

**SHRI VISHWAKARMA SKILL UNIVERSITY**  
(Enacted by the Act 25 of 2016, State of Haryana)  
**DUDHOLA, PALWAL**



**B.VOC. (MLT)**  
**2020-23**

**SCHEME: B.VOC. (MLT)**

Semester-I															
Category	Subject Code	Subjects	Credits			Marks						Total	Hours		
						Practical			Theory						
			T	P	To	I	E	To	I	E	To				
General Education Component	ENG501 ENG501L	Communication Skills	3	1	4	35	15	50	15	35	50	100	45	30	75
	LHS501	Introduction to Health Education	2	0	2	-	-	-	30	70	100	100	30	-	30
	GEC Total		5	1	6	35	15	50	45	105	150	200	75	30	105
Skill Education Component	MLT502 MLT502L	Fundamentals of Medical Laboratory, Instruments & Reagents	2	1	3	35	15	50	15	35	50	100	30	30	60
	LSH502 LSH502L	Medical Biochemistry-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	LSH504 LSH504L	Human Anatomy-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	LSH505 LSH505L	Human Physiology-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	OJT501	On-the-Job Training	0	12	12	245	105	350	-	-	-	350	-	360	360
	SEC Total		8	16	24	385	165	550	60	140	200	750	120	480	600
Total			13	17	30	420	180	600	105	245	350	950	195	510	705

Semester-II															
Category	Subject Code	Subjects	Credits			Marks						Total	Hours		
						Practical			Theory						
			T	P	To	I	E	To	I	E	To		T	P	To
General Education Component		Entrepreneurship	2	0	2	-	-	-	30	70	100	100	30	-	30
	MLT504 MLT504L	Introduction to Preventive and Social Medicine	2	2	4	35	15	50	15	35	50	100	30	60	90
	GEC Total		4	2	6	35	15	50	45	105	150	200	60	60	120
Skill Education Component	MLT501 MLT501L	Basics of Clinical Hematology – I	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT505 MLT505L	Medical Biochemistry-II	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT503 MLT503L	Fundamentals of Microbiology-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	LSH503 LSH503L	General Pathology	2	1	3	35	15	50	15	35	50	100	30	30	60
	OJT502	On-the-Job Training	0	12	12	245	105	350	-	-	-	350	-	360	360
	SEC Total		8	16	24	385	165	550	60	140	200	750	120	480	600
Total			13	17	30	420	180	600	105	245	350	950	180	540	720

Semester-III															
Category	Subject Code	Subjects	Credits			Marks						Total	Hours		
						Practical			Theory						
			T	P	To	I	E	To	I	E	To				
General Education Component		Yoga, Fitness and Self Defence	2	0	2	-	-	-	30	70	100	100	30	-	30
	MLT609 MLT609L	Laboratory Management & Biomedical Waste Management	2	2	4	35	15	50	15	35	50	100	30	60	90
	GEC Total		4	2	6	35	15	50	45	105	150	200	60	60	120
Skill Education Component	MLT601 MLT601L	Basics of Clinical Hematology-II	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT603 MLT603L	Diagnostic Biochemistry-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT605 MLT605L	Fundamentals of Microbiology-II	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT606 MLT606L	Histopathology & Histotechnique-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	OJT601	On-the-Job Training	0	12	12	245	105	350	-	-	-	350	-	360	360
	SEC Total		8	16	24	385	165	550	60	140	200	750	120	480	600
Total			12	18	30	420	180	600	105	245	350	950	180	540	720

Semester-IV															
Category	Subject Code	Subjects	Credits			Marks						Total	Hours		
						Practical			Theory						
			T	P	To	I	E	To	I	E	To				
General Education Component		Ethics	2	0	2	-	-	-	30	70	100	100	30	-	30
	LSH601 LSH601L	Nutrition	2	2	4	35	15	50	15	35	50	100	30	30	60
	GEC Total		4	2	6	35	15	50	45	105	150	200	60	30	90
Skill Education Component	MLT608 MLT608L	Immunology and Serology-I	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT607 MLT607L	Immuno-hematology Blood Banking Techniques	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT604 MLT604L	Diagnostic Cytology	2	1	3	35	15	50	15	35	50	100	30	30	60
	MLT602 MLT602L	Clinical Endocrinology & Tumor Markers	2	1	3	35	15	50	15	35	50	100	30	30	60
	OJT602	On-the-Job Training	0	12	12	245	105	350	-	-	-	350	-	360	360
	SEC Total		8	16	24	385	165	550	60	140	200	750	120	480	600
Total			12	18	30	420	180	600	105	245	350	950	180	510	690

**SUBJECT: Communication Skills****CODE: ENG501****CATEGORY: General Education Component**

Credit	Hours	Marks		
3	45	I	E	To
		15	35	50

**Objectives**

- To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
- To inculcate in students written communication skills.

**Learning Outcomes**

- The syllabus introduces students to have basic skill set of channelizing information, self-development, decision making and interpersonal skills.

Unit	Topic	Key Learning
I	Communication	<ul style="list-style-type: none"> <li>Meaning of Communication, Importance of Communication, Types of communication. Process of communication</li> <li>Communication network in an organization</li> <li>Barriers to communication, Essentials of good communication</li> </ul>
II	Remedial English Grammar Understanding and applying Vocabulary	<ul style="list-style-type: none"> <li>Articles, agreement between verb and subject, uses of tenses, Modal and their uses, Prepositions.</li> <li>One word substitutes, Synonyms and Antonyms</li> <li>Word formation:-Prefixes, Bases and Suffixes.</li> </ul>
III	Listening Skills	<ul style="list-style-type: none"> <li>The process of listening, Types of listening, Benefits of effective listening</li> <li>Barriers to listening, listening to announcements at work place.</li> </ul>
IV	Reading Skills	<ul style="list-style-type: none"> <li>Process and methodologies of reading, Skimming and scanning, Levels of reading, Proofreading, Summarizing, Precise writing</li> <li>Unseen comprehension passage, Note taking and reviewing</li> <li>convert the given information into charts and graphs.</li> </ul>
V	Writing Skills	<ul style="list-style-type: none"> <li>Main Forms of Written Communication: Notices, Drafting an E-mail</li> <li>Correspondence: Personal and Official, Notices,</li> <li>Technical Report Writing, Preparing agenda and minutes of meeting</li> </ul>

