clinical laboratory</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:

• Remember key concepts and techniques in applied biochemistry.
• Understand biochemical processes and their clinical applications.
• Apply techniques to analyze body fluids for diagnostics.
• Analyze test results to identify metabolic disorders.
• Evaluate the relevance and effectiveness of biochemical assays.
• Create clear reports documenting findings and their implications.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Hazards andsafety measures &QC</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Hazards & safety measures in clinical Biochemistry laboratory,Quality control and quality assurance in a clinical biochemistrylaboratory</td></tr>
<tr><td>Module 2</td><td>Clinical BiochemicalTest</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Principles of assay procedures, Normal range in blood, Serum,Plasma and Urine and reference values for: Glucose, Proteins, Urea, Uric acid, Creatinine, Bilirubin, Lipids.</td></tr>
</table>

Module 3	Electrolytes and other clinical tests	Assignment/ Quiz	Memory Recall-based Quizzes	**8 Sessions**
Principles, procedures for estimation & assessment of the following including errors involved and their corrections: Sodium, Potassium and Chloride, Iodine, Calcium, Phosphorus and Phosphates				
Module 4	Radioactivity & ELISA	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Instruments for detection of Radioactivity, Applications of Radioisotopes in clinical biochemistry, Enzyme linked immunesorbent assay				
Module 5	Blood Gases	Assignment/ Quiz	Numerical solving Task	**10 Sessions**
Estimation of electrolytes in body cavities fluid, Estimation of Carbon dioxide in TB patients, Importance, methods. Estimation of Hba1c test, principle, clinical importance.				

List of Laboratory Tasks:

Experiment No. 1: To estimate urea concentration in blood.

Experiment No. 2: To estimate uric acid concentration in blood.

Experiment No. 3: To estimate serum bilirubin levels.

Experiment No. 4: To estimate total cholesterol in blood.

Experiment No. 5: To estimate HDL cholesterol levels.

Experiment No. 6: To estimate LDL cholesterol levels.

Experiment No. 7: To estimate triglycerides (TG) in blood.

Experiment No. 8: To estimate creatinine concentration in blood.

Experiment No. 9: To estimate serum calcium and inorganic phosphate levels.

Targeted Application & Tools that can be used:

- Clinical diagnostic laboratories for disease screening, diagnosis, and monitoring
- Automated biochemical analyzers and spectrophotometers for quantitative assays
- Colorimetric and enzymatic methods for biomolecule estimation (e.g., cholesterol, urea)
- Flame photometry and atomic absorption spectrometry for electrolyte and mineral analysis
- Chromatographic techniques (e.g., paper chromatography) for metabolite separation
- Quality control tools including calibrators, controls, and standard reference materials

- Laboratory information management systems (LIMS) for data recording and reporting
- Point-of-care testing (POCT) devices for rapid biochemical analysis in clinical settings
- Software for data interpretation, graphing, and result validation

Project Work/ Assignment:

- Analyze and report biochemical parameters from simulated patient samples (e.g., blood urea, cholesterol, creatinine).
- Design and perform experiments to compare different methods for estimating serum glucose or cholesterol.
- Prepare a quality control plan for a clinical biochemistry laboratory, including calibration and validation procedures.
- Study the effect of various pre-analytical variables (like sample storage time, temperature) on biochemical test results.
- Research and present on emerging technologies and automation in clinical biochemistry diagnostics.
- Conduct a mini research project on the biochemical markers for a specific disease (e.g., diabetes, liver disease).
- Prepare standard operating procedures (SOPs) for biochemical assays including reagent preparation and instrument calibration.
- Data interpretation exercises using real or simulated lab reports to diagnose metabolic disorders

Text Book(s):

- **Burtis, C.A., Ashwood, E.R., & Bruns, D.E.** (2017). *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*. Elsevier Saunders.
- **Varley, H.** (2010). *Practical Clinical Biochemistry: Methods and Interpretations*. CBS Publishers & Distributors

Reference Book (s):

- **Plummer, D.T.** (2001). *An Introduction to Practical Biochemistry*. Tata McGraw-Hill Education.
- **Kaplan, L.A., & Pesce, A.J.** (2009). *Clinical Chemistry: Theory, Analysis, and Correlation*. Mosby.
- **Chatterjea, M.N., & Shinde, R.** (2012). *Textbook of Medical Biochemistry*. Jaypee Brothers Medical Publishers.

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks including clinical biochemistry and laboratory medicine (NCBI Bookshelf)
• https://www.pathologyoutlines.com/ – Free online reference for pathology, clinical chemistry, and laboratory diagnostics
• https://www.youtube.com/user/ArmandoHasudungan – Illustrated medical lectures covering biochemistry, clinical chemistry, and related medical topics
• https://open.umn.edu/opentextbooks – Free academic textbooks including clinical biochemistry, physiology, and health sciences
•
https://www.slideshare.net/search/slideshow?searchfrom=header&q=clinical+biochemistry – PPTs on clinical biochemistry for teaching and presentations
• https://www.khanacademy.org/science/health-and-medicine – Video lectures and notes covering biochemistry and clinical topics

Topics relevant to "SKILL DEVELOPMENT":

- Sample collection and handling
- Preparation of reagents and buffers
- Operation of clinical chemistry analyzers
- Qualitative and quantitative biochemical assays
- Calibration and quality control
- Spectrophotometry and colorimetry
- Data recording and interpretation
- Troubleshooting laboratory equipment and tests
- Safety and waste disposal

Course Code:	Course Title: Blood Bank and Genetics Type of Course: CC	L-T-P-C	3	0	2	4

Version No.	
Course Pre-requisites	NONE
Anti-requisites	NONE
Course Description	This course provides a comprehensive study of medically important parasites and arthropods that affect human health. It covers the biology, life cycles, diagnosis, epidemiology, and control measures of protozoan, helminthic parasites, and disease-transmitting vectors. Emphasis is placed on the identification of parasites and vectors, understanding their role in disease transmission, and developing skills for laboratory diagnosis and public health interventions.
Course Objective	• To understand the classification, components, and functions of the human blood group systems and basic principles of genetics. • To identify blood group incompatibilities, transfusion reactions, and inherited genetic disorders. • To develop skills for laboratory techniques such as blood typing, crossmatching, and genetic testing. • To study the molecular basis of inheritance and its role in transfusion medicine and disease diagnosis. • To learn strategies for safe transfusion practices and genetic counseling. • ☐ To appreciate the clinical and public health importance of blood banking and medical genetics.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in blood banking and genetics. • Understand blood transfusion principles and genetic inheritance. • Apply methods for blood typing, crossmatching, and genetic testing. • Analyze blood bank results and genetic data for compatibility and disorders. • Evaluate the accuracy and relevance of blood banking and genetic tests.

