Study & Evaluation Scheme

of

Bachelor of Science in Medical Laboratory Technology (BMLT)

[Applicable w.e.f. Academic Session 2011-12 till revised]

TEERTHANKER MAHAVEER UNIVERSITY

Delhi Road, Moradabad, Uttar Pradesh-244001

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TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U. P. Act No. 30, 2008)
Delhi Road, Moradabad (U.P)

Study & Evaluation Scheme
of
Bachelor of Science of Medical Laboratory Technology (BMLT)

SUMMARY

Programme	:	Bachelor of Science in Medical Laboratory Technology (BMLT)
Duration	:	Three years full time and six months internship (Annual System)
Medium	:	English
Minimum Required Attendance	:	75 %
Maximum Credits	:	82
Minimum credits required for the degree	:	82

Assessment :

Internal	External	Total
30	70	100

Internal Evaluation (Theory Papers)

Class Test I	Class Test II	Class Test III	Assignment (s)	Other Activity (including attendance	Total
Best two out of the three					
10	10	10	5	5	30

Evaluation of Practical/Dissertations & Project Reports :

Internal	External	Total
50	50	100

Duration of Examination :

External	Internal
3 hrs.	1.5 hr.

To qualify the course a student is required to secure a minimum of 50% marks in aggregate including the year-end examination and teacher's continuous evaluation (i.e. both internal and external). A candidate, who secures less than 50% marks in a course, shall be deemed to have failed in that subject/course(s). A candidate failing in more than two subjects will not be promoted to the next higher class. If a candidate fails in either theory or practical, he/she have to reappear in both the examination.

A candidate who has been placed under re-appear category in any of the subject shall be allowed to continue his/her studies in the next year but will have to pass the concerned subject in the supplementary examination to be conducted within three months after declaration of the result. Unless candidate passes the previous level examination, he /she shall not be allowed to appear in the next level examination. Failure in supplementary examination will be revert back to corresponding junior batch of students and will continue his/her studies with them for rest of the program.

Note: For internal assessment purpose, there will be three Class Tests in a year and best two tests will be computed for the final result.

INTERNSHIP

Internship is a phase of training wherein a graduate is expected to conduct actual practice of medical pathology technology and acquire skills under supervision so that he /she may become capable of functioning independently.

SPECIFIC OBJECTIVES

At the end of internship training the graduate shall be able to:

1. Perform all the diagnostic techniques
2. Use discretely the essential laboratory services
3. Manage all types of clinical diagnostic methods
4. Demonstrate skills in handling the modern equipments in laboratory test.
5. Develop leadership qualities to function effectively as a leader in the laboratory environment
6. Render services to the laboratory set up and to communicate effectively with the doctors and the hospital management.
7. Development of skill and competency in data processing, reporting and maintenance of records & Laboratory investigations.

INTERNSHIP TIME PERIOD: 6 Months

OTHER DETAILS

i) Entire internship shall be done in a Hospital or Medical College.
ii) Every candidate will be required after successfully completing the final Bachelor of Science in Medical Laboratory Technology (BMLT) Examination, to undergo compulsory rotator internship to satisfaction of the University for a period of 6 months so as to be eligible for the award of the degree.
iii) The University shall issue a provisional degree of Bachelor of Science in Medical Laboratory Technology (BMLT) on passing the final examination after the completion of internship on demand by the candidate.
iv) The internee shall be entrusted with laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.
v) Internee will not issue certified copy of investigation reports or other related documents under their signature.

ASSESSMENT OF INTERNSHIP

1. The Internee shall maintain the record of work, which is to be verified and certified by the senior medical officer/Technician under whom he /she works. Apart from scrutiny of record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during at the end of training. Based on the record of work and date of evaluation The Director/Principal shall issue certificate for satisfactory completion of training following which the university shall award the degree of Bachelor of Science in Medical Laboratory Technology (BMLT) to the candidate.

2. Satisfactory completion shall be determined on the basis of the following.
   a) Proficiency of knowledge required for each Laboratory techniques.
   b) The competency and skills expected to manage each laboratory technique.
   c) Responsibility, punctuality work up of laboratory techniques, involvement in special procedures and preparation of reports.
   d) Capacity to work in a team (behaviour with colleagues, nursing staff and relationship with medical and paramedical.
   e) Initiating, participating in discussions and developing research aptitude.

3. Only six leave are allowed to an internee during the period of his/her internship. If he/she extend his/her leave in the duration of internship, the period the internship shall be extended by double the days for which the student was absent.

PROJECT

Submitted by the candidate will be duly verified & a viva voce shall be conducted on the same at the time of Practical Examination of final year.

Study & Evaluation Scheme
Programme: Bachelor of Science in Medical Laboratory Technology (BMLT)
Year-I

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	S	P		Internal	External	Total
1	BML101	Human Anatomy	3	-	-	3	30	70	100
2	BML102	Human Physiology	3	-	-	3	30	70	100
3	BML103	Pathology	3	-	-	3	30	70	100
4	BML104	Medical Biochemistry	3	-	-	3	30	70	100
5	BML105	Community Healthcare	3	-	-	3	30	70	100
6	BML106	Foundation English	2	2	-	3	30	70	100
7	BML107	Basics of Computers	2	-	-	2	30	70	100
8	BML151	Human Anatomy (Practical)*	-	-	2	1	50	50	100
9	BML152	Human Physiology (Practical)*	-	-	2	1	50	50	100
10	BML153	Pathology (Practical)*	-	-	2	1	50	50	100
11	BML154	Medical Biochemistry (Practical)*	-	-	2	1	50	50	100
12	BML155	Basics of Computers (Practical)	-	-	2	1	50	50	100
13	BML156	Hospital Postings	-	-	10	5	100	-	100
Total			**19**	**2**	**20**	**30**	**560**	**740**	**1300**

*= Alternate week in batches

Year-II

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	S	P		Internal	External	Total
1	BML201	Bacteriology & Mycology	3	-	-	3	30	70	100
2	BML202	Parasitology & Virology	3	-	-	3	30	70	100
3	BML203	Histopathology	2	-	-	2	30	70	100
4	BML204	Hematology	2	-	-	2	30	70	100
5	BML205	Clinical Biochemistry-I	2	-	-	2	30	70	100
6	BML206	Clinical Biochemistry-II	2	-	-	2	30	70	100
7	BML207	English Communication	2	2	-	3	30	70	100
8	BML251	Bacteriology & Mycology (Practical)	-	-	2	1	50	50	100
9	BML252	Parasitology & Virology (Practical)	-	-	2	1	50	50	100
10	BML253	Histopathology & Hematology (Practical)	-	-	4	2	50	50	100
11	BML254	Clinical Biochemistry-I (Practical)	-	-	2	1	50	50	100
12	BML255	Clinical Biochemistry-II (Practical)	-	-	2	1	50	50	100
13	BML256	Hospital Postings	-	-	6	3	100	-	100
Total			**16**	**2**	**18**	**26**	**560**	**740**	**1300**

Year-III

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	S	P		Internal	External	Total
1	BML301	Immunology	3	-	-	3	30	70	100
2	BML302	Bacteriology & Applied Bacteriology	3	-	-	3	30	70	100
3	BML303	Cytology	3	-	-	3	30	70	100
4	BML304	Immunohematology & Blood Transfusion	3	-	-	3	30	70	100
5	BML305	Clinical Biochemistry-III	3	-	-	3	30	70	100
6	BML306	Advanced Medical Biochemistry	3	-	-	3	30	70	100
7	BML351	Immunology (Practical)	-	-	2	1	50	50	100
8	BML352	Bacteriology & Applied Bacteriology (Practical)	-	-	2	1	50	50	100
9	BML353	Cytology (Practical)	-	-	2	1	50	50	100
10	BML354	Immunohematology & Blood Transfusion (Practical)	-	-	2	1	50	50	100
11	BML355	Clinical Biochemistry-III (Practical)	-	-	2	1	50	50	100
12	BML356	Hospital Postings	-	-	6	3	100	-	100
Total			**18**		**16**	**26**	**530**	**670**	**1200**