**Suggested Readings:**

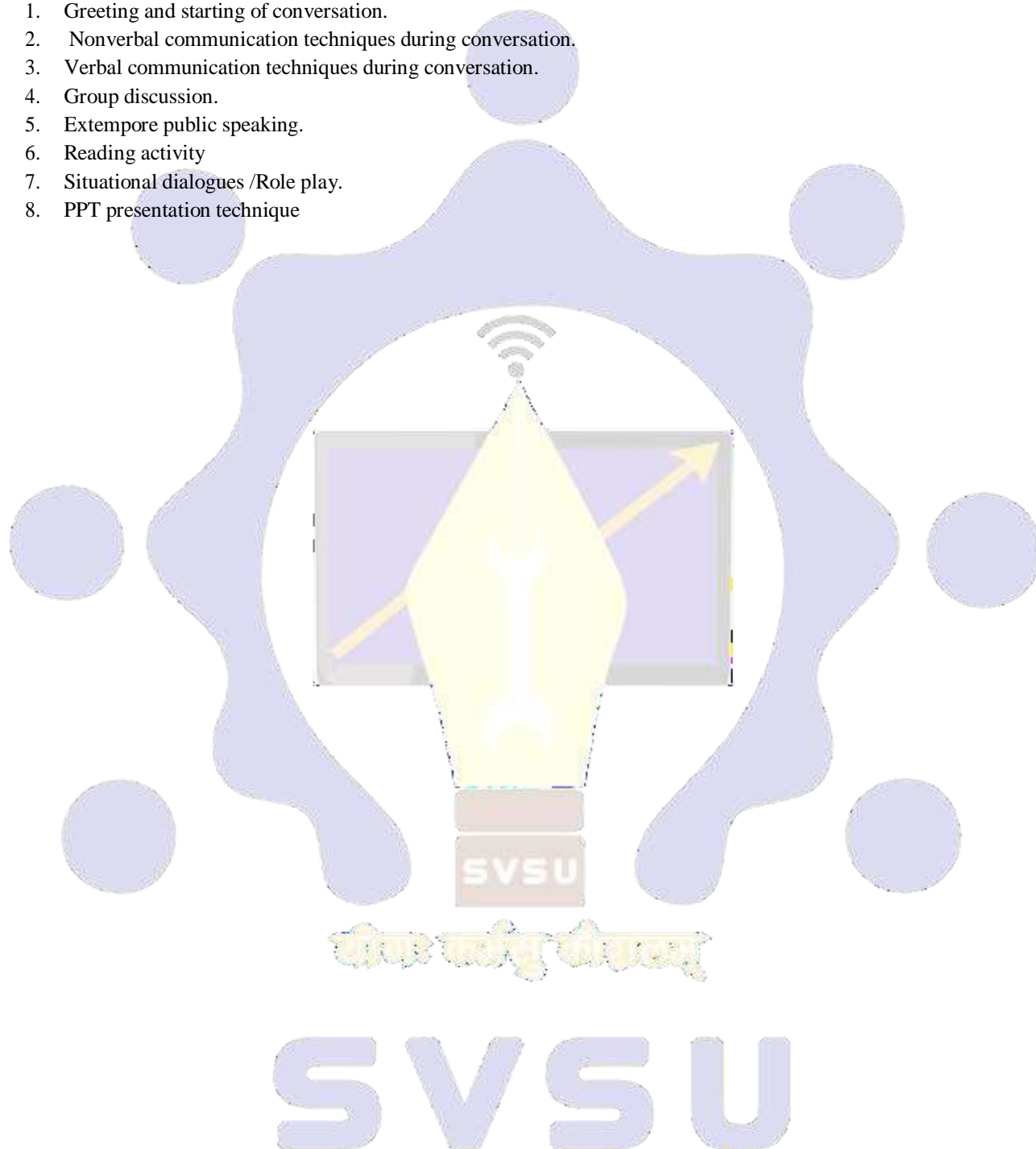
- Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
- Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
- Prasad, P. Communication Skills, S.K. Kataria & Sons.
- Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
- Roach Peter. English Phonetics and Phonology.
- A.S. Hornby's. Oxford Advanced Learners Dictionary of Current English, 7th Edition.
- Prasad, P. The Functional Aspects of Communication Skills, Delhi.
- McCarthy, Michael. English Vocabulary in Use, Cambridge University Press.
- Rajinder Pal and Prem Lata. English Grammar and Composition, Sultan Chand Publication.
- Idioms & Phrases (English-Hindi), Arihant Publication (India) Pvt. Ltd.
- One Word Substitution, Dr. Ashok Kumar Singh, Arihant Publications (India) Pvt, Ltd

**SUBJECT: Communication Skills-Lab****CODE: ENG501L****CATEGORY: General Education Component**

Credit	Hours	Marks		
		I	E	To
1	30	35	15	50

**List of Experiments**

1. Greeting and starting of conversation.
2. Nonverbal communication techniques during conversation.
3. Verbal communication techniques during conversation.
4. Group discussion.
5. Extempore public speaking.
6. Reading activity
7. Situational dialogues /Role play.
8. PPT presentation technique



**SUBJECT: Health Education**  
**CODE: LSH501**  
**CATEGORY: General Education Component**

Skill Faculty of Applied Sciences and Humanities

Credit	Hours	Marks		
		I	E	T
2	30	15	35	50

### Objectives

Introduce students to the broad concepts of health. Provide an in-depth understanding of various frameworks on social determinants of health and inter linkages between health and development at local, national and global levels.

### Learning Outcome

On completion of this course, participants will be able to:

1. Describe the health system of India
2. demonstrate some knowledge and understanding of the wider determinants of health and ill-health
3. Explain understanding of the roles of people and agencies who undertake work in the promotion of public health
4. Have basic knowledge on burden of disease
5. Explain the causes, prevention and control of various communicable, non-communicable diseases.
6. Explain the concept of health and wellness.