	• ☐ Create reports documenting findings with clinical implications.			
Course Content:				
Module 1	Introduction to Blood Banking	Assignment/ Quiz	Numerical solving Task	**8 Sessions**
History and discovery of various blood group systems, ABO blood group system, Rh and other major blood group systems, sources of error in blood grouping and their elimination, ABO grouping: forward and reverse grouping, Rh grouping.				
Module 2	Compatibility and Automation test in blood transfusion	Assignment/ Quiz	Memory Recall based Quizzes	**10 Sessions**
Collection of blood for crossmatching from a blood bag, major and minor crossmatching, use of enzymes in blood bank—especially Papain, complications and hazards of blood transfusion, laboratory investigations of transfusion reactions and mismatched transfusions, precautions during procurement and storage of grouping antisera, automation in immunohematology including solid phase technology, gel technology, and affinity column technology, and haemopheresis procedures related to leucocytes, platelets, and plasma.				
Module 3	Blood Transfusion and Blood Bank Practices	Assignment/ Quiz	Memory Recall-based Quizzes	**9 Sessions**
Various anticoagulants used for blood collection in transfusion, donor selection and procedure for collecting blood from a healthy donor, preparation of blood components for transfusion and therapeutic use such as packed red cells, washed red cells, frozen red cells, platelet-rich plasma (PRP), platelet concentrate, frozen platelets, fresh plasma (FP), fresh frozen plasma (FFP), and cryoprecipitate, brief introduction to blood substitutes/artificial blood, haemopheresis related to leucocytes, platelets, and plasma, and quality control measures in the blood bank.				
Module 4	Genetics and Inheritance	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Continuity of life through heredity and variation, Mendel's laws of inheritance, chromosomal basis of inheritance, other patterns of inheritance including incomplete dominance, multiple allelism, and quantitative inheritance, chromosomes in bacterial				

and eukaryotic cells, parallelism between genes and chromosomes, genome structure, linkage and crossing over, gene mapping, and recombination.

Module 5	Molecular Genetics	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Molecular genetics: DNA as genetic material—its structure and replication, structure of RNA and its role in protein synthesis, vectors and plasmids, human genetics, and microbial genetics.

List of Laboratory Tasks:

Experiment No. 1: Preparation of Acid Citrate Dextrose (ACD) solution.

Experiment No. 2: Preparation of Citrate Phosphate Dextrose (CPD) solution.

Experiment No. 3: Screening of blood donor through physical examination and medical history assessment.

Experiment No. 4: Collection and preservation of blood for transfusion purposes.

Experiment No. 5: Screening of blood for malaria, microfilaria, HBsAg, syphilis, and HIV.

Experiment No. 6: Determination of ABO and Rh blood grouping.

Experiment No. 7: Performing Direct Coomb's Test.

Experiment No. 8: Performing Indirect Coomb's Test.

Experiment No. 9: Performing crossmatching (Major and Minor).

Experiment No. 10: Demonstration of blood component separation

Targeted Application & Tools that can be used:

- Light Microscope
- Centrifuge
- Staining reagents (Leishman stain, Field's stain, Iodine, JSB stain)
- Microscope slides and cover slips
- Sample collection kits (stool containers, blood collection tubes)
- Flotation and sedimentation equipment
- Model specimens of parasites and worms
- Digital imaging software (for parasite identification and documentation)
- Laboratory information management system (LIMS) software
- Electrophoresis apparatus (for advanced diagnostic techniques)

Project Work/ Assignment:

- Collection and serological screening of donor blood samples for transfusion-transmitted infections (TTIs) such as HIV, Hepatitis B, and Syphilis.
- Preparation and staining of blood smears for morphological evaluation and identification of hematological or inherited disorders (e.g., thalassemia, leukemia).

- Identification and documentation of blood group systems and genetic disorders (e.g., ABO, Rh, Bombay blood group, hemophilia) using models, slides, or case files.
- Comparative study of crossmatching techniques (Major vs. Minor, manual vs. gel methods) and analysis of grouping discrepancies.
- Research report on genetic inheritance patterns and transmission of blood-related genetic conditions (e.g., sickle cell anemia, thalassemia, hemophilia).
- Survey on blood group distribution or prevalence of genetic blood disorders in a local community or hospital setting.
- Designing a public health awareness campaign focused on safe blood donation, transfusion safety, and awareness of inherited blood disorders.
- Case study analysis of a transfusion reaction or inherited blood disorder, including diagnostic approach, laboratory findings, and treatment strategy.

Text Book(s):

- Bhattacharya, M., & Sulochana, P.V. (2015). *Textbook of Blood Banking and Immunohematology*. CBS Publishers & Distributors.
- Dhot, P.S. (2016). *Basics of Blood Banking and Transfusion Medicine*. Jaypee Brothers Medical Publishers.
- Baveja, C.P. (2012). *Medical Genetics*. Arya Publications.

Reference Book (s):

- Mollison, P.L., Engelfriet, C.P., & Contreras, M. (2013). *Blood Transfusion in Clinical Medicine* (12th Edition). Wiley-Blackwell.
- Harmening, D.M. (2018). *Modern Blood Banking and Transfusion Practices* (7th Edition). F.A. Davis Company.
- Daniels, G. (2013). *Human Blood Groups* (3rd Edition). Wiley-Blackwell.
- Reid, M.E., & Lomas-Francis, C. (2004). *The Blood Group Antigen FactsBook* (2nd Edition). Academic Press.

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks including parasitology and infectious diseases (NCBI Bookshelf)

• https://www.cdc.gov/parasites/ – Comprehensive resources on parasitic diseases, diagnostics, and prevention (CDC)

• https://www.youtube.com/user/ArmandoHasudungan – Illustrated medical lectures covering parasitology and related topics

• https://open.umn.edu/opentextbooks – Free academic textbooks including microbiology and parasitology • https://www.slideshare.net/search/slideshow?searchfrom=header&q=medical+parasitology – PPTs on medical parasitology for teaching and presentations • https://www.khanacademy.org/science/health-and-medicine – Video lectures and notes on microbiology and infectious diseases
Topics relevant to "SKILL DEVELOPMENT": • Sample collection, handling, and preservation techniques for blood and genetic testing. • Preparation and staining of blood smears for hematological and genetic disorder analysis. • Microscopic examination and identification of abnormal blood cells and hereditary anomalies. • Application of techniques like crossmatching, Coomb's test, and antigen-antibody reactions • Use of advanced diagnostic tools such as electrophoresis and PCR in genetic analysis. • Interpretation of laboratory results for blood grouping, transfusion reactions, and genetic disorders. • Documentation and reporting of transfusion-related and genetic findings in clinical formats. • Public health education and awareness regarding safe blood transfusion and inherited blood disorders. • Teamwork and collaboration in blood bank and genetics laboratory settings. • Strict adherence to biosafety and infection control protocols in transfusion and genetic testing labs.