Note:

L – Lecture 1L = 1Hr

T- Tutorial 1T= 1 Hr

P- Practical 1P= 1 Hr

C-Credits
1C = 1Hr of Theory Paper
2 Hrs of Practical/Tutorial

Evaluation Scheme for Practical (Internal & External)

Viva (General)	Long Case	Short Case	Student Journal	Total Marks
20 marks	**10 marks**	**10 marks**	**10 marks**	**50**

Theory Question Paper Structure

1. The question paper shall consist of eight questions. First question shall be of short answer type and be compulsory. It shall contain 8 parts, covering the entire syllabus and the student shall be required to answer any five of them (weightage 4 marks each).
2. Out of the remaining seven questions, student shall be required to attempt any five. The weightage of Question No. 2 to 8 shall 10 marks each.

Year- I
Human Anatomy

Course Code: BML101 **L-3, T-0, P-0, C-3**

Course Contents

Unit I

Introduction: Human body as a whole

Definition of anatomy and its divisions, Terms of location, positions and planes, Cell and its organelles, Epithelium-definition, classification, describe with examples, function, Glands-classification, describe serous & mucous glands with examples, Basic tissues – classification with examples.

Unit II

Locomotion and Support

Cartilage – types with example & histology, Bone – Classification, names of bone cells, parts of long bone, microscopy of compact bone, names of bones, vertebral column, inter vertebral disc, fontanelles of fetal skull, Joints – Classification of joints with examples, synovial joint (in detail for radiology), Muscular system- Classification of muscular tissue & histology, Names of muscles of the body.

Unit III

Cardiovascular System

Heart-size, location, chambers, exterior & interior, Blood supply of heart, Systemic & pulmonary circulation, Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial, artery, superficial palmar arch, femoral artery, internal iliac artery, Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses, Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief.

Unit IV

Gastro-intestinal System

Parts of GIT, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, Radiographs of abdomen.

Unit V

Respiratory System

Parts of RS, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, Histology of trachea, lung and pleura, Names of paranasal air sinuses.

Unit VI

Peritoneum: Description in brief.

Urinary System

Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder.

Unit VII

Reproductive System

Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology), Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology), Mammary gland-gross.

Unit VIII

Endocrine Glands
Names of all endocrine glands in detail on pituitary gland, thyroid gland, parathyroid gland, suprarenal glad (gross & histology).

Unit IX
Nervous System
Neuron, Classification of NS, Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology), Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei, Blood supply of brain, Cranial nerves, Sympathetic trunk & names of parasympathetic ganglia.

1. Sensory Organs

Skin: Skin-histology, Appendages of skin, Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply, Ear: parts of ear- external, middle and inner ear and contents

2. Embryology

Spermatogenesis & oogenesis, Ovulation, Fertilization, Fetal circulation, Placenta

Reference Books:

1. William Davis, *Understanding Human Anatomy and Physiology*, McGraw Hill
2. Chaursia's, *A Text Book of Anatomy*
3. Ranganathan, T.S., *A Text Book of Human Anatomy*
4. Fattana, *Human Anatomy,* (Description and Applied), Saunder's & C P Prism Publishers, Bangalore
5. Ester. M. Grishcimer, *Physiology & Anatomy with Practical Considerations*, J.P. Lippin Cott. Philadelphia.

*** Latest editions of all the suggested books are recommended.**

Year -I
Human Physiology

Course Code: BML102 **L-3, T-0, P-0, C-3**

Course Contents:

1. **Cell**

   Definition, Structure and function of Cytoplasmic Organelles, Reproduction-Meosis, Mitosis.

2. **The important physico-chemical laws applied to physiology**

   Diffusion, Osmosis, Bonding, Filtration, Dialysis, Surface Tension, Adsorption, Colloid.

3. **Introduction- composition and function of blood**

   Red blood cells- Erythropoiesis, stages of differentiation function, counts physiological Variation. Haemoglobin -Structure, function, concentration physiological variation. Methods of Estimation of Hb, White blood cell- Production, function, life span, count, differential count. Platelets- Origin, normal count, morphology functions. Plasma Proteins- Production, concentration, types, albumin, globulin, fibrinogen, Prothrombin functions. Haemostasis & Blood coagulation. Haemostasis – Definition, normal haemostasis, clotting factors, mechanism of clotting disorders of clotting factors. Blood Bank, Blood groups-A, B, O system, Rh system, **Blood grouping & typing**, Cross-matching, Rh system-Rh factor, Rh in Cross-matching, Blood transfusion – Indication, universal donor and recipient concept. Selection criteria of a blood donor. Transfusion Anticoagulant – Classification, Examples and uses. Anaemia's: Classification – morphological and etiological. Effects of anaemia on body. Blood indices – Colour index, MCH, MCV, MCHC, Erythrocyte Sedimentation Rate (ESR) and Paced cell volume, Normal Values, Definition, determination. Blood Volume – Normal value, determination of blood volume and regulation of blood volume body fluid- pH, normal value, regulation and variation.

4. **Fundamentals of different Organ Systems:**
   i. Cardiovascular System
   ii. Respiratory System
   iii. Excretory System
   iv. Reproductive System
   v. Endocrine System
   vi. Lymphatic System

Reference Books:

1. Guyton, Arthur, *Text Book of Physiology*, Prism Publishers
2. Chatterjee, C C, *Human Physiology*, Medical Allied Agency
3. A.K Jain, *Human Physiology*

*** Latest editions of all the suggested books are recommended.**

Year -I
Pathology

Course Code: BML103 **L-3, T-0, P-0, C-3**

Course Contents:

1. Histopathology

Introduction to Histopathology, Receiving of Specimen in the laboratory, Grossing Techniques, Mounting Techniques – various Mounts, Maintenance of records and filling of the slides. Use & care of Microscope, Various fixatives, Mode of action, Preparation and Indication. Section Cutting, Tissue processing for routine paraffin sections, Decalcification of Tissues. Staining of tissues - H& E Staining. Bio-Medical waste management.

2. Clinical Pathology

Introduction to Clinical Pathology. Collection, Transport, Preservation, and Processing of various clinical Specimens of Urine Examination – Collection and Preservation of urine. Physical, Chemical, Microscopic Examination, Examination of body fluids. Examination of cerebro spinal fluid (CSF), Sputum Examination. Examination of feces.

3. Haematology

Introduction to Haematology, Normal constituents of Blood, their structure and function. Collection of Blood samples, Various Anticoagulants used in Haematology. Various instruments and glassware used in Haematology, Preparation and use of laboratory glassware. Laboratory safety guidelines, SI units and conventional units in Hospital Laboratory, Hb, PCV, ESR, Normal Haemostasis, Bleeding Time, Clotting Time, Prothrombin Time, Activated Partial Thromboplastin time.