Unit	Topic	Key Learning
I	Introduction to Health	Meaning, Definition, Aim, Objectives and Principles of health , School Health Program, Health Service, Personal Hygiene and Health Record; Care of Eyes, Ear, Nose, Skin, Mouth and Teeth.
II	Health providers	health care providers, various health schools, Allopathy and AYUSH, Informal Providers, Front line workers,
III	Health Care Delivery System	Aim, Objectives and Functions: National Institute of Health & Family Welfare (NIHFW), World Health Organization (WHO), United Nations Educational Scientific & Cultural Organization (UNESCO), United Nations International Children's Emergency Fund (UNICEF).
IV	Health Problems	Prevention and Control, Communicable Disease and Non-Communicable Disease: Meaning, Definition and Types; Causes, Prevention and Control. Concept of sporadic, epidemic and pandemic. Injuries: Meaning, Definition and Types; Management of Sprain, Strain, Wound, Fracture and Dislocation
V	Wellness, Ageing and First-Aid	Concept of Wellness. Meaning, Definition and Components of wellness. Ageing: Meaning and Definition; Aging Phenomenon, First-aid: Meaning, Definition, Need and Importance; Golden Rules of First-aid.

### Text Books

- Ghosh, B.N. A Treatise of Hygiene and Public Health, Scientific Publishing Co., Kolkata
- Bandopadhyay, K. and Dutta, B.K. Prakcharjar Abhimukh, Classic Publishers, Kolkata.
- Thakur, S. Krira Chikitsa, Paschimanga Rajya Pustak Parsad.
- Essential Orthopaedics (Including Clinical Methods) by J. Maheshwari.

### Web Links

- [www.nhm.gov.in](http://www.nhm.gov.in) [www.mohfw.gov.in](http://www.mohfw.gov.in).
- [www.rntcp.gov.in](http://www.rntcp.gov.in)

**SUBJECT: Fundamentals of Medical Laboratory,  
Instruments & Reagents**  
**CODE: MLT502**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

To purpose of the course is to provide fundamental knowledge and exposure to the concepts, theories and practices in the field of Laboratory Technology

### Learning Outcomes

By the end of this course:

- The student demonstrates an understanding of the processes of Laboratory Technology.
- Identify the basic functions, and management challenges in the Laboratories.

Unit	Topic	Key Learning
I	Introduction to Laboratory	Basic laboratory principles
II	Code	Code of conduct of medical laboratory personnel
III	Role of a laboratory Technician	Organization of clinical laboratory and role of medical laboratory technician
IV	Safety measures-	Various safety measures used in Medical Laboratory
V	Professional Ethics	Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician

**SUBJECT: Fundamentals of Medical Laboratory,  
Instruments & Reagents-Lab**  
**CODE: MLT502L**  
**CATEGORY: Skill Education Component**

### LIST OF PRACTICALS

1. Common glassware in clinical laboratory.
2. Cleaning, care and maintenance of glassware.
3. Calibration of pipettes and other volumetric apparatus.
4. Laboratory instruments.
  - a. Microscopes-Principles, parts, use, care and maintenance of Light microscope,
5. Electron microscope, Fluorescent microscope, Dark ground microscope, Phase contrast microscope etc
  - a. Centrifuge
  - b. Water bath
  - c. Refrigerators
  - d. Autoclave
6. Hot air oven
  - i. Mixer
  - ii. Water distillation apparatus.
7. 10. General approach to specimen collection, transport and disposal.
8. 11. Anticoagulants- E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride.
9. 12. Preparation of solution: Normal solution, Buffer solution, Percent solution, normal saline, Molar solution.
10. 13. Preparation of Normal saline
11. Methods of measuring liquids, weighing solids.
12. Clinical Laboratory records.
13. Modern Laboratory set up.
14. Quality control in clinical laboratories, basic outline

### Books Recommended

- KI Mukherjee: Medical Lab Technology (Tata Mc Graw Hill)

- P.D. Godkar: Textbook Of Medical Lab Technology (Balani Publishing House)

**SUBJECT: Medical Biochemistry-I****CODE: LHS502****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objective**

Review of Chemistry as applicable to human biochemical systems: knowledge about chemical properties and standardization of various materials used in biochemical analysis. Chemistry of molecules, enzymes, laboratory safety

**Learning Outcome**

By the end of this course:

- The student demonstrates an understanding of the processes of Medical Biochemistry
- Identify the basic functions, and challenges in the Laboratories.

Unit	Topic	Key Learning
I	Chemistry of Lipids	Introduction, definition, classification, biomedical importance, essential fatty acids, importance and function of simple, compound and derived lipids Brief outline of metabolism: Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol & its clinical significance, Lipoproteins, its type & their functions, lipid profile test, Atherosclerosis.
II	Introduction of Enzymes	Introduction, definition, properties, classification, coenzymes, cofactors, isoenzymes, metalloenzymes, measuring units of enzyme activity factors affecting enzyme action, factors responsible for abnormal enzyme level, Nucleic acids: Structure, Function and types of DNA and RNA, Nucleotides, Nucleosides, Nitrogen bases
III	Vitamins:	classification, function and disease associated with vitamins. Minerals and ions: Micro and macro minerals, requirement, function and biological importance of Calcium, Iron, Iodine, Zinc, Phosphorus, Copper, Sodium and Potassium
IV	Diabetes	Hyperglycemia & hypoglycemia - mellitus - definition, types, features, gestation diabetes mellitus, glucose tolerance test, glycosylated hemoglobin glycosuria, Hypoglycemia & its causes, Estimation of protein, albumin, globulin, A/G ratio, 24 hours urinary protein
V	Photocolorimeter	Principle, application, calibration and maintenance of, spectrophotometer, Blood Chemistry analyzer, Flame photometer, Turbidimetry

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**SUBJECT: Medical Biochemistry-I-Lab**

**CODE: LHS-502L**

**CATEGORY: Skill Education Component**

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**Learning (Practical)**

Unit 1: To study general properties of the enzyme (Urease) & Achromatic time of salivary amylase.

Unit 2: Urine analysis – normal & abnormal constituents of urine; Glucose tolerance test & Glycosylated hemoglobin

Unit 3: CSF Analysis - Gross & Microscopic.

Unit 4: Centrifugation: Principle, types & applications, Chromatography: Definition, types, RF value, description of paper chromatography & applications.

Unit 5: Uses, Care and Maintenance of various instruments of the laboratory

**Reference Books**

- Sharma and Parashar. Dictionary Of Biochemistry; CBS Publications
- Harold And Varley. Practical Clinical Biochemistry
- Laxmi Ahuja; Quick Review In Biochemistry; Asia Printograph
- A.C. Deb; Fundamentals Of Biochemistry; New Central Book Agency
- Varun Kumar Malhotra; Handbook Of Practical Biochemistry; Jaypee Brothers

**Web Links:**

- <http://www.colby.edu/chemistry/BC176/CH1.pdf>
- <https://doctorlib.info/medical/biochemistry/3.html>
- [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_science\\_students/MedicalBiochemistry.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/MedicalBiochemistry.pdf)



**SUBJECT: Human Anatomy-I**  
**CODE: LHS-504**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

To enable the students to review the areas of anatomy relevant to the practice of applied life sciences.