Course Code: BMLT021	**Course Title: Immunopathology and Molecular Biology** **Type of Course: DSE**	**L-T-P-C**	3	0	2	4
Version No.						
Course Pre-requisites	NONE					

Anti-requisites	NONE
Course Description	This course provides in-depth knowledge of the human immune system, immunopathological disorders, and essential molecular biology techniques used in medical diagnostics. It covers cellular and humoral immune responses, transplantation immunology, autoimmunity, hypersensitivity reactions, and molecular approaches such as PCR, electrophoresis, and sequencing. The course integrates theoretical concepts with laboratory skills necessary for disease diagnosis and biomedical research.
Course Objective	• To understand the components and functions of the immune system. • To comprehend immunopathological processes such as hypersensitivity, autoimmunity, and transplant rejection. • To study key molecular biology techniques used in clinical diagnostics. • To develop laboratory skills in immunological and molecular testing methods. • To appreciate the role of molecular diagnostics in modern healthcare. • To ensure biosafety and ethical practices in immunology and molecular laboratories.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in immunopathology and molecular biology. • Understand immune responses and molecular diagnostic principles. • Apply methods like PCR and immunological testing in the lab. • Analyze data to diagnose diseases and assess immune function. • Evaluate the accuracy and relevance of diagnostic techniques. • Create clear reports documenting findings and clinical implications.
Course Content:	

Module 1	**Introduction to Immunology**	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Cells of the immune system, Types and Mechanisms of immune response, Lymphoid organs of the Immune system.				
Module 2	Transplant Immunology	Assignment/ Quiz	Memory Recall based Quizzes	**6 Sessions**
MHC I & II, HLA Typing & Cross matching				
Module 3	Autoimmunity, Hypersensitivity	Assignment/ Quiz	Memory Recall-based Quizzes	**7 Sessions**
Hypersensitivity: Definition, Types, Mechanisms, Autoimmunity: Basic concepts				
Module 4	Introduction to Molecular Biology	Assignment/ Quiz	Numerical solving Task	**11 Sessions**
Molecular Biology Techniques : Principle, Reagents used, procedure and applications in Medical diagnostics. Polymerase Chain Reaction and its advanced versions Gel Electrophoresis				
Module 5	Chemical composition of DNA and Advanced Immunological and Genomic Technique	Assignment / Quiz	Numerical solving Task	**12 Sessions**
DNA replication, DNA damage and repair, Regulation of				

prokaryotic and eukaryotic gene expression & Cell Cycle
B cell ELIS pot assay, Microfluidic single-cell technology,
next-generation sequencing (NGS)

List of Laboratory Tasks:

Experiment No. 1: Isolation of Peripheral Blood Mononuclear Cells (PBMCs) by gradient centrifugation.

Experiment No. 2: Separation of T and B lymphocytes from PBMCs.

Experiment No. 3: Immunofluorescence assay for Anti-Nuclear Antibody (ANA) and Anti-Neutrophil Cytoplasmic Antibody (ANCA).

Experiment No. 4: Study of AIDS Immunology and Pathogenesis (AIP) using relevant case profiles or simulation.

Experiment No. 5: Agglutination test for detection of Thyroid Microsomal Antigen (TMA).

Experiment No. 6: Protein separation and analysis using electrophoresis.

Experiment No. 7: Immunodiffusion technique using gel diffusion method.

Experiment No. 8: Quantitative analysis of proteins using nephelometry.

Experiment No. 9: HLA Typing using serological crossmatch methods.

Experiment No. 10: HLA Molecular Typing using PCR-based methods.

Experiment No. 11: Nitro Blue Tetrazolium (NBT) test for neutrophil function.

Experiment No. 12: Flow cytometric analysis of CD4 and CD8 T lymphocytes using FACS.

Experiment No. 13: ELISA technique for the laboratory diagnosis of AIDS.

Experiment No. 14: Amplification of target DNA using Polymerase Chain Reaction (PCR) and its advanced versions.

Experiment No. 15: Separation and visualization of nucleic acids using agarose gel electrophoresis.

Experiment No. 16: Protein analysis using Western Blotting.

Experiment No. 17: Isolation of DNA and RNA from biological samples.

Experiment No. 18: Estimation of DNA and RNA concentration using spectrophotometry.

Experiment No. 19: Determination of molecular weight and quantification of DNA using agarose gel electrophoresis.

Targeted Application & Tools that can be used:

- Flow Cytometer (FACS)
- Centrifuge
- Light Microscope
- Gel Electrophoresis Apparatus
- PCR Thermocycler
- ELISA Reader
- Western blotting system
- Microfluidic analysis system

- Spectrophotometer
- Digital imaging and documentation software
- Molecular typing kits (HLA)
- Biosafety cabinet

Project Work/ Assignment:

- Report on immune cell isolation and analysis
- Immunological profiling of an autoimmune disease
- Comparison of PCR and NGS in clinical diagnostics
- Study of molecular mechanisms of hypersensitivity
- Case study: Organ transplant rejection and lab diagnosis
- Experimental report on ELISA results for infectious disease
- Data analysis of FACS-based immune cell quantification
- Poster presentation on molecular biology in personalized medicine

Text Book(s):

Abbas, A.K., Lichtman, A.H., & Pillai, S. (2021). Basic Immunology (6th Edition). Elsevier

Brown, T.A. (206). Gene Cloning and DNA Analysis (7th Edition). Wiley-Blackwell..

Reference Book (s):

- Janeway, C.A., Travers, P., Walport, M., & Shlomchik, M.J. (2001). *Immunobiology* (5th Edition). Garland Science.
- Sambrook, J. & Russell, D.W. (2001). *Molecular Cloning: A Laboratory Manual* (3rd Edition). Cold Spring Harbor Laboratory Press.
- Roitt, I.M., Brostoff, J., & Male, D. (2001). *Immunology* (6th Edition). Mosby.

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://www.ncbi.nlm.nih.gov/books/
- https://www.cdc.gov/labtraining/
- https://www.khanacademy.org/science/health-and-medicine
- https://www.youtube.com/user/ArmandoHasudungan
- https://open.umn.edu/opentextbooks
- https://www.protocols.io

Topics relevant to "SKILL DEVELOPMENT":

- PBMC isolation and cell sorting

• DNA/RNA extraction and quantification • PCR and advanced molecular diagnostics • Immunofluorescence and ELISA • Flow cytometry-based immune cell profiling • Interpretation of immunological data and molecular results • Adherence to biosafety protocols in diagnostic labs • Proper documentation and scientific reporting • Collaboration in molecular and immunology labs • Clinical application of immune response assessment

SEMSTER-6th

Course Code: BMLT021	**Course Title: Medical Parasitology & Entomology** **Type of Course: DSE**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course provides a comprehensive study of medically important parasites and arthropods that affect human health. It covers the biology, life cycles, diagnosis, epidemiology, and control measures of protozoan, helminthic parasites, and disease-transmitting vectors. Emphasis is placed on the identification of parasites and vectors, understanding their role in disease transmission, and developing skills for laboratory diagnosis and public health interventions.					
Course Objective	• To understand the classification, morphology, and life cycles of medically important parasites. • To identify common parasitic infections and their clinical manifestations. • To develop skills for the laboratory diagnosis of parasitic diseases. • To study the biology and role of arthropod vectors in disease transmission. • To learn methods for prevention and control of parasitic infections and vector-borne diseases. • To appreciate the public health significance of parasitology and entomology.					