4. Blood Bank

Introduction, Blood grouping and Rh Types, Cross matching

Reference Books:

1. Rabbins & Cotran, *Pathologic Basis & Diseases*
2. Harsh Mohan, *Pathologic Basis & Diseases*
3. Todd & Sanford, *Clinical Diagnosis by Laboratory Method*
4. Dacie & Lewis, *Practical Hematology*
5. Ramanik Sood, *Laboratory Technology Methods and Interpretation*

*** Latest editions of all the suggested books are recommended.**

Year-I
Medical Biochemistry

Course Code: BML104 **L-3, T-0, P-0, C-3**

Course Contents:

1. Specimen Collection

Pre-analytical variables, Collection of blood, Collection of CSF & other fluids, Urine collection. Use of preservatives, Anticoagulants

2. Introduction to Laboratory Apparatus

Pipettes- different types (Graduated, volumetric, Pasteur, Automatic etc.), Calibration of glass pipettes, Burettes, Beakers, Petri dishes, depression plates. Flasks - different types)Volumetric, round bottomed, Erlenmeyer conical etc.,). Funnels – different types (Conical, Buchner etc.) Bottles: Reagent bottles – graduated and common, Wash bottles – different types, Specimen bottles etc.

Measuring cylinders, Porcelain dish, Tubes – Test tubes, centrifuge tubes, test tube draining rack Tripod stand, Wire gauze, Bunsen burner. Cuvettes, significance of cuvettes in colorimeter, cuvettes for visible and UV range, Cuvette holders Racks – Bottle, Test tube, Pipette, Desiccators, Stop watch, rimers, scissors, Dispensers – reagent and sample.

Any other apparatus which is important and may have been missed should also be covered

3. Maintenance of Lab Glassware and Apparatus

Glass and plastic ware in Laboratory, use of glass: significance of boro-silicate glassware and cleaning of glassware, different cleaning solutions of glassware and cleaning of plastic ware, different cleaning solutions.

4. Instruments (Theory and demonstration)

Water bath: Use, care and maintenance, Oven & Incubators: Use, care and maintenance. Water Distillation plant and water deionizers. Use, care and maintenance, Refrigerators, cold box, deep freezers – use, care and maintenance. Reflux condenser: Use, care and maintenance. Centrifuges (Theory and demonstration) *Diagrams to be drawn.*

Definition, Principle, Svedberg unit, centrifugal force, centrifugal field rpm, ref. Conversion of G to rpm and vice versa. Different types of centrifuges, Use care and maintenance of a centrifuge. Laboratory balances [Theory & Practical) Diagrams to be drawn. Manual balances: Single pan, double pan, trip balance, Direct read out electrical balances. Use care and maintenance. Guideline to be followed and precautions to be taken while weighing. Weighing different types of chemicals, liquids. Hygroscopic compounds etc. Colorimeter and spectrophotometer (Theory and Practical) *Diagrams to be drawn*. Principle, Parts diagram. Use, care and maintenance of pH meter and electrodes, Guidelines to be followed and precautions to be taken while using pH meter.

5. Conventional and SI Units

Preparation of normal solutions e.g., In Na_2CO_3, O In Oxalic acid, 0.1N HCl, 0.1N H_2S0_4, 0.66 N H_2S0_4 etc. Percent solutions. Preparation of different solutions – v/v, w/v (solids, liquids and acids). Conversion of a percent solution into a molar solution.

6. Dilutions

Diluting solutions: e.g. Preparation of 0.1N NaCl from 1N NaCl from 2N HCl etc., preparing working standard from stock standard, Body fluid dilutions, Reagent dilution techniques, calculating the dilution of a solution, body fluid reagent etc., Saturated and supersaturated solutions.

Standard solutions: Technique for preparation of standard solutions e.g. Glucose, urea, etc., Significance of volumetric flask in preparing standard solutions. Volumetric flasks of different sizes, Preparation of standard solutions of deliquescent compounds ($CaCl_2$, potassium carbonate, sodium hydroxide etc.,) Preparation of standards using conventional and SI units.

Acids, bases, salts and indicators: Acids and Bases – Definition, physical and chemical properties with examples. Arrhenius concept of acids and bases, Lowry – Bronsted theory of acids and bases classification of acids and bases. Difference between bases and alkali, acidity and basicity, monoprotonic and polyprotonic acids and bases. Concepts of acid base reaction, hydrogen ion concentration, Ionisation of water, buffer, pH value of a solution, preparation of buffer solutions using pH meter.

Salts – Definition, classification, water of crystallization – definition and different types, deliquescent and hygroscopic salts.

Acid-base indicators: (Theory and Practical) Definition, concept, mechanism of dissociation of an indicator, colour change of an indicator in acidic and basic conditions, use if standard buffer solution and indicators for pH determinations, preparation and its application, list of commonly used indicators, and their pH range, suitable pH indicators used in different titrations, universal indicators.

Quality control: Accuracy, Precision, Specificity, Sensitivity. Limits of error allowable in laboratory, Percentage error, Normal values and Interpretations, pH Regulation, Disturbance in acid Base Balance, Metabolic acidosis & alkalosis, Respiratory acidosis & alkalosis, Respiratory alkalosis, Basic Principles and estimation of Blood Gases and pH, Basic principles and estimation of Electrolytes, Nutritional importance of lipids, carbohydrates, proteins and Vitamins.

Reference Books:

1. Varley, *Clinical Chemistry*
2. Teitz, *Clinical Chemistry*
3. Kaplan, *Clinical Chemistry*
4. Ramakrishna S, Prasanna KG, Rajna, *Text Book of Medical Biochemistry*, Orient Longman
5. Vasudevan DM & Sreekumari S, *Text Book of Biochemistry for Medical Students*.
6. Das, Debajyothi, Biochemistry, Academic, Publishers, Calcutta.
7. Chatterjee, *A Text book of Medical Biochemistry*
8. U. Satyanarayan, *Medical Biochemistry*

*** Latest editions of all the suggested books are recommended.**

Year-I
Community Healthcare

Course Code: BML105 **L-3, T-0, P-0, C-3**

Course Contents:

1. **Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.**

   National Health Policy.
   National Health Programmers (Briefly Objectives and Scope).
   Population of India and Family welfare programme in India.

2. **Family:**

   The family, meaning and definitions, Functions of types of family, Changing family patterns. Influence of family on Individuals Health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their Importance to physiotherapy.

3. **Community:**

   Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.
   Urban community – Meaning and features – Health hazards of urbanities.

4. **Culture and Health Disorders**

   Social Change: Meaning of social changes, Factors of social changes, Human adaptation and social changes, Social changes and stress, Social changes and deviance, Social changes and health programme, the role of social planning in the Improvement of health and rehabilitation.

5. **Social Problems of disabled:**
   Consequences of the following social problems in relation to sickness and disability
   Population explosion.

Reference Books:

1. K. Perks, Sunder Lal, Adarsh Pandey, *Textbook of Preventive Social Medicine*

*** Latest editions of all the suggested books are recommended.**

Year I
Foundation English

Course Code: BML106
(Common with BRT106/BPT107/COT105)

L	T	P	C
2	2	0	3

Unit I
Functional Grammar: Patterns & Parts of speech Subject, Predicate, Noun, Pronoun, Adjective, Adverb, Verb, Verb phrases, Conjunction, Interjection. Articles, Preposition, Tenses: functions, Synthesis, Transformation, Spotting errors and correction of sentences. **(12 Hours)**

Unit II
Vocabulary: Word formation, Prefix, Suffix, compound words, conversion, Synonyms, Antonyms, Homophones and Homonyms, How to look up a dictionary, The Language of Doctor and Patient, General description and Medical description, Medical abbreviations, Terminology used in Medical Lab Technology etc. **(12 Hours)**

Unit III
Communication: Meaning & importance of communication, elements of human communication, Barriers to effective communication, channels of communication, Language as a tool of communication, 7C's of Communication, Tips for effective communication. **(12 Hours)**

Unit IV
Requisites of Sentence writing: Fragmented sentences, a good sentence, expletives, garbled sentences, rambling sentences, loaded sentences, Parallel Comparison, Series, Squinting construction, Loose & periodic sentences, Dangling participles, ellipsis. **(12 Hours)**

Unit V
Requisites of Paragraph writing: Structure of Paragraph, Coherence & Unity, Development of paragraph, Inductive order, Deductive order, spatial order, Linear, chronological orders, expository writing, and Argumentative writing, Factual description of objects, process, experiments.
(12 Hours)

Recommended Books:

1. Wren & Martin, *High School English Grammar & Composition* – S. Chand & Co. Delhi.
2. Lewis Norman, *Word Power Made Easy* – W.R. Goyal Publication & Distributors, Delhi.
3. Raman Meenakshi & Sharma Sangeeta, *Technical Communication-Principles & Practice* – O.U.P. New Delhi. 2007.
4. Medical Lab Technology Terminology.