### Learning Outcomes

1. The student demonstrates an understanding of human body.
2. Identify the basic functions, location, anatomical position and motion of various bone.

Unit	Topic	Key Learning
I	Introduction to Human Anatomy	Introduction to bones, surfaces of bone, anatomical planes, Anatomical terminologies, anatomical position, anatomical directions, terms related to movement
II	Body Cavities	Different body cavities, systemic approach, abdominal body cavity and its contents.
III	Upper limb	Introduction to bones of upper limb, joints of upper limb, muscles of upper limb, movement of upper limb.
IV	Lower Limb	Introduction to bones of limb, joints of lower limb, muscles of lower limb, movement of lower limb.
V	Head, neck and spine	Introduction to head and neck, spine, spine curvature, cervical spine, thoracic spine and lumbar spine.

**SUBJECT: Human Anatomy-I-Lab**  
**CODE: LHS-504L**  
**CATEGORY: Skill Education Component**

### LIST OF PRACTICALS

1. Identification and description of all anatomical structures.
2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).
4. Demonstration of skeleton - articulated and disarticulated.

### Text Books

- B.D. Chaurasia's Human Anatomy 5 (Vol) 6<sup>th</sup> edition-2001; CBS Publishers & Distributors
- Textbook of Anatomy by Inderbir Singh 3 (Vol) 2<sup>nd</sup> edition-1999 Jaypee Brothers Medical Publishers
- Imaging atlas of Human Anatomy by Jamiewar & Abraham 1<sup>st</sup> edition-1998 Thomas Press Ltd.

**SUBJECT: Human Physiology--I**  
**CODE: LHS-505**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

To purpose of the course is to provide fundamental knowledge and exposure to the concepts, theories and practices in the field of management. It aims to understand individual and group behaviour at work place.

### Learning Outcomes

3. The student demonstrates an understanding of the processes of management.
4. Identify the basic functions, and management challenges in the emerging perspective.

Unit	Topic	Key Learning
I	Introduction to physiology	Basic of cell, tissue, organ and organ systems, various types of cells and tissues and their functions.
II	Vital events and vital organs	Characteristics of life and vital functions, vital organs.
III	Respiratory and cardiac system	Respiratory organs and its mechanism, cardiac organs and its mechanism.
IV	Sensory system and Excretory system	Sensory organs and their functioning
V	Reproduction and nervous system	Reproduction and its mechanism, nervous system and its mechanism.

**SUBJECT: Human Physiology-I-Lab**  
**CODE: LHS-505L**  
**CATEGORY: Skill Education Component**

### LIST OF PRACTICALS

1. Collection of blood sample
2. Determination of blood type
3. Calculation of bleeding time
4. Calculation of clotting time
5. Blood Pressure measurement by Auscultatory Method
6. Pulse palpitation and heart sounds
7. Hearing tests

### Text Books

- Essentials of Medical Physiology Book by K. Sembulingam and Prema Sembulingam
- Manual of Practical Physiology (For OTPT, MLT & Other Allied Courses) (English, Paperback, Dr. A.K. Jain)

### Reference Books

- Human Physiology in Nutshell by Dr A K Jain

**SUBJECT: Introduction to Preventive & Social Medicine****CODE: MLT504****CATEGORY:** General Education Component

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	2	60	35	15	50
TOTAL	3	60	50	50	100

**Objectives** This curriculum impart the knowledge of various diseases and functioning of various health programmes.

**Learning Outcome:** Upon completion of this syllabus students can able to

- Understand about health, diseases & its aetiology
- Population studies, risk factors
- Underlying pathologic process
- Epidemiology for medical conditions and determine the appropriate health care setting.

Unit	Topic	Key Learning
I	Introduction to Health	Definition and concepts of health, health problems of developed and developing countries, Role of environment and health, important public health acts Nutrition and nutritional disorders, their manifestations and prevention, role of regular exercise and yoga in prevention and management of various diseases
II	Epidemiology and diseases, Basic emergency care and first aid	Epidemiology, aetiology, pathogenesis and control of communicable disease like malaria, cholera, tuberculosis, leprosy, diarrhoea, poliomyelitis, viral hepatitis, measles, dengue, rabies, AIDS Prevention of cancer, diabetes and cardiovascular diseases
III	National Health Policy and Programs	DOTS, National AIDS control programme, National cancer control programme, RNTCP, Universal and National immunization programs, and vaccine schedules.
IV	Demography	Population, problems of population growth, birth rates, death rates and fertility rates, MMR, CPR, and Reproductive and child health. Hygiene and sanitation
V	Family welfare and planning	Family welfare and planning, objectives and goals of WHO, UNICEF, Indian Red Cross Society, UNFPA, FAO, ILO Introduction to occupational hazards and diseases

**Text Books**

- Textbook of Preventive Social Medicine, K.Parks, Sunder Lal,
- Park & Park, Preventive & Social Medicine
- Text Book of Pathology, Harshmohan,

**Reference Books**

- Park & Park, Preventive & Social Medicine

**Web Links**

- <https://www.dhs.wisconsin.gov/ic/precautions.htm>
- [https://en.wikipedia.org/wiki/Laboratory\\_quality\\_control](https://en.wikipedia.org/wiki/Laboratory_quality_control)
- [https://www.who.int/ihr/publications/lqms\\_en.pdf](https://www.who.int/ihr/publications/lqms_en.pdf)

**SUBJECT: Basics of Clinical Haematology-I****CODE: MLT501****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objective**

The curriculum of hematology aims to prepare the students in basic understanding of the composition of blood, waste management, instrumentation, techniques and methods of estimating different parameters.