<table>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:

• Remember key concepts and techniques in parasitology and entomology.
• Understand the role of parasites and vectors in diseases.
• Apply methods to identify parasites and arthropods.
• Analyze samples to detect infections and vector species.
• Evaluate diagnostic methods for parasitic and vector-borne diseases.
• Create accurate reports documenting findings and their clinical significance.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic concept of Parasites</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Introduction to Medical Parasitology – Key terms in parasitology, general characteristics of protozoa.
Protozoan Parasites – Geographical distribution, habitat, morphology, life cycle, mode of infection, and laboratory diagnosis of:
• Entamoeba species
• Intestinal and vaginal flagellates (Giardia, Trichomonas)
• Blood and tissue flagellates (Plasmodium, Toxoplasma)</td></tr>
<tr><td>Module 2</td><td>Helminthology / Helminthic Parasites</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>10 Sessions</td></tr>
<tr><td colspan="5">General features of cestodes, trematodes, and nematodes, Life cycle, infection mode, and lab diagnosis of: Taenia solium, Taenia saginata, Echinococcus granulosus, Hymenolepis nana, Schistosoma haematobium, S. mansoni, Fasciola hepatica, F. buski, Trichuris trichiura, Trichinella spiralis, Strongyloides stercoralis, Ancylostoma duodenale, Enterobius vermicularis, Ascaris lumbricoides, Wuchereria bancrofti, Dracunculus medinensis.</td></tr>
<tr><td>Module 3</td><td>Diagnostic Procedure (Stool)</td><td>Assignment/ Quiz</td><td>Memory Recall-</td><td>7 Sessions</td></tr>
</table>

			based Quizzes	

Examination of stool for parasites, Stool collection procedures, Microscopic examination rules, Unstained and stained preparation, Iodine and permanent staining methods, Detection of intestinal protozoa, Direct smear preparation, Helminth detection, Flotation and sedimentation concentration techniques, Egg counting methods.

Module 4	Blood Parasite Detection & Advanced Diagnostic Techniques	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Examination of blood for parasites, Preparation of thin and thick blood films, Leishman stain, Field's stain, JSB stain, Examination for malarial parasites and microfilariae, Advanced diagnostic techniques, Electrophoretic methods.

Module 5	Sample Handling for Parasitological Investigations	Assignment/ Quiz	Numerical solving Task	**9 Sessions**

Sample collection, transport, and preservation for parasitology, Morphology, life cycle, and lab diagnosis of *Giardia*, *Entamoeba*, roundworms, hookworms, *Taenia solium*, *T. saginata*, malarial parasites (*P. vivax*, *P. falciparum*), Diagnosis of hydatid cyst and cysticercosis, Ova and cyst concentration techniques.

List of Laboratory Tasks:

Experiment No. 1: Routine stool examination for intestinal parasites using saline preparation.

Experiment No. 2: Routine stool examination for intestinal parasites using iodine preparation.

Experiment No. 3: Routine stool examination for intestinal parasites using flotation method.

Experiment No. 4: Routine stool examination for intestinal parasites using centrifugation method.

Experiment No. 5: Routine stool examination for intestinal parasites using formal ether method.

Experiment No. 6: Routine stool examination for intestinal parasites using zinc sulphate method.

Experiment No. 7: Identification of adult worms from models/slides: tapeworm and

tapeworm segments.

Experiment No. 8: Identification of adult worms from models/slides: *Ascaris* (roundworm), hookworms, and pinworms.

Experiment No. 9: Preparation of thin and thick blood smears for malarial parasite detection.

Experiment No. 10: Staining of blood smears for malarial parasite examination.

Experiment No. 11: Microscopic examination of blood smears for *Plasmodium vivax* and *Plasmodium falciparum*.

Targeted Application & Tools that can be used:

- Light Microscope
- Centrifuge
- Staining reagents (Leishman stain, Field's stain, Iodine, JSB stain)
- Microscope slides and cover slips
- Sample collection kits (stool containers, blood collection tubes)
- Flotation and sedimentation equipment
- Model specimens of parasites and worms
- Digital imaging software (for parasite identification and documentation)
- Laboratory information management system (LIMS) software
- Electrophoresis apparatus (for advanced diagnostic techniques)

Project Work/ Assignment:

- Collection and microscopic examination of stool samples for intestinal parasites.
- Preparation and staining of blood smears for malarial parasite detection.
- Identification and documentation of common helminth and protozoan parasites using models or slides.
- Comparative study of concentration techniques for parasite detection in stool samples.
- Research report on life cycles and transmission modes of selected parasites (e.g., *Plasmodium*, *Taenia*).
- Survey on prevalence of parasitic infections in a local community or hospital setting.
- Designing a public health awareness campaign on prevention and control of parasitic diseases.
- Case study analysis of a patient with parasitic infection including diagnostic approach and treatment.

Text Book(s):

• Chatterjee, K.D. (2016). Parasitology (13th Edition). CBS Publishers & Distributors.
• Mandal, B.K. (2013). Medical Parasitology. CBS Publishers & Distributors.

Reference Book (s):

• Ash, L.R., Orihel, T.C. (2007). Parasites: A Guide to Laboratory Procedures and Identification. ASCP Press.
• Markell, E.K., Voge, M., John, D.T. (2012). Medical Parasitology (9th Edition). Saunders Elsevier.
• Garcia, L.S. (2016). Diagnostic Medical Parasitology (6th Edition). ASM Press.

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks including parasitology and infectious diseases (NCBI Bookshelf)
• https://www.cdc.gov/parasites/ – Comprehensive resources on parasitic diseases, diagnostics, and prevention (CDC)
• https://www.youtube.com/user/ArmandoHasudungan – Illustrated medical lectures covering parasitology and related topics
• https://open.umn.edu/opentextbooks – Free academic textbooks including microbiology and parasitology
•
https://www.slideshare.net/search/slideshow?searchfrom=header&q=medical+parasitology – PPTs on medical parasitology for teaching and presentations
• https://www.khanacademy.org/science/health-and-medicine – Video lectures and notes on microbiology and infectious diseases

Topics relevant to "SKILL DEVELOPMENT":

- Sample collection, handling, and preservation techniques
- Preparation and staining of blood and stool smears
- Microscopic identification of protozoan and helminth parasites
- Application of concentration methods for stool examination
- Use of advanced diagnostic tools like electrophoresis
- Interpretation of laboratory results for parasitic infections
- Documentation and reporting of findings
- Public health communication and awareness about parasitic diseases
- Teamwork and collaboration in laboratory settings
- Adherence to biosafety and infection control protocols

Course Code: BMLT022	Course Title: Clinical Virology Type of Course: DSE	L-T-P-C	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course covers the study of viruses that cause human diseases, focusing on their structure, replication, pathogenesis, and clinical manifestations. The course emphasizes laboratory diagnosis, techniques for virus detection, and interpretation of results. It also explores antiviral therapies, vaccine development, and the role of virology in public health and infection control.					
Course Objective	• To understand the biology and classification of medically important viruses. • To learn viral replication, pathogenesis, and clinical features of viral infections. • To master laboratory techniques for virus detection and diagnosis. • To interpret virological test results accurately. • To explore principles of antiviral treatment and vaccine development. • To apply virology knowledge to infection control and public health strategies.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts, terminology, and techniques in clinical virology. • Understand viral pathogenesis and its role in disease diagnosis. • Apply laboratory methods for viral detection and identification. • Analyze virological test results to identify viral infections. • Evaluate the effectiveness and relevance of virological diagnostic methods. • Create clear reports documenting viral findings and their clinical significance.					