NOTE:
This syllabus has been designed to improve the oral and written communication skills of students. The faculty members should put emphasis on practical (oral) activities for generating students' interest in language learning.

*** Latest editions of all the suggested books are recommended.**

Year-I
Basics of Computers

Course Code: BML107 **L-2, T-0, P-0, C-2**

Course Contents:

Unit I

Input and Output units: Their functional characteristics, main memory, cache memory read only memory, overview of storage devices – floppy disk, hard disk, compact disk, tape.
Computer Networks and Communication: Network types, network topologies.

Unit II

Internet - Evolution, Protocols, Interface Concepts, Internet Vs Intranet, Growth of Internet, ISP.SSS.
Connectivity – Dial-up, Leased line, VSAT etc. URLs, Domain names, Portals.
E-MAIL- Concepts, POP and WEB based E-mail, merits, address, Basics of Sending & Receiving, E-mail Protocols, Mailing List, Free E-mail services.

Unit III

Electronic Payment Systems: Introduction, Types of Electronic Payment Systems, Digital Token-Based, Electronic Payment Systems, Smart Card and Electronic Payment Systems, Credit Card- Based Electronic Payment Systems, Risk and Electronic Payment Systems.

Unit IV

Html – Concepts of Hypertext, Versions of HTML, Elements of HTML syntax, Head & Body Sections, Building HTML documents, Inserting texts, Images, Hyperlinks, Backgrounds and Color Controls, Different HTML tags, Table layout and presentation, Use of font size & Attributes, List types and its tags, Use of Frames and Forms in web pages. Overview of MS Front Page, Macromedia Dream weaver, and other popular HTML editors, designing web sites using MS Front Page (using at least Front Page 2000).

Reference Books:

1. Sanders, D.H., *Computers Today*, McGraw Hill.
2. Trainer, T.N., *Computers*, McGraw-Hill.
3. Joseph, P.T., S.J., *E- Commerce: An Indian Perspective*, Prentice Hall of India.

*** Latest editions of all the suggested books are recommended.**

Year-I
Human Anatomy (Practical)

Course Code: BML151 **L-0, T-0, P-2, C-1**

Course Contents:

1. Histology of types of epithelium, Histology of serous, mucous & mixed salivary gland.
2. Histology of the 3 types of cartilage, Demo of all bones showing parts, radiographs of normal bones & joints, Histology of compact bone (TS & LS), Demonstration of all muscles of the body, Histology of skeletal (TS & LS), smooth & cardiac muscle.
3. Demonstration of heart and vessels in the body, Histology of large artery, medium sized artery & vein, large vein, Microscopic appearance of large artery, medium sized artery & vein, large vein, pericardium, Histology of lymph node, spleen, tonsil & thymus, Normal chest radiograph showing heart shadows, Normal angiograms.
4. Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.
5. Demonstration of reflections.
6. Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen-IVP, retrograde cystogram.
7. Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary, Radiographs of pelvis – hystero salpingogram.
8. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.
9. Histology of peripheral nerve & optic nerve, Demonstration of all plexuses and nerves in the body, Demonstration of all part of brain, Histology of cerebrum, cerebellum and spinal cord.
10. Histology of thin and thick skin, Demonstration and histology of eyeball, Histology of cornea & retina.

Reference Books:

1. William Davis, *Understanding Human Anatomy and Physiology*, McGraw Hill.
2. Chaurasia's, *Practical of Human Anatomy.*

*** Latest editions of all the suggested books are recommended.**

Year-I
Human Physiology (Practical)

Course Code: BML152 **L-0, T-0, P-2, C-1**

Course Contents:

1. Haemoglobinometry.
2. White Blood Cell Count.
3. Red Blood Count.
4. Determination of Blood Groups.
5. Leishman's staining and Differential WBC count.
6. Determination of packed cell Volume.
7. Erythrocyte sedimentation rate [ESR].
8. Calculation of blood indices.
9. Determination of Clotting Time, Bleeding Time.
10. Blood pressure Recording.
11. Auscultation for Heart Sounds.
12. Artificial Respiration.
13. Determination of vital capacity.

Reference Books:

1. A.K Jain, *Practical Handbook of Human Physiology.*
2. Nageshwari, *Practical Workbook of Human Physiology.*
3. Gupta, *Medical Physiology Made Easy.*

*** Latest editions of all the suggested books are recommended.**

Year-I
Pathology (Practical)

Course Code: BML153 **L-0, T-0, P-2, C-1**

Course Contents:

1. Urine Examination,
    a) Physical
    b) Chemical
    c) Microscopic
2. Blood Grouping Rh typing.
3. Hb Estimation, Packed Cell Volume [PCV], Erythrocyte Sedimentation rate{ESR]
4. Bleeding Time, Clotting Time.
5. Histopathlogy – Section cutting and H &E Staining.

Reference Books:

1. Rabbins & Cotran, *Pathologic Basis & Diseases.*
2. Harsh Mohan, *Pathologic Basis & Diseases.*
3. Todd & Sanford, *Clinical Diagnosis by Laboratory Method.*
4. Dacie & Lewis, *Practical Hematology.*
5. Ramanik Sood, *Laboratory Technology Methods and Interpretation.*

*** Latest editions of all the suggested books are recommended.**

Year-I
Medical Biochemistry (Practical)

Course Code: BML154 **L-0, T-0, P-2, C-1**

Course Contents:

1. Analysis of Normal Urine.
2. Liver Function tests.
3. Lipid Profile.
4. Renal Function test.
5. Blood gas and Electrolytes.
6. Demonstration of Glucometer with strips.

Reference Books:

1. Varley, *Clinical Chemistry.*
2. Kaplan, *Clinical Chemistry.*
3. Das, Debajyothi, *Biochemistry*, Academic, Publishers, Calcutta.
4. Chatterjee, A *Text book of Medical Biochemistry.*
5. Satyanarayan,U., *Medical Biochemistry.*

*** Latest editions of all the suggested books are recommended.**

Year-I
Basics of Computers (Practical)

Course Code: BML155 **L-0, T-0, P-2, C-1**

Course Contents:

Unit I

Concept in Computer: Definition of Computer, History of Computer , Generations, Characteristic and Application of Computers, Classification of Computers, Computer Hardware, CPU, Various Types of I/O devices, Peripherals Devices, Storage Devices. Management Introductory concepts in operating system, textual Vs GUI Interface, Introduction to DOS

Unit II

Starting MS WORD, Creating and formatting a document, Changing fonts and point size, Table Creation and operations, Autocorrect, Auto text, spell Check, Word Art, Inserting objects, Page setup, Page Preview, Printing a document, Mail Merge.

Unit III

Starting Excel, Work sheet, cell inserting Data into Rows/ Columns, Alignment, Text wrapping , Sorting data, Auto Sum, Use of functions, referencing formula cells in other formulae , Naming cells, Generating graphs, Worksheet data and charts with WORD, Creating Hyperlink to a WORD document , Page set up, Print Preview, Printing Worksheets.