**Learning Outcome**

By the end of this course, the students will be able to

- Collect, process and preserve the blood samples
- Can efficiently perform routine investigations in clinical hematology laboratory

Unit	Topic	Key Learning
I	Introduction	Introduction to Haematology, Organization of laboratory and safety measures, Laboratory Safety guidelines, Important equipment used in haematology lab
II	Haematopoiesis	Erythropoiesis, Leucopoiesis, Thrombopoiesis, sites of hemopoiesis, Mechanism of hemopoiesis, stages of cell development, , Blood and its composition, Anticoagulants, mechanism of action, types and uses, merits and demerits, effect of storage on blood cells
III	Sample Collection	Requirement, methods of collection, transport, preservation, and processing of various clinical Specimens, Blood collection for hematological investigations, Venipuncture, Capillary blood, Arterial blood, Precautions during collection, Vacutainer tubes, its type and uses, sample acceptance and rejection criteria.
IV	Hemoglobin	structure, function and types, Hemoglobinometry, Hemoglobin estimation by various methods, advantages and disadvantages, physiological and pathological variations on blood parameters Hemocytometry, visual and electronic method, neubauer counting chamber, RBC count, WBC count, Platelets count, absolute eosinophil count, principle, procedure, calculation , significance, precautions involved during counting, absolute count of various WBCs. Physiological and pathological changes in values
V	Smear preparation	Preparation of thin and thick smears, staining of smears, Romanowsky dyes, preparation and staining procedures of blood smears, Morphology of normal blood cells and their identifications, differential leucocytes count by manual and automated method, physiological and pathological variations in value.

**SUBJECT: Basics of Clinical Haematology-I-Lab**

**CODE: MLT501L**

**CATEGORY: Skill Education Component**

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### LIST OF PRACTICALS

1. To learn general laboratory safety rules
2. To demonstrate glass wares, apparatus and plastic wares used in laboratory
3. To prepare EDTA, Sod. Citrate & Sod. Fluoride anticoagulants and bulbs/vials used in laboratory
4. Demonstration of Vacutainer
5. To demonstrate method of blood collection
6. To separate serum and plasma
7. Demonstration of microscope
8. Determination of Hemoglobin by various methods
9. Determination of TLC
10. Preparation of thick and thin smear
11. Determination of DLC
12. Determination of Total RBC
13. Determination of total platelet count
14. Determination of absolute leucocyte count

### Text Books:

- Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
- Singh Tejinder,(2014),Atlas & Textbook of Haematology,3rd edition,Avichal Publications
- Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education

### Reference Books:

- Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill Sood Ramnik,(2015),
- Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications

### Web Links:

- <http://www.colby.edu/chemistry/BC176/CH1.pdf>
- <https://doctorlib.info/medical/biochemistry/3.html>
- [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_science\\_students/MedicalBiochemistry.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/MedicalBiochemistry.pdf)

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**SUBJECT: Medical Biochemistry-II**  
**CODE: LSH505**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objective

Review of Chemistry as applicable to human biochemical systems: knowledge about chemical properties and standardization of various materials used in biochemical analysis. Chemistry of molecules, enzymes, laboratory safety

### Learning Outcome

By the end of this course:

- The student demonstrates an understanding of the processes of Medical Biochemistry
- Identify the basic functions, and challenges in the Laboratories.

Unit	Topic	Key Learning
I	Chemistry of Carbohydrates	Carbohydrates and their related metabolism - Introduction, definition, classification, biomedical importance & properties. Brief outline of metabolism: Glycogenesis & glycogenolysis (in brief), Glycolysis, citric acid cycle & its significance, HMP shunt & Gluconeogenesis (in brief), regulation of blood glucose level.
II	Amino Acids	Definition, classification, essential & non-essential amino acids.
III	Chemistry of Proteins	Chemistry of Proteins & their related metabolism - Introduction, definition, classification, biomedical importance. Metabolism: Transformation, Decarboxylation, Ammonia formation & transport, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine & Tryptophan, Creatine, Creatinine, Proteinuria
IV	Metabolism of Urea	Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine & Tryptophan, Creatine, Creatinine, Proteinuria

**SUBJECT: Medical Biochemistry-II-Lab**  
**CODE: LSH505L**  
**CATEGORY: Skill Education Component**

### LIST OF PRACTICALS

1. Laboratory organization: Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.
2. Identification of Carbohydrates (qualitative tests).
3. Identification of Proteins (qualitative tests).
4. To study general properties of the enzyme (Urease) & Achromatic time of Salivary amylase.
5. Urine analysis – normal & abnormal constituents of urine

### Text Books

- Sharma and Parashar. Dictionary of Biochemistry; CBS Publications
- Harold And Varley. Practical Clinical Biochemistry
- Laxmi Ahuja; Quick Review In Biochemistry; Asia Printograph

### Reference Books

- A.C. Deb; Fundamentals Of Biochemistry; New Central Book Agency
- Varun Kumar Malhotra; Handbook Of Practical Biochemistry; Jaypee Brothers

**SUBJECT: Fundamentals of Microbiology-I****CODE: MLT503****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objective**

To introduce basic principles and application relevance of clinical disease for students who are in preparation for Laboratory Technicians. The content of this course includes etiological agents responsible for global infectious diseases

**Learning Outcome**

- The student demonstrates an understanding of the basic concepts of Microbiology.
- Identify the basic organisms and structures included in the course.

Unit	Topic	Key Learning
I	Human rights at various level	Lab organization, Laboratory Safety measures in Microbiology, Occurrence of lab infections, route of infections in laboratory, Universal precautions Prokaryotic and eukaryotic cells, Introduction, basic features and importance of bacteria, viruses, fungi, protozoa
II	Human rights in India	General characters and classification of Bacteria, Morphology based on size, shape, arrangement, motility, flagella, spores, capsules, cell wall, plasma membrane, pili, ribosomes. Cell size, shape and arrangement, cell-wall, composition and detailed structure of Gram-positive and Gram-negative cell walls, Staining Methods: Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, capsule staining, Negative Impregnation
III	Human Rights Violations	Growth and Maintenance of Microbes: Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO <sub>2</sub> requirement, temperature, pH, light
IV	Professional values	Sterilization and Disinfection: Physical agents- Sunlight, Temperature less than 1000C, Temperature at 1000C, steam at atmospheric pressure and steam under pressure, irradiation, filtration. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.
V	Code of conduct	Culture Media: Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media, Aseptic techniques in microbiology

**SUBJECT: Fundamentals of Microbiology-I-Lab****CODE: MLT503L****CATEGORY: Skill Education Component****LIST OF PRACTICALS**

- Unit 1: Preparation of swabs/sterile tubes & bottles.
- Unit 2: Preparation of smear.
- Unit 3: Staining: Gram & Ziehl-Neelsen staining.
- Unit 4: Identification of Culture media.
- Unit 5: Identification of common microbes

**Text Books**

- Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
- Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
- Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition.
- Elsevier Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

**SUBJECT: General Pathology****CODE: LSH503****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objective**

The student will be able to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases

**Learning Outcome**

By the end of this course, the student will be able to

- explain the basic nature of disease processes from the standpoint of causation, epidemiology, natural history, and the structural and functional abnormalities.