Course Content:				
Module 1	Introductionto Virology	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Introduction to medical virology, Introduction to medically important viruses, Structure and Classification of viruses., Nature and Properties of Viruses Structure of Viruses- Viruses: Capsid symmetry, enveloped and non-envelopedviruses				
Module 2	Classification of viruses	Assignment/ Quiz	Memory Recall based Quizzes	**9 Sessions**
Isolation, purification and cultivation of viruses Classification of different groups of viruses, Multiplication ofviruses., Collection, transportation and storage of sample for viral diagnosis				
Module 3	Staining Techniques, Processing of Samples and Rapid Diagnosis of Viral Infections	Assignment/ Quiz	Memory Recall-based Quizzes	**9 Sessions**
Staining techniques used in Virology., Processing of samplesfor viral culture (Egg inoculation and tissue culture). Rapid diagnosis of viral infections with special reference toHIV, HBV and HCV, EIA. Immunofluorescence and PCR.				
Module 4	Symptoms, Mode of Transmission, Common Viral Diseases	Assignment/ Quiz	Numerical solving Task	**12 Sessions**
Symptoms, mode of transmission, prophylaxis and control of Polio, Herpes, Hepatitis, Rabies, Dengue, HIV, Influenza with brief description of Chikungunya, Japanese Encephalitis. Symptoms, mode of transmission Poxviruses, Herpesviruses, hepaptitis viruses, retroviruses-HIV, rhabdoviruses, orthomyxoviruses				
Module 5	Oncogenic viruses	Assignment/ Quiz	Numerical solving Task	**6 Sessions**
Introduction to oncogenic viruses, Types of oncogenic DNAand RNA viruses.				
List of Laboratory Tasks:				

Experiment No. 1: Study of body fluids and secretions.

Experiment No. 2: Demonstration of virus structure and multiplication using charts.

Experiment No. 3: Perform Giemsa stain.

Experiment No. 4: Perform Seller's stain.

Experiment No. 5: Immunofluorescent staining procedures for viral diagnosis.

Experiment No. 6: Demonstration of fertilized hen egg for viral cultivation.

Experiment No. 7: Demonstration of various inoculation routes.

Experiment No. 8: Perform HBsAg (Australia Antigen) detection by rapid method.

Experiment No. 9: Perform HBsAg detection by ELISA.

Experiment No. 10: Perform HIV detection by Tridot method.

Experiment No. 11: Perform HIV detection by ELISA.

Experiment No. 12: Perform Dengue IgG/IgM antibody detection.

Experiment No. 13: Perform TORCH profile testing.

Experiment No. 14: Demonstration of PCR technique for HBV detection.

Targeted Application & Tools that can be used:

- Light microscope
- Fluorescence microscope (for immunofluorescence staining)
- Staining reagents (Giemsa stain, Seller's stain)
- ELISA kits and microplate reader
- Rapid diagnostic test kits (HBsAg, HIV Tridot, Dengue IgG/IgM)
- PCR machine and reagents for viral DNA/RNA amplification
- Fertilized hen eggs for virus cultivation
- Inoculation tools and equipment
- Sample collection kits (blood, body fluids)
- Biosafety cabinets and personal protective equipment (PPE)
- Laboratory information management system (LIMS) software

Project Work/ Assignment:

- Case study analysis of a patient with a viral infection (e.g., HBV, HIV, Dengue).
- Comparison of rapid diagnostic tests vs ELISA for viral detection.
- Preparation of a report on recent viral outbreaks and diagnostic approaches.
- Chart/model presentation on viral structure and replication cycles.
- Survey on awareness and vaccination status of hepatitis B among students.
- Laboratory report on viral diagnostic methods performed (HBsAg, HIV, Dengue, TORCH, PCR).
- Roleplay or poster presentation on biosafety practices in virology labs.
- Compilation of current advances in antiviral therapies and vaccine technologies.

Text Book(s):

• Dimmock, N.J., Easton, A.J., & Leppard, K.N. (2016). *Introduction to Modern Virology* (7th Edition). Wiley-Blackwell.
• Murray, P.R., Rosenthal, K.S., & Pfaller, M.A. (2020). *Medical Microbiology* (9th Edition). Elsevier.

Reference Book (s):

• Brooks, G.F., Carroll, K.C., Butel, J.S., & Morse, S.A. (2013). *Jawetz, Melnick, & Adelberg's Medical Microbiology* (26th Edition). McGraw-Hill Education.
• Fenner, F., Gibbs, E.P.J., Murphy, F.A., Rott, R., Studdert, M.J., & White, D.O. (2010). *Veterinary Virology* (4th Edition). Academic Press.
• Ryan, K.J., & Ray, C.G. (Eds.). (2018). *Sherris Medical Microbiology* (7th Edition). McGraw-Hill Education.

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks including virology, microbiology, and infectious diseases (NCBI Bookshelf)
• https://www.cdc.gov/vaccines/pubs/pinkbook/index.html – CDC's Pink Book: vaccine-preventable viral diseases and immunization strategies
• https://www.youtube.com/user/ArmandoHasudungan – Illustrated medical lectures on virology, virus structure, and replication
• https://open.umn.edu/opentextbooks – Free academic textbooks covering microbiology and virology
• https://www.slideshare.net/search/slideshow?searchfrom=header&q=clinical+virology – PPTs on clinical virology for teaching and reference
• https://www.khanacademy.org/science/health-and-medicine – Educational videos and notes on viruses, immunology, and infectious diseases

Topics relevant to "SKILL DEVELOPMENT":

- Accurate sample collection and handling for viral diagnostics
- Performing ELISA and rapid diagnostic tests (RDTs)
- PCR-based detection and interpretation for viral infections
- Immunofluorescent staining and microscopy skills
- Preparation and examination of blood and body fluid samples
- Use of biosafety and infection control protocols
- Critical evaluation of diagnostic methods (e.g., RDT vs ELISA vs PCR)
- Data recording, result interpretation, and reporting
- Communication of diagnostic findings in clinical settings

• ☐ Awareness of vaccination protocols and public health guidelines

Course Code: BMLT023	**Course Title: Histopathology** **Type of Course: DSE**	**L-T-P-C**	3	0	4	5
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course introduces the principles and practices of Histopathology, focusing on the microscopic study of diseased tissues. It covers tissue processing, fixation, embedding, microtomy, staining techniques, and slide examination. Students will learn to identify normal and pathological tissue structures and understand their clinical significance, preparing them for roles in diagnostic and research laboratories.					
Course Objective	• To understand the basic principles of histopathology and tissue architecture. • To learn methods of tissue collection, fixation, processing, and sectioning. • To gain knowledge of routine and special staining techniques. • To develop skills in slide preparation, microtomy, and microscopic examination. • To identify normal and pathological features in various tissues. • To understand the role of histopathology in disease diagnosis and patient care. • To follow laboratory safety and quality control protocols in histopathology labs.					
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts and techniques in histopathology, including tissue preparation and staining. • Understand the role of histological examination in diagnosing diseases.					