Unit IV

Starting MS–Power Point,, Creating a presentation using auto content Wizard, Blank Presentation, creating, saving and printing a presentation, Adding a slide to presentation, Navigating through a presentation, slide sorter, slide show, editing slides, Using Clipart, Word art gallery, Adding Transition and Animation effects, setting timings for slide show, preparing note pages, preparing audience handouts, printing presentation documents, MS- Access, Creating tables and database, Internet, Use of Internet (Mailing, Browsing, Surfing).

Text Books:

1. Sinha P. K., Computer Fundamentals.
2. Bruck Bill, The Essentials Office 2000 Book.

Reference Books:

1. Leon A and Leon M., Introduction to Computers.
2. Norton's Peter, Introduction to Computers.

*** Latest editions of all the suggested books are recommended.**

Year -I
Hospital Postings

Course Code: BML156 **L-0, T-0, P-10, C-5**

Course Contents:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection to different labs.

Process of performing various tests in different labs.

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 50.

Year -II
Bacteriology & Mycology

Course Code: BML201 **L-3, T-0, P-0, C-3**

Course Contents:

Unit I
Bacteriology:

1. Morphology of Bacteria
   a) Classification
   b) Size & shape, Structure of Bacteria
2. Growth and Nutrition of Bacteria
3. Anti Microbial Sensitivity Test
4. Sterilization and Disinfection

Unit II
Mycology:

1. Introduction of Mycology. Terms & Classification.
2. Lab Diagnosis of Fungal Infections
3.
   c) Superficial Mycoses
   d) Subcutaneous Mycoses
      i) Mycetoma
      ii) Rhinosporidium
      iii) Sporotrichosis
   e) Dermatophytes
   f) Systemic Mycoses
      i) Histoplasmosis
      ii) Blastomycosis
      iii) Coccidiodosis
      iv) Paracoccidiodosis
   g) Opportunistic Fungi
      i) Aspergillosis
      ii) Penicillosis
      iii) Zygomycosis
      iv) Pneumocystis
      v) Mycotoxins

Reference Books:

1. Anand Narayan and Panikar, *Textbook of Microbiology*
2. Baweja, *Medical Microbiology*
3. Arora, *Medical Lab Technology*

*** Latest editions of all the suggested books are recommended.**

Year -II
Parasitology & Virology

Course Code: BML202 **L-3, T-0, P-0, C-3**

Course Contents:

Unit I

Parasitology

1. Protozology
   a) Entamoeba histolytica
   b) Balantidium coli
   c) Giardia
   d) Toxoplasma
   e) Malaria
   f) Leishmania
2. Helminthology
   a) Cestodes - Taenia, Echinococcus, D.latum, H.nana
   b) Trematodes - Schistosoma, Fasciola
   c) Nematodes – Ascaris, hookworm, Strongyloides, Trichuris, Trichinella, Dracunculus, Filarial worms

Unit II

Virology

General properties of virus, cultivation of viruses, Pox viruses, Herpes viruses, Adenoviruses, Picornaviruses,Orthomyxovirus, Paramyxoviruses,Arboviruses, Rhabdoviruses, Hepatitis viruses, Oncogenic viruses, HIV, Parvovirus, Viral haemorrhagic fevers, SARS, Rotavirus, Norwalk virus, Astrovirus, Corona virus

Reference Books:

1. Anand Narayan and Panikar, *Textbook of Microbiology*
2. Baweja, *Medical Microbiology*
3. Arora, *Medical Lab Technology*
4. Karykartee and Damle, *Textbook of Parasitology*

*** Latest editions of all the suggested books are recommended.**

Year -II
Histopathology

Course Code: BML203 **L-2, T-0, P-0, C-2**

Course Contents:

Unit I

Instrumentation:

a) Automated Tissue Processor
b) Micro tomes, Knives, Knife sharpeners And Ultra microtome
c) Freezing microtome and Cryostat
d) Automatic slide Steiner

Unit II

Techniques:

a) Routine paraffin section cutting
b) Frozen section and Cryostat section studies Staining techniques: Special stains for Carbohydrates, Connective tissue, Nervous tissue, Bone tissue, Collagen fibres, Elastic Fibres, Lipids, Organisms, fungi, parasites, pigments and deposits in tissues.

Unit III

Mounting techniques: Various mounts and mounting techniques.
Electron Microscope, Scanning electron microscope, Dark ground and Fluorescent microscope, Museum technology.

Unit IV

Microphotography and its applications.
Maintenance of records and filling of slides.
ICDS Classification and coding.
Application of computers in Pathology.

Reference Books:

1. Praful Godkar, *Textbook of Medical Laboratory Technology*
2. Dasie Lewis, *Medical Laboratory Technology*
3. Kanai Mukherjee, *Medical Laboratory Technology*
4. Bancroft, *Textbook of Medical Laboratory Techniques*

*** Latest editions of all the suggested books are recommended.**

Year -II
Hematology

Course Code: BML204 **L-2, T-0, P-0, C-2**

Course Contents:

Unit I

Haematopoiesis, Stem cells, formed elements of blood and their functions Anticoagulants used in various hematological studies, Routine hematological tests and normal values:

a) Determination of Hemoglobin and Hematocrit
b) Enumeration of RBC, WBC & Platelets
c) Absolute Eosinophil count
d) Reticulocyte count
e) Calculation of Red cell Indices
f) Preparation andstaining of blood film for morphological examination of red cells and differential count.

Unit II

Special Hematological tests:

a) Sickling tests
b) Osmotic fragility test
c) Determination HbF and HbA2
d) Hemoglobin Electrophoresis
e) Investigation of G6PD deficiency
f) Plasma haptoglobin and demonstration of hemosiderin in urine
g) Tests for Autoimmune hemolytic anaemia
h) Measurement of abnormal Hb pigments

Unit III

Hemostasis and Coagulation

a) Normal hemostasis, mechanism of blood coagulation and normal fibrinolytic system
b) Collection of blood and anticoagulants used in coagulation studies
c) Investigation of hemostatic mechanism-BT, CT, whole blood coagulation time test, PT, PTT
d) Assay of clotting factors.
e) Tests for fibrinolytic activity- Euglobulin , clot lysis test and FDP
f) Platelet function tests

Unit IV

Investigation of Megaloblastic anaemia and Iron deficiency anaemia

a) B12 and Folate assay and Schilling test
b) Estimation of serum iron and iron binding capacity

Unit V

Bone marrow biopsy study

a) Needle aspiration and surgical biopsy technique
b) Preparation of smears and staining
c) Demonstration of LE cells
d) Quality control

Reference Books:

1. Praful Godkar, *Textbook of Medical Laboratory Technology*
2. Dasie Lewis, *Medical Laboratory Technology*
3. Kanai Mukherjee, *Medical Laboratory Technology*
4. Mehendi, *Laboratory Procedure in Haematology*

*** Latest editions of all the suggested books are recommended.**

Year -II
Clinical Biochemistry –I

Course Code: BML205 **L-2, T-0, P-0, C-2**

Course Contents:

1. Colorimetry- Principle & It's working.
2. Carbohydrates (Metabolism & disorder of carbohydrate metabolism) - Blood sugar & its types, DM, complications.
3. Lipids (metabolism & disorder) – digestion & absorption. Metabolism.
4. Proteins – digestion & absorption.
5. Vitamins.
6. Enzymes.
7. Biophysics – surface tension, osmolarity & viscosity.
8. Spectreophotometry.
9. Urine Chemistry.
10. Quality control in clinical biochemistry laboratory.