Unit	Topic	Key Learning
I	Introduction to pathology	Introduction to pathology, subdivisions of pathology, common terminology used in pathology Cell Injury and Cellular Adaptations: a) Normal Cell b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling; c) Cell death : types- autolysis, necrosis, apoptosis & gangrene; d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia, metaplasia, necrosis and apoptosis
II	Inflammation	a) Acute inflammation - vascular event, cellular event, inflammatory cells; b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma. Phagocytosis, Acute phase proteins
III	Haemodynamic Disorders	Introduction to Oedema, hyperemia, congestion, haemorrhage, circulatory disturbances, thrombosis, ischaemia & infarction
IV	Tumour	Introduction to Neoplasia, tumor, characteristics of tumor, spread of tumors, difference between benign tumor and malignant tumor Introduction and significance of tumor markers.
V	Healing	Healing: Definition, different phases of healing, factors influencing wound healing.

**SUBJECT: General Pathology****CODE: LSH503****CATEGORY: Skill Education Component****LIST OF PRACTICALS**

- Unit 1: Components & setting of the Compound microscope.
- Unit 2: Focusing of object, use of low & high power objectives of microscope
- Unit 3: Use of oil immersion lens, care and Maintenance of the microscope.
- Unit 4: Different types microscopy: Dark field microscopy, Fluorescence Microscopy
- Unit 5: Electronic Microscopy in brief

**Reference Book**

- Text Book of Pathology, Harshmohan, 7<sup>th</sup> Edition
- Text book of Pathology, Robbins, 4<sup>th</sup> edition,

**Web Links**

- <http://gonuke.org/wp-content/acad/IntroductiontoMedicalLaboratoryTechnology.pdf>
- <https://scholarworks.bgsu.edu/cgi/viewcontent.cgi?article=1282&context=honorsprojects>

**SUBJECT: Basics of Clinical Hematology-II****CODE: MLT601****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objectives**

The unique proposition of this paper is that the students learn the basic haematological technique with clotting mechanism, blood banking techniques and automation.

**Learning Outcomes**

- Able to recognize various instruments used in hematology.
- Develop understanding of coagulation and immunohematology.
- Able to perform various routine hematological and immunohematological tests.
- Able to evaluate, compare and validate the test results.

Unit	Topic	Key Learning
I	ESR and PCV	Erythrocyte sedimentation rate, manual and automated method, factor affecting ESR, packed cell volume, red cell indices (MCV, MCH, MCHC), Physiological and Pathological variations in value
II	Examination of blood and other specimens	Complete blood count, determination by automated method and significance of each parameter, Reticulocyte count, routine examination of CSF, semen, sputum and stool.
III	Hemostasis	Mechanism of coagulation, coagulation factors, Bleeding time, clotting time, platelet count, protamine sulphate test, clot retraction test
IV	Blood Banking	Introduction to immuno hematology and blood banking technology, antigen, antibody, complements, ABO & Rh blood group system, method of determination, other blood group system, Donor selection, blood collection, anticoagulants, additive systems, blood bags, its labelling, storage and transportation
V	Automation in Hematology	Uses, care & maintenance and calibration of Coulter counter, coagulometer, automatic ESR analyzer, urine analyzer, point of care testing. Pre and Post analytical variables, automation in hematology

**Text Books**

- Text book of Medical lab Technology, Praful B Godkar, IIIrd edition
- Text book of Medical Lab Technology, Ramnik Sood, Jaypee Publishers
- Text Book of Pathology, Harshmohan, 6<sup>th</sup> Edition
- Text book of Pathology, 3<sup>rd</sup> edition,

**Reference Books**

- Practical Haematology, Dacie & Lewis, 11<sup>th</sup> edition

**Web Links**

- [https://www.cdc.gov/nchs/data/nhanes/nhanes\\_07\\_08/cbc\\_e\\_met.pdf](https://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/cbc_e_met.pdf)

**SUBJECT: Diagnostic Biochemistry-I**  
**CODE: MLT603**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

This paper gives brief understanding about various types of organ function test, acidosis and alkalosis.

### Learning Outcomes

- Able to memorize and enlist various organ function tests.
- Able to perform and demonstrate various tests.
- Able to compare and evaluate the test results.

Unit	Topic	Key Learning
I	Diabetic Profile and Liver Function Test	Introduction, bile pigment metabolism, jaundice and its types, Estimation of Bilirubin, Bile salt, Bile pigments, Urobilinogen, SGPT/ALT, SGOT/AST, ALP, GGT, Viral Hepatitis
II	Renal and Pancreatic Function Test	Renal Function Test: Introduction, Glomerular filtration rate, renal threshold, Urea, Creatinine, Uric Acid, Sodium, Potassium, Creatinine Clearance test, Urea clearance test, Examination of renal calculi Estimation and significance of amylase and lipase
III	Cardiac Function Test	Introduction, myocardial infarction, CHD, Biochemical markers of Heart diseases and their estimation, Role of laboratory in monitoring heart diseases, Lipid Profile Test
IV	Gastric Function Test	Introduction, gastric secretions, total and free acid, stimulation test, physical & chemical examination of gastric secretions.
V	Acid Base Balance	Acid base balance, action of buffer system, Hb buffers, respiratory and metabolic acidosis, respiratory and metabolic alkalosis, Arterial blood gas analysis, Blood gas analyzer.

### Text Books

- Text book of Medical lab Technology, Praful B Godkar, IIIrd edition
- Text book of Biochemistry, D M Vasudevan, Jaypee Publishers
- Text book of Biochemistry, M N Chatterjea, RanaShinde
- Practical Biochemistry, Singh & Sahni

### Reference Books

- Clinical Chemistry, Teitz

### Web Links

- <http://www.grsmu.by/files/file/university/cafedry/klinicheskaya-immynologiya/files/fiu/4.pdf>

**SUBJECT: Fundamentals of Microbiology-II**  
**CODE: MLT605**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

This subject gives a general insight into the basics of microbiology, culture media preparation and various biochemical test used in microbiology, methods for recovery, culture techniques, procedures and antibiotic testing.

### Learning Outcomes

- Able to recognize various culture media and its preparation method.
- Understanding of concepts of culturing methods.
- Able to perform and interpret various biochemical tests.
- Able to differentiate various microorganisms.