	• Apply techniques for tissue processing, sectioning, and staining. • Analyze histological slides to identify pathological changes. • Evaluate the accuracy and relevance of histopathological methods. • Create clear reports documenting findings and their clinical significance			
Course Content:				
Module 1	Overview of Histopathology	Assignment/ Quiz	Numerical solving Task	**6 Sessions**
Introduction to Histopathology, Basic concepts about routinemethods of examination of tissues, Collection and transportation of specimens for histological examination, Safety measures in a histopathology laboratory				
Module 2	Basic Concepts of Fixation	Assignment/ Quiz	Memory Recall based Quizzes	**9 Sessions**
Basic concepts of fixation Various types of fixatives used in a routine histopathology laboratory Simple fixatives Compound fixatives Special fixatives for demonstration of various tissue elements, Decalcification Criteria of a good decalcification agent technique of decalcification followed with selection of tissue, fixation, and de calcification, neutralization of acid andthorough washing Various types of decalcifying fluids:				
Module 3	Processing of Various Tissues for Histological Examination	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**
Processing of various tissues for histological examination Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing. Components & principles of various types of automatic tissue Processors Embedding: Definition Various types of embedding media, Section Cutting Introduction regarding equipment used for sectioning Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping.				
Module 4	Histology Staining's	Assignment/ Quiz	Numerical solving Task	**12 Sessions**
Staining, Impregnation, and Mountants: Covers staining theory, dye classification, principles of dye chemistry, types and preparation of stains, solvents, aniline water, and buffers. Includes common mountants in histotechnology, general staining methods for paraffin-embedded				

tissues (nuclear and cytoplasmic), manual and automated staining techniques, slide mounting, labeling, cataloguing, and routine staining like Hematoxylin and Eosin (H&E).

Module 5	Advancements in Histopathology	Assignment/ Quiz	Numerical solving Task	**8 Sessions**

Introduction to Automation in histopathology, fully automation in histopathology- Automatic tissue Processor with microprocessor etc .

List of Laboratory Tasks:

Experiment No. 1: Use of antiseptics, disinfectants, and insecticides in a tissue culture processing laboratory.

Experiment No. 2: Reception and labelling of histological specimens.

Experiment No. 3: Preparation of various fixatives.

Experiment No. 4: Testing of melting point of paraffin wax.

Experiment No. 5: Embedding of given tissue in paraffin block.

Experiment No. 6: Processing of bone for decalcification.

Experiment No. 7: Preparation of ascending and descending grades of alcohol from absolute alcohol.

Experiment No. 8: Processing of tissue using manual and automated processor methods.

Experiment No. 9: Section cutting (rough and fine).

Experiment No. 10: Attachment of tissue sections to glass slides.

Experiment No. 11: Use of tissue floatation bath and drying sections in oven (60–65°C).

Experiment No. 12: Perform and practice the Haematoxylin and Eosin (H&E) staining technique.

Experiment No. 13: Perform and practice Mallory's Phosphotungstic Acid Haematoxylin (PTAH) staining.

Targeted Application & Tools that can be used:

- Antiseptics, disinfectants, and insecticides for lab safety and contamination control
- Fixative preparation materials (e.g., formalin, Bouin's solution)
- Paraffin wax with melting point apparatus
- Tissue embedding stations and embedding molds
- Manual and automated tissue processors
- Microtomes for section cutting (rough and fine)
- Tissue floatation baths and drying ovens (60–65°C)
- Glass slides, cover slips, mounting media, and labeling tools
- Staining reagents and equipment for Hematoxylin & Eosin (H&E), Mallory's PTAH, and other special stains

- Protective gear such as gloves, lab coats, and eye protection

Project Work/ Assignment:

- Prepare a detailed report on the preparation and use of various fixatives in tissue processing.
- Conduct a step-by-step demonstration and documentation of tissue embedding and sectioning techniques.
- Perform staining of tissue sections using Hematoxylin and Eosin (H&E) and Mallory's PTAH stains, and analyze the microscopic findings.
- Compare manual versus automated tissue processing methods through practical observation and report.
- Develop a safety protocol for handling antiseptics, disinfectants, and insecticides in the histopathology lab.
- Create a labeling and cataloguing system for histological slides ensuring accuracy and traceability.
- Investigate the effect of different grades of alcohol on tissue dehydration and prepare a summary report.
- Prepare a presentation on the importance and application of decalcification in bone tissue processing.

Text Book(s):

- **"Theory and Practice of Histological Techniques"** by John D. Bancroft and Marilyn Gamble
- **"Histotechnology: A Self-Instructional Text"** by Freida L. Carson and Christa Hladik

Reference Book (s):

- **"Histopathology Techniques"** by Dr. S. K. Bhattacharyya
- **"Basic Histopathology"** by Dr. A. K. Gupta
- **"Textbook of Histology"** by Leslie P. Gartner and James L. Hiatt
- **"Robbins Basic Pathology"** by Kumar, Abbas, and Aster (for pathology correlation)
- **"Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology"** by J. R. Kiernan

Online Resources (e-books, notes, ppts, video lectures etc.):

- https://histologyguide.com – Free interactive e-book and tutorials on histology
- https://www.pathologystudent.com – Notes and case studies for pathology students
- https://www.youtube.com/user/DrNajeebLectures – Comprehensive histology and pathology video lectures
- https://www.youtube.com/user/ArmandoHasudungan – Illustrated medical lectures on histology and pathology concepts
- https://www.coursera.org – Online courses on histology and pathology from top universities
- https://openstax.org – Free academic textbooks on histology, anatomy, and related subjects
- https://www.slideshare.net/search/slideshow?searchfrom=header&q=histotechnology – PPTs on histotechnology techniques for teaching and reference
- ☐ https://scholar.google.com – Access to research articles and recent advances in histopathology

Topics relevant to "SKILL DEVELOPMENT":

- Specimen reception, labelling, and documentation
- Preparation and use of fixatives
- Melting point determination of paraffin wax
- Tissue embedding in paraffin blocks
- Bone tissue decalcification techniques
- Preparation of graded alcohols for tissue dehydration
- Manual and automated tissue processing
- Microtomy: rough and fine section cutting
- Mounting tissue sections on glass slides
- Use of tissue floatation bath and drying ovens
- Routine and special staining methods (H&E, Mallory's PTAH)
- Slide mounting, cover slipping, and cataloguing

Course Code: BMLT024	**Course Title: Applied Pathology** **Type of Course: DSE**	**L-T-P-C**	9 3	0	4	5

Version No.	
Course Pre-requisites	NONE
Anti-requisites	NONE
Course Description	This course focuses on the practical application of pathology principles in clinical settings. It covers the study of disease mechanisms, including cellular injury, inflammation, healing, and neoplasia, with emphasis on diagnostic techniques. Students will learn to correlate pathological findings with clinical presentations to aid in accurate diagnosis and treatment planning.
Course Objective	• To understand fundamental concepts of disease processes and mechanisms. • To recognize and describe cellular injury, inflammation, and tissue repair. • To learn the pathology of neoplastic diseases and tumor classification. • To correlate pathological changes with clinical symptoms and diagnostic findings. • To develop skills in interpreting laboratory and histopathological reports. • To apply pathology knowledge for effective patient diagnosis and management.
Course Outcomes	**List the course outcomes** **On successful completion of this course the students shall be able to:** • Remember key concepts, terminology, and techniques in pathology. • Understand the mechanisms of disease and their impact on the body. • Apply laboratory techniques for tissue, blood, and fluid analysis. • Analyze pathology results to diagnose diseases and assess disease progression. • Evaluate diagnostic methods for their accuracy and clinical relevance. • Create clear reports documenting findings and their clinical significance.
Course Content:	