Reference Books:

1. Raju Bindu, *Review of Medical Biochemistry*
2. Damodaran K, *Practical Biochemistry*
3. DS Sheriff, *Textbook of Medical Biochemistry*
4. U.Satyanarayan, *Textbook of Medical Biochemistry*

*** Latest editions of all the suggested books are recommended.**

Year –II
Clinical Biochemistry –II

Course Code: BML206 **L-2, T-0, P-0, C-2**

Course Contents:

1. Liver function test.
2. Renal function test.
3. Gastric function test.
4. Cardiac profile test.
5. Hormones – introduction, classification, chemistry & function.
6. Water & Mineral metabolism.
7. Urolithiasis – formation & types of urinary stones & examination.
8. Serum electrophoresis.
9. Importance of blood urea, uric acid & creatinine.

Reference Books:

1. Raju Bindu, *Review of Medical Biochemistry*
2. Damodaran K, *Practical Biochemistry*
3. DS Sheriff, *Textbook of Medical Biochemistry*
4. Satyanarayan,U., *Textbook of Medical Biochemistry*

*** Latest editions of all the suggested books are recommended.**

Year II
English Communication

Course Code: BML207
(Common with BRT207/BPT207)

L	T	P	C
2	2	0	3

Unit I
Technical Paper writing: Definition and purpose, essentials of a good technical paper/Article, Scientific Article writing, Difference between Technical Paper, Article and Scientific Article, elements, Steps in writing Technical paper & Scientific Article, Methods of writing technical paper & Scientific article. **(12 Hours)**

Unit II
Office Management: Types of Correspondence- different types of official correspondence, Demi Official letters, Government letters, Memos and notes. Receipt and Dispatch of mail, Filing System, Classification of Mails, Managing Computer & E-mail. **(12 Hours)**

Unit III
Presentation skills: Importance of Presentation Skills, Capturing Data, Voice & Picture Integration, Guidelines to make Presentation Interesting, Body Language, Voice Modulation, Audience Awareness, Presentation Plan, Visual Aids, Forms of Layout, Style of Presentation. **(12 Hours)**

Unit IV
Writing skills: Precis writing, Report writing (with special stress on scientific/technical report, preparing field/observation report). Letter writing/application writing (Social, business letter, applying for a job, for higher studies, Preparing curriculum vitae, subscribing to a journal, letters to the Editor), Essay writing. **(12 Hours)**

Unit V
Corporate behavior & Oral communication: Corporate behavior, Corporate expectation, Office etiquettes, Telephonic conversation & etiquette. Principles of effective oral communication, features, Vitals of communication, communicating with concern & empathy, interpersonal communication, Persuasive communication. **(12 Hours)**

Recommended Books:

1. Newstron John W., *Organizational Behaviour: Human Behaviour at work* – Tata McGraw Hill.
2. Mishra Sunita & Muraliksishra C., *Communication Skills for Engineers* – Pearson Education, New Delhi.
3. Raman Meenakshi & Sharma Sangeeta, *Technical Communication-Principles & Practice* – O.U.P. New Delhi. 2007.

NOTE:
This syllabus has been designed to improve the oral and written communication skills of students. The faculty members should put emphasis on practical (oral) activities for generating students' interest in language learning.

*** Latest editions of all the suggested books are recommended.**

Year -II
Bacteriology & Mycology (Practical)

Course Code: BML251 **L-0, T-0, P-2, C-1**

Course Contents:

Bacteriology:

1. Compound Microscope.
2. Demonstration and sterilization of equipments – Hot Air Oven, Autoclave, Bacterial filters.
3. Demonstration of commonly used cutler media, Broth, and different agars.
4. Antibiotic sensitivity test.
5. Demonstration of common serological tests – Vidal, VRDL, ELISA Techniques.
6. Grams staining.
7. Acid fast staining.

Mycology:

1. Slide culture technique
2. KOH mount
3. Identification of fungal cultures
4. Colony characteristics and Microscopic examination of Candida, Cryptococcus, Trichophyton, Microsporum, Aspergillus niger, Asp fumigatus, Rhizopus, Fusarium, Penicillium.

Reference Books:

1. Anand Narayan and Panikar, *Textbook of Microbiology*
2. Baweja, *Medical Microbiology*
3. Arora, *Medical Lab Technology*

*** Latest editions of all the suggested books are recommended.**

Year -II
Parasitology & Virology (Practical)

Course Code: BML252 **L-0, T-0, P-2, C-1**

Course Contents:

Parasitology:

1. Stool examination
2. Saline mount
3. Iodine mount

Virology

1. Demonstration of embryonated egg inoculation
2. Virology exercise:
   a) Spots test, ELISA (HBv, HCV, HIV), HI, Paul Bunnel test
   b) Applied exercise – Rabies, Infantile Diarrhoea, Herpus, HBV, HIV, Influenza.

Reference Books:

1. Anand Narayan and Panikar *Textbook of Microbiology*
2. Baweja, *Medical Microbiology*
3. Arora, *Medical Lab Technology*
4. Karykartee and Damle, *Textbook of Parasitology*

*** Latest editions of all the suggested books are recommended.**

Year -II
Histopathology & Hematology (Practical)

Course Code: BML253 **L-0, T-0, P-4, C-2**

Course Contents:

1. Paraffin section cutting
2. Staining by Hematoxylin & Eosin and other special stains
3. Determination of Hemaglobin and Hematocrit
4. Red blood cell count
5. Total white blood cell count
6. Platelet count
7. Differential count of white blood cells
8. Absolute Eosinophil count
9. Reticulocyte count
10. Calculation of red cell indices
11. Determination of ESR
12. Determination of BT, CT, Whole blood clotting time
13. Determination of PT and PTT
14. Blood smear preparation and staining
15. Osmotic fragility test
16. Sickling test
17. LE cell preparation

Reference Books:

1. Praful Godkar, Textbook of Medical Laboratory Technology
2. Dasie Lewis
3. Kanai Mukherjee, Medical Laboratory Technology, 3rd vol.
4. Bancroft, Textbook of Medical Laboratory Techniques
5. Mehdi, Laboratory Procedure in Haematology.

*** Latest editions of all the suggested books are recommended.**

Year –II
Clinical Biochemistry–I Practical

Course Code: BML254 **L-0, T-0, P-2, C-1**

Course Contents:

1. Estimation of glucose, urea, creatinine. & uric acid.
2. Estimation of bilirubin, amylase, SGOT, SGPT.
3. Estimation of cholesterol, triglyceride & serum HDL.
4. Estimation of total protein, A:G ratio & globulin fraction.

Reference Books:

1. Chawla, *Practical Clinical Biochemistry Methods and Interpretation*.

*** Latest editions of all the suggested books are recommended.**

Year –II
Clinical Biochemistry –II Practical

Course Code: BML255 **L-0, T-0, P-2, C-1**

Course Contents:

1. Estimation of acid & alkaline phosphates, & inorganic phosphorus.
2. Estimation of sodium, potassium, calcium.
3. Estimation of urinary proteins, & urea calcium.
4. Electrophoresis of serum, CSF proteins.

Reference Books:

1. Chawla, Practical Clinical Biochemistry Methods and Interpretation.

*** Latest editions of all the suggested books are recommended.**

Year -II
Hospital Postings

Course Code: BML256 **L-0, T-0, P-6, C-3**

Course Contents:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection to different labs.

Process of performing various tests in different labs.

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 50.