Unit	Topic	Key Learning
I	Cultural Media	Classification, Liquid and solid Media, Synthetic media, Selective media, differential media, transport media containers for media, distribution of medias in tubes, bottles and Petri dishes, Composition and preparation of cultural media, role of ingredients of culture media, Precautions during media preparation
II	Culturing of Microorganism	Inoculation of culture media, culturing of aerobes and anaerobes Growth and Nutrition of Bacteria: various phases of growth, typical growth curve, Nutrition of microbes and physical condition required for growth. Effect of Carbon, Nitrogen, Growth factors, Vitamins, Temperature, pH, Osmotic Pressure, Oxygen and Carbon Di Oxide on microbial growth.
III	Methods of Culture Preservation	Pure culture isolation and preservation: Streaking, serial dilution and plating methods, cultivation, maintenance and preservation/stocking of pure cultures, cultivation of aerobic and anaerobic bacteria.
IV	Biochemical Test	Culturing of microorganisms and identification, Biochemical test such as Catalase, Citrate utilization test, Coagulase test, Indole test, Oxidase test, Urease test, MR-VP test, TSI slants and others biochemical test
V	Antimicrobial Sensitivity Test	Antimicrobial sensitivity test, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Choice of antibiotics MIC and MBC: Concepts and methods for determination various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method

### Text Books

- Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
- Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
- Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

### Reference Books

- Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4<sup>th</sup> edition. Elsevier
- Willey JM, Sherwood LM, and Woolverton C.J. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

### Web Links

- <http://www.grsmu.by/files/file/university/cafedry/klinicheskaya-immynologiya/files/fiu/4.pdf>

**SUBJECT: Histopathology & Histotechniques-I****CODE: MLT606****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objectives**

Students will learn about various basic of histopathology & Histotechnique, handling and processing of tissue specimens, staining procedures and application of Histotechnique.

**Learning Outcomes**

- Understanding of histopathology laboratory, equipments and fixation procedure.
- Identification of samples and selection of proper tissue processing techniques.
- Able to employ and demonstrate various microtomy procedures and staining method.
- Comparing and interpreting various staining procedures.
- Developing and designing of histopathology laboratory.

Unit	Topic	Key Learning
I	Introduction of histopathology	Introduction of histopathology & histotechniques, laboratory organization, care & maintenance of equipments used in histotechnology lab ,Safety measures in histotechnology lab Reception, Recording, Labeling and transportation of tissue specimens, Basic concepts of fixation and various types of fixative used in histopathology and cytopathology
II	Tissue and its processing	Tissue and its types, Location and function, Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor Decalcification, decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties
III	Microtomy	Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies, Section adhesive Cryostat, frozen sections of fresh, fixed and unfixed tissue, freeze drying, rapid frozen sections and staining for emergency diagnosis
IV	Principles of staining	Dye chemistry, Stains and dyes, natural dye, acidic dye, basic dye, neutral dyes, fluorescence dye, mordant, accelerators, accentuators, metachromasia, metachromatic dyes Progressive, regressive, vital, supravital staining, types of hematoxylin, Haematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages
V	Application of Histotechniques	Staining of carbohydrates, Connective tissue, Demonstration and identification of lipids, Demonstration of microorganism on tissue specimens Demonstration of sex chromatin, Museum techniques Immunohistochemistry: principle, types, applications, antigen retrieval, APAAP, PAP Staining

**Text Books**

- Text Book of Histopathology & Histotechniques, C FA Culling
- Diagnostic Cytology, Koss & Koss
- Cytopathology, Bibbo
- Diagnostic Cytology, Naib

**Reference Books**

- Histopathology & Histotechniques, Bancroft,

**Web Links**

- <https://webpath.med.utah.edu/HISTHTML/HISTOTCH/HISTOTCH.html>

**SUBJECT: Nutrition****CODE: LSH601****CATEGORY:** General Education Component

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	2	60	35	15	50
TOTAL	3	60	50	50	100

**Objectives**

The syllabus introduces students to familiarize students with fundamentals of food, nutrients and their relationship to Health. To create awareness with respect to deriving maximum benefit from available food resources.

**Learning Outcomes**

- Students will be able to use the computer for basic purposes of preparing personnel/business letters, viewing information on Internet, sending mails, using internet banking services etc.
- Understand basic computer operations and ICT applications.
- Understand Network troubleshooting.
- Undertake data entry services

Unit	Topic	Key Learning
I	Basic Concepts in Nutrition	Basic terms used in nutrition, Understanding relationship between food, nutrition and health, Functions of food-Physiological, psychological and social, Basic food groups and concept of balanced diet.
II	Nutrients	Energy- Functions, sources and concept of energy balance, Recommended Dietary Allowances, dietary sources, effects of deficiency and/ or excess consumption, on health of the following nutrients: Carbohydrates and dietary fiber, Lipids, Proteins, Fat soluble vitamins-A, D,E and K, Water soluble vitamins – Thiamin, Riboflavin, Niacin, Pyridoxine, Folate, Vitamin B12 and Vitamin C, Minerals – Calcium, Iron, Zinc and Iodine
III	Nutrition during Lifecycle	Physiological considerations and nutritional concerns for the following life stages: Adult man / woman, Preschool children, Adolescent children, Pregnant woman, Nursing woman and infant
IV	Introduction to Nutritional deficiency diseases	Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Flurosis
V	Food Adulteration	PFA definition of food adulteration, Adulterants in commonly consumed food items, Accidental contamination: botulism, staphylococcal and aflatoxin intoxication, Importance of food labels in processed foods and nutritional labelling, Food laws, regulations and standards, Codex Alimentarius, Prevention of Food Adulteration (PFA) Act, Agmark, Fruit Products Order (FPO), Meat Products Order (MPO), Bureau of Indian Standards (BIS), MMPO, FSSAI

**Text Books**

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2012; New Age International Publishers
- Mudambi, SR, Rao SM and Rajagopal, MV. Food Science; Second Ed; 2006; New Age International Publishers
- Srilakshmi B. Nutrition Science; 2012; New Age International (P) Ltd.
- Srilakshmi B. Food Science; Fourth Ed; 2010; New Age International (P) Ltd.
- Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.

**Reference Books**

- Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd.
- Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
- Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence

**SUBJECT: Immunology & Serology-I**  
**CODE: MLT608**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

### Learning Outcomes

- The students will learn scientific approaches/techniques that are used to investigate various diseases.