Module 1	Introduction to Pathology	Assignment/ Quiz	Numerical solving Task	**7 Sessions**
Overview of pathology history, key terms, and cell injury mechanisms including reversible/irreversible damage, hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis, and apoptosis.				
Module 2	Acute and Chronic Inflammation	Assignment/ Quiz	Memory Recall based Quizzes	**8 Sessions**
Features of inflammation including vascular changes, cellular responses, mediators, and phagocytosis.				
Module 3	Tissue Renewal, Repair, and Pathology	Assignment/ Quiz	Memory Recall-based Quizzes	**10 Sessions**
Processes of tissue healing, fibrosis, cirrhosis, and concepts like edema, hyperemia, congestion, hemorrhage, hemostasis, thrombosis, embolism, infarction, shock, and hypertension.				
Module 4	Disease Pathophysiology and Management	Assignment/ Quiz	Numerical solving Task	**10 Sessions**
Nutritional disorders (deficiencies and excess), effects of metals (zinc, iron, calcium), and diseases such as diabetes, arteriosclerosis, myocardial infarction, COPD, Parkinson's disease. Infectious diseases overview including pathogenesis, transmission, prevention, with examples like typhoid and dengue.				
Module 5	Understanding Cancer	Assignment/ Quiz	Numerical solving Task	**10 Sessions**
Definitions, types, benign vs malignant tumors, metastasis, carcinogens, oncogenes, tumor suppressor genes, DNA repair mechanisms, and cancer stem cells.				

List of Laboratory Tasks:

Experiment No. 1: Microscopic identification of cell injury (reversible vs irreversible) and cellular adaptations (atrophy, hypertrophy, hyperplasia, metaplasia, etc.).

Experiment No. 2: Observation and comparison of necrosis and apoptosis using histological slides.

Experiment No. 3: Study of acute inflammation: examination of pus cells and vascular changes under the microscope.

Experiment No. 4: Study of chronic inflammation: observation of lymphocytes, macrophages, and tissue damage.

Experiment No. 5: Demonstration and drawing of the process of phagocytosis.

Experiment No. 6: Microscopic study of fibrosis and healing tissue following injury.

Experiment No. 7: Identification of edema, thrombosis, infarction, and hemorrhage through prepared slides or case demonstrations.

Experiment No. 8: Case-based diagnosis of nutritional deficiency disorders such as iron deficiency anemia, vitamin B12 deficiency, and rickets.

Experiment No. 9: Demonstration of Widal test for Typhoid and NS1 antigen test for Dengue.

Experiment No. 10: Observation of blood smear for malarial parasites under oil immersion microscopy.

Experiment No. 11: Study of benign and malignant tumors under the microscope and identification of histological features.

Experiment No. 12: Diagrammatic representation and explanation of routes of metastasis and tumor spread.

Experiment No. 13: Viva and worksheet on oncogenes, tumor suppressor genes, and carcinogens.

Targeted Application & Tools that can be used:

- Diagnosis and monitoring of diseases through tissue, fluid, and cytological examination
- Clinical support in identifying pathological changes in oncology, infectious diseases, and autoimmune conditions
- Hands-on skill development for Medical Laboratory Technology (MLT) and pathology students
- Specimen collection tools: syringes, biopsy punches, FNAC kits, collection vials
- Fixatives and preservatives: formalin, Bouin's solution, alcohol-based reagents
- Paraffin wax, melting point apparatus, and tissue embedding stations
- Microtome (manual/semi-automated) for rough and fine tissue sectioning
- Tissue floatation bath and drying oven (60–65°C)
- Staining reagents and equipment for routine (Hematoxylin & Eosin) and special stains (Ziehl-Neelsen, PAS, PTAH)

Project Work/ Assignment:

- **Demonstrate Tissue Processing Steps:** Prepare a detailed report and perform hands-on tasks for fixation, dehydration, clearing, embedding, and sectioning of a given tissue specimen.
- **Comparative Study:** Analyze and compare the results of manual vs automated tissue processing, including turnaround time, quality, and efficiency.

- **Staining Techniques Report:** Perform and document routine (Hematoxylin & Eosin) and special staining methods (e.g., PAS, Ziehl-Neelsen), including principles and interpretations.
- **Slide Cataloguing System:** Develop and present a model system for labelling, cataloguing, and storing histological slides with patient safety considerations.
- **Decalcification Project:** Process a bone sample, document the decalcification process, and analyze challenges and solutions.
- **Lab Safety SOP:** Create a standard operating procedure for handling and disposing of antiseptics, disinfectants, and biohazard materials in a pathology lab.
- **Alcohol Preparation Assignment:** Prepare graded alcohols from absolute alcohol and document their role in tissue dehydration with flowcharts and observations.
- **Case-based Analysis:** Correlate histological findings with a clinical case (real or simulated) and prepare a diagnostic pathway report.

Text Book(s):

• *"Theory and Practice of Histological Techniques"* by John D. Bancroft and Marilyn Gamble

• *"Histotechnology: A Self-Instructional Text"* by Freida L. Carson and Christa Hladik

Reference Book (s):

• *"Robbins Basic Pathology"* by Vinay Kumar, Abul K. Abbas, and Jon Aster

• *"Textbook of Histology"* by Leslie P. Gartner and James L. Hiatt

• *"Histopathology Techniques and Practical Pathology"* by Dr. S.K. Bhattacharyya

• *"Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology"* by J.R. Kiernan

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.ncbi.nlm.nih.gov/books/ – Access to free medical textbooks including histology and pathology (NCBI Bookshelf)

• https://www.histologyguide.com – Comprehensive interactive histology atlas and tutorials

• https://www.osmosis.org – Video lectures and notes on pathology and histology concepts

• https://www.slideshare.net/search/slideshow?searchfrom=header&q=histopathology – PPTs and presentations on histopathology topics

• https://www.khanacademy.org/science/health-and-medicine – Educational videos covering pathology and related medical sciences

• https://openstax.org/subjects/science – Free textbooks including anatomy and physiology that support histopathology learning
Topics relevant to "SKILL DEVELOPMENT": • Specimen collection, reception, and labelling techniques • Preparation and use of fixatives and preservatives • Tissue processing: manual and automated methods • Embedding tissue in paraffin blocks and section cutting with microtome • Slide preparation: mounting, staining (routine and special stains), and cover slipping • Use and maintenance of laboratory equipment (microtome, tissue processor, floatation bath) • Microscopic examination and interpretation of histological slides • Quality control and documentation procedures in histopathology labs • Lab safety, handling of disinfectants, antiseptics, and biohazard waste management

Course Code: BMLT027	**Course Title: Research Methodology & Biostatistics** **Type of Course: PRW**	**L-T-P-C**	3	0	2	4
Version No.						
Course Pre-requisites	NONE					
Anti-requisites	NONE					
Course Description	This course covers the fundamentals of immune system function and disorders, focusing on immunopathology and molecular biology. Topics include immune responses, hypersensitivity, autoimmune diseases, and molecular techniques like gene expression and molecular diagnostics. Students gain theoretical knowledge and practical skills to study immune-related diseases at the molecular level.					
Course Objective	• To understand the basic principles of immune system function and dysfunction. • To recognize different types of hypersensitivity and autoimmune disorders. • To learn molecular biology techniques used in immunological research and diagnostics. • To correlate immunopathological mechanisms with clinical diseases.					