Year –III
Immunology

Course Code: BML301 **L-3, T-0, P-0, C-3**

Course Contents:

1. **Infection 2hrs**
2. **Immunity 4 Hrs.**
   a) Innate immunity
   b) Acquired immunity (adaptive immunity)
   c) Active and passive immunity
      i) Natural acquired active immunity
      ii) Artificial acquired active immunity
      iii) Natural acquired passive immunity - Breast feeding
      iv) Artificial acquired passive immunity
3. **Immune System Brief Introduction**
   a) Cell development
   b) Lymphocytes
      i) Bursa of Fabricus
      ii) Stem cell differentiation
      iii) Gut-associated lymphoid tissue (GALT)
      iv) T- lymphocytes
         - Stem cell differentiation (general knowledge of their role)
         - Cytotoxic T (TC) cells
         - Delayed-type hypersensitivity T (TD) cells
         - Helper T (TH) cells
         - Suppressor T (TS) cells
      v) Natural killer cells
   c) Dual nature of the immune system
      i) Humeral immunity
      ii) Cell-mediated immunity
   d) General properties of immune responses
      i) Recognition of self versus non self
         - Clonal selection theory B-cells
         - Tolerance
         - Clonal deletion
      ii) Specificity
         - Definition
         - Cross-reactions
      iii) Heterogeneity
      iv) Memory
         - Memory cells
         - Anamnestic response
4. **Humoral Immunity**
   i) General characteristics
      - Antigen types
      - Antigen sensitization
      - Plasma cells
5. **Antigen & Antibody**
   i) Antigens
   ii) Epitopes (antigenic determinants)
   iii) Happen
   iv) Antibodies consequences of antibody binding

v) Titer

6. Immune Response

a) Properties of Antibodies (immunoglobulin's)

i) Light chains

ii) Heavy chains

iii) Constant and variable regions

iv) Antigen binding sites

6. Fab and Fc regions

B. Classes of immunoglobulin's

1. IgG
2. IgM
3. IgA
   a. J chain
   b. Secretory piece
4. IgE
5. IgD
6. Antibody titre

C. Primary and secondary responses

1. Primary response
2. Secondary response

D. Kinds of antigen-antibody responses

E. How humeral responses eliminate foreign antigens

1. Basic mechanisms
   a. Agglutination
   b. Opsonization

c. Activation of complement

2. Summary of humoral immunity

7.**Monoclonal Antibodies**

A. Production

1. Hybridoma formation
2. Cloning of cells

B. Uses

1. Research tools
2. Diagnostic uses
3. Therapy

8.Cell-Mediated Immunity

A. General characteristics

B. The cell-mediated immune reactions

1. Antigen processing
2. Helper T (TH) cells

a. TH1 (inflammatory T) cells

b. TH2 cells

3. Suppressor T (TS) cells
4. Cytotoxic (killer) T (TC) cells
5. Natural killer (NK) cells
6. Memory T cells
7. Lymphokine release
8. Superantigens

9.**Factors That Modify Immune Responses**

A. Compromised host

B. Modifying factors

1. Age
2. Stress
3. Diet
4. Exercise
5. Injuries
6. Environmental factors
7. Hypersensitivity reactions
8. Autoimmune disorders
9. Transplantation immunology

Reference Books:

1. Anand Narayan and Panikar Textbook of Microbiology
2. Baweja, Medical Microbiology
3. Arora, Medical Lab Technology

*** Latest editions of all the suggested books are recommended.**

Year –III
Bacteriology & Applied Bacteriology

Course Code: **BML302** L-3, T-0, P-0, C-3

Course Contents:

1. Antimicrobial Sensitivity.
2. Bacteriology of Water, Milk and Air
3. Systematic Bacteriology

Classification, Morphology, Genotypic & Phenotypic characteristics, Pathogenesis, Disease caused, **Lab Diagnosis & Prophylaxis**

A. **Gram Positive Bacteria**

i. Staphyloccus
ii. Streptococcus
iii. Pneumococcus
iv. Corynebacteria
v. Clostridia
vi. Bacillus
vii. Listeria
viii Actinomyces
ix. Nocardia

B. **Gram Negative Bacteria**

i. Neisseria
ii. Enterobacteriaceae
iii. Escherichia
iv. Klebsiella
v. Enterobacter
vi. Proteus
vii. Salmonella
viii. Shigella
ix. Yersinia
x. Pseudomonas
xi. Haemophilus
xii. Brucella
xiii. Pasturella
xiv. Legionella
xv. Bordetella
xvi. Burkholderia
xvii. Gardnerella
xviii. Vibrio
xix. Campylobacter
xx. Helicobacter
xxi. Bacteroides
xxii. Fusobacterium

C. **Spirocheates**

i. Treponema
ii. Borrelia
iii. Leptospira

D. **Mycobacteria**

i. M.tuberculosis
ii. M.leprae
iii. Atypical Mycobacteria

E. **Mycoplasma**

F. **Chalmyadiae**

G. Ricketssiaceae

H. **APPLIED MICROBIOLOGY RELATED TO DISEASES.**

Molecular techniques in diagnostic microbiology- PCR, DNA hybridisation

Reference Books:

1. Anand Narayan and Panikar Textbook of Microbiology
2. Baweja, Medical Microbiology
3. Arora, Medical Lab Technology

*** Latest editions of all the suggested books are recommended.**

Year –III
Cytology

Course Code: **BML303** **L-3, T-0, P-0, C-3**

Course Contents:

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Types of specimens, methods of collection & preparation of cell block
3. Different fixatives and methods of fixation
4. Staining:

(a) Papanicoloau's stain- principle, preparation and staining techniques
(b) May Grunwald Giemsa stain
(c) Shorr's stain
(d) Aceto orcin stain

Female Genital tract

1. Anatomy, Histology, Physiology & normal cytology
2. Techniques of collection of specimen for cervical cytology study
3. Hormonal cytology and cytological indices
4. Cervical cytology screening for malignant and nonmalignant Conditions, Radiation changes & follow up
5. Cytology of Endometrium – normal, nonmalignant and in malignant Conditions
6. Cytology in Ovarian cancers

Respiratory tract, gastrointestinal tract and Urinary tract
Anatomy, Histology and Physiology
Collection of sample, preparation of smears and staining
Cytology of normal, nonmalignant & malignant conditions C S F and Effusions

7. Cytology of CSF in inflammatory, nonmalignant & malignant Conditions
8. Cytology of effusions in nonmalignant and malignant conditions Glands – Breast, Thyroid, Salivary glands and Lymph nodes
9. Anatomy, Histology and Physiology
10. Fine needle aspiration cytology of glands and other soft tissue mass
11. Cytology features in nonmalignant and malignant conditions of Different glands and nipple discharges

Automation in Cytology

1. Flow Cytometry
2. Image Analysis
3. Principles, Equipments, procedures & Evaluation

Tissue culture and Immunohistochemistry

1. Equipments for Tissue culture studies

(a) Laminar air flow equipment
(b) Carbon dioxide incubator
(c) Inverted microscope

2. Derivation of culture from tissue

(a) Enzymatic digestion of tissue using collaginase, protease
(b) Plating in tissue culture media
(c) Observation of cells in Invertoscope
(d) Subculturing & derivation of cell lines

3. Characterization of cell lines

(a) Determination of biochemical markers in cells
(b) Chromosomal & DNA content of cells © Immunological properties of cells

4. Preservation of Immortalized cell lines

(a) Storage in Glycerol in Liquid Nitrogen
(b) Storage in Dimethyl sulfoxide in Liquid Nitrogen

Cytogenetics

1. Introduction to cytogenetics, terminology, classification and Nomenclature of human chromosomes
2. Methods of karyotypic analysis

(a) Culture of bone marrow cells, peripheral blood lymphocytes, Solid tumors & skin fibroblasts
(c) Direct preparation from tumor materials

3. Characterization of human chromosomes by various banding techniques
4. Sex chromatin identification
5. Chromosomes in neoplasia and oncogenes