Unit	Topic	Key Learning
I	Immune System	History and Introduction of the immune system, innate and adaptive immunity; active and passive immunity, primary and secondary immune response. Cell and organs of immune system, Phagocytosis
II	Antigens and haptens	Antigens and haptens: Properties, foreignness, molecular size, heterogeneity, B and T cell Epitopes, T dependent and T independent antigens.  Antibodies: structure, function and properties of the antibodies, different classes, subclasses and biological activities of antibodies Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody
III	Major Histocompatibility Complex	Mechanism of humoral and cell mediated immune response. Introduction of Major Histocompatibility Complex, Antigen presenting cells Complement system and complement fixation test. Introduction of Hypersensitivity and its types
IV	Rheumatological diseases	Introduction to Rheumatological diseases, etiology and pathogenesis and lab investigations Introduction to autoimmunity, autoimmune disorders and autoimmune markers such as parietal cell antibody, anti sperm antibody, lupus anticoagulants, anti mitochondrial antibody, ANA, ds DNA, HLA-B27, ASMA, anti CCP
V	Laboratory tests for demonstration of antigen	Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation, precipitation in gels, ELISA, RIA, Immunofluorescence assay, WIDAL, ASO, CRP, RA, RPR, TPHA, Introduction and classification of vaccines

### Text Books

- Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

### Reference Books

- Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
- Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

**SUBJECT: Immunohematology and Blood Banking Techniques**  
**CODE: MLT607**  
**CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

### Objectives

This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

### Learning Outcomes

- The students will learn scientific approaches/techniques that are used to investigate various diseases.

Unit	Topic	Key Learning
I	Blood Banking	Basic Principles of Blood Banking, Antigen, Antibody, naturally occurring antibody, Complement, ABO & Rh blood group system, Methods of blood group determination, Forward and Reverse grouping, Slide & Tube method, Gel method
II	Other Blood Group system	Other blood group system such as Lewis, MNS, Kell, Duffy etc Anticoagulants and preservative used in blood bank Donor selection criteria, Blood collection and processing
III	Testing	Transfusion transmissible infectious disease screen, Coomb's test, Cross matching, Compatibility testing, Antibody Screening & Identification, Grading of Reaction/Agglutination
IV	Blood Components	Blood components and its preparation, preservation, storage and transportation Indications for different blood component transfusion, Blood transfusion reaction and its type, HDN Introduction of stem cell banking and bone marrow transplantation.
V	Role of different Agency	Apheresis, indications of hemapheresis, plasmapheresis, plateletspheresis, plasmapheresis Quality control of reagents, equipments, blood components used in transfusion medicine. Role of NACO, Indian Red Cross Society, DGHS and blood transfusion services.

### Text Books

- Compendium of Trasfusion Medicine, Dr R N Makroo
- Text book of Medical lab Technology, Praful B Godkar, IIIrd edition
- Text book of Medical Lab Technology, Ramnik Sood, Jaypee Publishers
- Text Book of Pathology, Harshmohan, 6<sup>th</sup> Edition
- Practical Haematology, Dacie & Lewis, 11<sup>th</sup> edition

**SUBJECT: Diagnostic Cytology****CODE: MLT604****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objectives**

This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

**Learning Outcomes**

- Students would be able to perform collection, processing, staining and quality control in cytological diagnosis.

Unit	Topic	Key Learning
I	Cell Structure of Tumor	Cell: basic structure and function, cell organelles, cell cycle, Benign and Malignant tumors, Instruments used in cytology, preparation of buffers, stains,
II	Instruments and equipment used in cytology	Instruments and equipments used in cytology Fixation and Fixatives used in cytology, Adhesive and mounting media, Cell block and cytospin technique, Staining such as PAP, Diff-quick, MGG, H&E, Shorr staining, significance of PAP-HPV, Destaining and restaining of slides, Cover slipping
III	Aspiration and exfoliative cytology	Aspiration and exfoliative cytology, Patient preparation, Sample collection, Fixation, Processing and Staining FNAC: procedure, processing of sample and staining, on site quick staining procedure
IV	Pap staining	Pap staining, Progressive & Regressive, Collection, preservation, transportation and processing of cytological specimens such as sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample
V	Immunocytochemistry	Sex chromatin demonstration, Introduction of Immunocytochemistry, different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device

**Text Books**

- Clinical Diagnosis & Management, Henry
- Histopathology & Histotechniques, Bancroft,
- Text Book of Histopathology & Histotechniques, C FA Culling
- Diagnostic Cytology, Koss& Koss
- Cytopathology, Bibbo

**SUBJECT: Clinical Endocrinology and Tumor****Marker****CODE: MLT602****CATEGORY: Skill Education Component**

	CREDIT	HOURS	I	E	TOTAL
THEORY	2	30	15	35	50
PRACTICAL	1	30	35	15	50
TOTAL	3	60	50	50	100

**Objectives**

This paper is framed to provide basic knowledge of hormones & toxic substances with their determination techniques as well as related disorders.

**Learning Outcomes**

- Students would be able to perform collection, processing, staining and quality control in cytological diagnosis.

Unit	Topic	Key Learning
I	Hormones	Hormones, Classification of hormones, organs of endocrine system their secretion and function, regulation of hormone secretion, Mechanism of action
II	Thyroid Function	Thyroid function test: Thyroid hormones, biological function, hypothyroidism, hyperthyroidism, Determination of T <sub>3</sub> , T <sub>4</sub> , TSH, FT <sub>3</sub> , FT <sub>4</sub> , TBG, Disorder associated with thyroid dysfunction. Hormones of Parathyroid gland and their estimation,
III	Infertility	Infertility, types of infertility, test for female and male infertility Infertility profile: LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone, DHEA-S, 17- Ketosteroids, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test, Quadruple Test
IV	Growth Hormones	Growth hormone, ACTH, Aldosterone, Cortisol their estimation and clinical significance, reference range, hypo and hyper secretion
V	Tumor Markers	Tumor markers, their types, significance and estimation, Advantages and disadvantages of tumor markers

**Text Books**

- Text book of Biochemistry, D M Vasudevan, Jaypee Publishers
- Text book of Biochemistry, M N Chatterjea, Rana Shinde
- Clinical Chemistry, Teitz
- Clinical Chemistry, Bishop
- Text book of Medical Lab Technology, Praful B Godkar, IIIrd edition