<table>
<tr><td></td><td colspan="4">• To develop skills in applying molecular tools for diagnosis and research in immunology.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">List the course outcomes
On successful completion of this course the students shall be able to:

• Remember key concepts and techniques in immunopathology and molecular biology.
• Understand immune responses and molecular diagnostic principles.
• Apply methods like PCR and immunological testing in the lab.
• Analyze data to diagnose diseases and assess immune function.
• Evaluate the accuracy and relevance of diagnostic techniques.
• Create clear reports documenting findings and clinical implications.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basics of Research and Ethics</td><td>Assignment/ Quiz</td><td>Numerical solving Task</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Introduction to research methods, Identifying research problem, Difference between exploratory and experimental research, Ethical issues in research, Research design, Ethics of clinical trials, Permission from ethical committee, Social ethics</td></tr>
<tr><td>Module 2</td><td>Biostatistics and Data Understanding</td><td>Assignment/ Quiz</td><td>Memory Recall based Quizzes</td><td>8 Sessions</td></tr>
<tr><td colspan="5">Basic concepts of biostatistics, Types of data, Research tools and data collection methods, Need of biostatistics, Understanding data in biostatistics, Relation between data and variables, Types of variables, Defining data set</td></tr>
<tr><td>Module 3</td><td>Sampling Methods and Data Analysis</td><td>Assignment/ Quiz</td><td>Memory Recall-based Quizzes</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Sampling methods, Probability rules and distributions (Normal and Binomial), Collection of relevant data, Construction of study: population and sample, Concept of normality, Summarizing data relevant to study, Understanding statistical analysis (conceptual)</td></tr>
</table>

Module 4	Research Proposal Development	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Developing a research proposal, Models involving patient information, Use of diagnostic data and databases				
Module 5	Use of Advanced Research and Search Tools	Assignment/ Quiz	Numerical solving Task	**9 Sessions**
Management software (Zotero, Mendeley), Paper formatting software (LaTeX, MS Office), Plagiarism detection software, Advanced search tools for research literature				

List of Laboratory Tasks:

Experiment No. 1: Identification of research problems and formulation of research objectives and questions.

Experiment No. 2: Classification and tabulation of data types and variables from healthcare datasets.

Experiment No. 3: Application of descriptive statistics: calculation of mean, median, mode, standard deviation, and range.

Experiment No. 4: Construction of data collection tools such as questionnaires and data entry sheets.

Experiment No. 5: Demonstration of sampling methods (simple random, stratified, systematic) using hypothetical datasets.

Experiment No. 6: Use of probability distributions (Normal and Binomial) in real-world biostatistical scenarios.

Experiment No. 7: Preparation of a mini research proposal including background, objectives, methodology, and ethical considerations.

Experiment No. 8: Use of referencing and management software (Zotero/Mendeley) for literature citation and bibliography generation.

Experiment No. 9: Conducting plagiarism checks using software tools and interpreting the results.

Experiment No. 10: Practice of paper formatting using LaTeX/MS Word as per scientific journal requirements.

Targeted Application & Tools that can be used:

- Designing and conducting ethical biomedical research using appropriate methodologies and study designs.
- Analyzing clinical and epidemiological data using statistical tools such as SPSS, R, and

Python (Pandas, SciPy).

- Creating well-structured research proposals with reference management tools like Zotero and Mendeley.
- Conducting literature reviews and preventing plagiarism using Turnitin and similar plagiarism detection software.
- Summarizing and interpreting healthcare data with visualization tools like MS Excel and Google Sheets.
- Utilizing online databases and survey platforms like PubMed, Google Scholar, and REDCap for data sourcing and collection.

Project Work/ Assignment:

- Design a mini research project on a relevant healthcare topic, including formulation of research questions and objectives.
- Prepare a research proposal with background, methodology, sampling strategy, and ethical considerations.
- Conduct a literature review using Zotero/Mendeley and present the findings in a structured format.
- Collect and analyze sample data using Microsoft Excel/SPSS and present statistical summaries (mean, SD, charts).
- Write a report interpreting the statistical findings and suggesting possible conclusions and recommendations.
- Create a poster or PowerPoint presentation to showcase the research design, methodology, analysis, and results.

Text Book(s):

- **"Research Methodology: Methods and Techniques"** by C.R. Kothari
- **"Biostatistics: A Foundation for Analysis in the Health Sciences"** by Wayne W. Daniel and Chad L. Cross

Reference Book (s):

- **"Basic & Clinical Biostatistics"** by Beth Dawson and Robert G. Trapp
- **"Principles of Biostatistics"** by Marcello Pagano and Kimberlee Gauvreau
- **"Essentials of Research Methodology for All Researchers"** by P. S. Yadava
- **ICMR Guidelines** for Biomedical Research on Human Participants

Online Resources (e-books, notes, ppts, video lectures etc.):

• https://www.coursera.org/learn/biostatistics – Biostatistics in Public Health by Johns Hopkins University (video lectures, quizzes, and reading materials) • https://ocw.mit.edu – MIT OpenCourseWare: Research methods and statistical modeling courses • https://nptel.ac.in – NPTEL courses on Research Methodology and Biostatistics by IITs (video lectures and notes) • https://www.khanacademy.org/math/statistics-probability – Concepts in probability, sampling, and hypothesis testing explained with videos • https://www.slideshare.net – PPT presentations on Research Methods, Sampling Techniques, and Statistical Tools • https://libgen.rs/ – Access to various textbooks and research methodology reference materials • https://www.ncbi.nlm.nih.gov/pmc/ – Full-text research articles to study research writing formats and statistical interpretations
Topics relevant to "SKILL DEVELOPMENT": • Formulating research questions and identifying problems in healthcare and clinical settings • Designing ethically sound clinical and laboratory research studies • Developing skills in literature review, citation management (Zotero/Mendeley), and plagiarism checking • Collecting, cleaning, and organizing research data using appropriate sampling methods • Applying statistical software (SPSS, R, Python) for data analysis and interpretation • Performing hypothesis testing, regression modeling, and probability distribution analysis • Preparing structured research proposals for grants, institutional review boards (IRBs), or dissertations • Writing scientific papers and theses using LaTeX/MS Word formatting tools • Presenting research findings through graphs, tables, and data visualization tools like Excel, Power BI, and Tableau • Understanding bioethics and data privacy principles in healthcare research

Semester-7

Sl. No.	Course Code	Course Name	L	T	P	Credits
1	BMLT403	Internship	0	0	48	24
		Total	0	0	48	24

Semester-8

Sl. No.	Course Code	Course Name	L	T	P	Credits
1	BMLT403	Internship	0	0	48	24
		Total	0	0	48	24