Immunocytochemistry

1. Basics concepts, monoclonal antibodies & preparation
2. Flurescence reactions

Reference Books:

1. Orell, Fine Needle Cytology, 4th Ed

*** Latest editions of all the suggested books are recommended.**

Year –III

Immunohematology and Blood transfusion

Course Code: BML304 **L-3, T-0, P-0, C-3**

Course Contents:

1. ABO Blood group and Rh system
2. Subgroups of A and B , Other blood groups and Bombay group
3. HLA antigens and their significance
4. Principles of Blood transfusion:

(a) Blood donor selection
(b) Methods of bleeding donors
(c) Blood containers, anticoagulants and storage of blood
(d) Coomb's test and its significance
(e) Screening of blood for infective material
(f) Blood components, preparation & component therapy
(g) Autologous transfusion
(h) Transfusion reactions and work up
(i) Blood bank organization, standards, procedures, techniques and quality control

Reference Books:

1. Rudman, Blood Banking
2. Ramnik Sood , Textbook of Medical Laboratory Technology
3. Mehdi, Essential of Blood Banking: A Handbook of Students of Blood Banking and Clinical Residence

*** Latest editions of all the suggested books are recommended.**

Year –III
Clinical Biochemistry- III

Course Code: BML305 **L-3, T-0, P-0, C-3**

Course Contents:

Liver Function tests. Role of the Liver in metabolism, formation of bilirubin and mode of excretion.
Gastric Analysis: Composition of gastric juice, concepts of free and bound acids, gastric acid secretions stimulations.
Renal function, renal function test and renal clearance test.
Calculi: Theory of formation and analysis, Renal clearance concentration and application of Phenolsulfonaphthalein.
Acid – Base balance and its disturbances.
Inorganic ions: Calcium metabolism, phosphate metabolism, sodium-potassium balance and trace element (Fe, CU).
Metabolism of proteins and amino acids.
Over view & replication, translation, transcription and genetic engineering.
Metabolic disorders:

a. Amino acids
b. Proteins
c. Inborn errors of metabolic disorders.

10. Clinical enzymologist.

Reference Books:

1. Varley, Clinical Chemistry
2. Teitz, Clinical Chemistry
3. Kaplan, Clinical Chemistry
4. Ramakrishna S, Prasanna KG, Rajna, Text Book of Medical Biochemistry, Orient Longman
5. Vasudevan DM & Sreekumari S, Text Book of Biochemistry for Medical Students.
6. Das, Debajyothi, Biochemistry, Academic, Publishers, Calcutta.
7. Chatterjee, A Text book of Medical Biochemistry
8. Satyanarayan, U., Medical Biochemistry

*** Latest editions of all the suggested books are recommended.**

Year –III
Advanced Medical Biochemistry

Course Code: BML306 **L-3, T-0, P-0, C-3**

Course Contents:

1. Radio isotope techniques: Principle, definition of units, measurement of radiation standards, crystal counting. Resources and applications
2. Immunoassay: Different methods, principle and applications.
3. Biostatistics: Population means, Correlation Coefficient, Standard deviation, Standard error.

Reference Books:

1. Varley, Clinical Chemistry
2. Teitz, Clinical Chemistry
3. Kaplan, Clinical Chemistry
4. Ramakrishna S, Prasanna KG, Rajna, Text Book of Medical Biochemistry, Orient Longman
5. Vasudevan DM & Sreekumari S, Text Book of Biochemistry for Medical Students.
6. Das, Debajyothi, Biochemistry, Academic, Publishers, Calcutta.
7. Chatterjee, A Text book of Medical Biochemistry
8. Satyanarayan, U., Medical Biochemistry

*** Latest editions of all the suggested books are recommended.**

Year –III
Immunology (Practical)

Course Code: BML351 **L-0, T-0, P-2, C-1**

Course Contents:

Estimation of different immunoglobulisation.
Study of antigen and antibody reaction.
Electrophoresis

Reference Books:

1. Anand Narayan and Panikar Textbook of Microbiology
2. Baweja, Medical Microbiology
3. Arora, Medical Lab Technology

*** Latest editions of all the suggested books are recommended.**

Year –III
Bacteriology & Applied Bacteriology (Practical)

Course Code: BML352 **L-0, T-0, P-2, C-1**

Course Contents:

BACTERIOLOGY

1. Staining

a.Grams staining
ZN staining
Alberts staining
Hanging drop preparation
Culture methods
Introduction to biochemical reactions
Identification of bacterial culture
Colony characteristics
Morphological characteristics
Motility study
Interpretation of biochemical reactions

6. Antibiotic sensitivity testing- Kirby Bauer method

1. Applied bacteriology- exercise
2. Immunology: Serological tests:

Specimen collection
Principle
Methods.
Procedure
Normal values/ significant titer
Interpretations
Limitations: of all the following tests
Widal
ASO
CRP
RPR/VDRL/TRUST
RA
HBsAg /anti HIV detection
ELISA

Reference Books:

1. Anand Narayan and Panikar, Textbook of Microbiology
2. Baweja, Medical Microbiology
3. Arora, Medical Lab Technology

*** Latest editions of all the suggested books are recommended.**

Year –III
Cytology (Practical)

Course Code: BML353 **L-0, T-0, P-2, C-1**

1. Preparation of various cytology smears and fixation
2. Papanicoloau's and May Grunwald Geimsa staining
3. Hormonal cytology study

Reference Books:

1. Orell, Fine Needle Cytology, 4th ed

*** Latest editions of all the suggested books are recommended.**

Year –III
Immunohematology and Blood Transfusion (Practical)

Course Code: BML354 **L-0, T-0, P-2, C-1**

Practicals

Blood grouping and Rh typing
Cross matching techniques
Screening of Donor's blood for infective agents
Transfusion reaction work up
Preparation of blood components

Reference Books:

1. Rudman, Blood Banking
2. Ramnik Sood, Textbook of Medical Laboratory Technology
3. Mehdi, Essential Of Blood Banking: A Handbook of Students of Blood Banking and Clinical Residence

*** Latest editions of all the suggested books are recommended.**

Year –III
Clinical Biochemistry-III (Practical)

Course Code: BML355 **L-0, T-0, P-2, C-1**

List Of Practicals:

1. Specimen Collections: Urine, Blood, Gastric juice,
2. Accuracy, precision and quality control –Methods used to check the accuracy of a result by histogram, F-test and Barr test.
3. Enzymes: amylase (salivary and Pancreatic), Alkaline Phosphates, Acid Phosphates, SGOT, SGPT, LDH and CPK- demonstration on auto analyzer.
4. Liver function tests: estimation of Bilirubin – total and conjugates, Urobilinogen,
5. Gastric analysis: Determination of free and total acid, gastric stimulation.
6. Lipid determination of serum lipids – cholesterol, triglycerides and lipoprotein Fractionation.
7. Inorganic ions – Determination of calcium in serum and urine, serum phosphates, chloride sodium and potassium.
8. Analysis of calculi
9. Urine – screening for inborn errors of metabolism
10. RFT
11. Cardiac markers.
12. (Relevant charts on the above topics for interpretation and diagnosis).

Reference Books:

1. Vasudevan DM & Sreekumari S, Text Book of Biochemistry for Medical Students.
2. Das, Debajyothi, Biochemistry, Academic, Publishers, Calcutta.
3. Chatterjee, A Text book of Medical Biochemistry
4. Satyanarayan, U., Medical Biochemistry

*** Latest editions of all the suggested books are recommended.**

Year -III
Hospital Postings

Course Code: BML356 **L-0, T-0, P-6, C-3**
Course Contents:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs.

Process of performing various tests in different labs

Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 50.