L. J. SCHOOL OF APPLIED SCIENCES
MLT Certificate Course & M.Sc. M.L.T. PART-1

APPLICABLE FROM 2021-2022

FIRST YEAR

MAIN SUBJECTS	**1.** Clinical Biochemistry
	2. General and Clinical Microbiology
	3. Clinical Haematology, histopathology and cytology
INTERNAL SUBJECTS	**1.** Report Writing / Case study

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PAPER – 40400101: CLINICAL BIOCHEMISTRY

Course Outcomes:

CO1 Describe metabolism of carbohydrates. proteins, lipids & vitamins, Knowledge about estimation and clinical significance of glucose, urea & creatinine

CO2 Ability to demonstrate the functioning, the principle & maintenance of various instruments used in the lab
Describe functions & diseases related to vitamins, Knowledge of principle & applications of commonly used instruments in laboratory

CO3 Principle and applications of electrophoresis, chromatography, Knowledge about estimation and clinical significance of uric acid, total protein & albumin

CO4 Basic concepts of analysers commonly used in biochemistry laboratory

UNIT 1: Introduction, General Aspects & Instrumentation

a) Introduction to clinical Biochemistry
b) Study of weights, Volumes and Units. Inter-conversion of units, Measurements, Preparation of solution, Normal range
c) Different anticoagulants used in Clinical Biochemistry, its application and Mechanism of action
d) Hazards in the Laboratory
e) Automation in Clinical Biochemistry laboratory.
f) Electrophoresis, Chromatography, Colorimeter, Spectrophotometer, ELISA, RIA, Flame Photometer, Centrifugation.

UNIT 2: General Biochemistry of Carbohydrates, Protein &Lipids

a) Classification, Biomedical importance, properties (Chemical and physical)
b) Carbohydrate metabolism (in Brief): Glycolysis, TCA, HMP shunt, Regulation of blood sugar, GTT, Diabetes
c) Amino acids, peptides, Classification & properties of Plasma proteins, immunoglobulins
d) Protein metabolism: Transamination, Deamination, Urea cycle, Phenyl ketonuria, Alkaptonuria
e) Lipids: Definition, Classification, Properties, Phospholipids
f) Lipid metabolism: Cholesterol, Lipoproteins, VLDL, LDL, HDL, Atherosclerosis, Ketosis, Lipid profile

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UNIT 3: Nucleic Acids, Molecular Biology and Haemoglobin

a) Nucleotides: Nucleic acids, functions (in brief): purine catabolism, Uric acid: formation, Estimation, Interpretation, Gout
b) Molecular biology (in brief): Replication, transcription, DNA recombinant technology, Blot techniques, PCR
c) Haemoglobin structure, Hbs, Thalassemia (Biochemistry aspects)
d) Haemoglobin: synthesis (in brief) porphyria, Haem breakdown, Bilirubin, Jaundice, Lab diagnosis

UNIT 4: Enzymes, Vitamins, Minerals, Nutrition and function test

a) Enzymes: Definition, Classification, Factors affecting enzyme activity, inhibition, Diagnostic use of enzyme
b) Vitamins (In brief): A, D, E, K, B12, Folic acid and Vitamin C(In brief)
c) Minerals: Calcium, Iron, Phosphorous, Iodine, Sodium and Potassium
d) Principles of nutrition, Balance diet, BMR, Kwashiorkor and marasmus
e) Liver function tests: Introduction, function of liver, type of investigation carried out, normal range and interpretation of results
f) Renal function tests: Function of kidneys, Various renal function tests including clearance tests and interpretation of results
g) Thyroid function tests: Estimation of T3, T4, TSH, interpretation of results. pH, blood buffers, Acid-base balance, Anionic gap
h) Quality Control: Internal and External

Reference Book

Textbook of Biochemistry for Medical Students	DM Vasudevan, Sreekumari S, Kannan Vaidyanathan	8th Ed, 2022	Jaypee Brothers
Harper's Illustrated Biochemistry	Victor W. Rodwell et al.	32nd Ed, 2022	McGraw Hill
Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics	Carl A. Burtis, David E. Bruns	8th Ed, 2019	Elsevier
Clinical Biochemistry: Metabolic and Clinical Aspects	William J. Marshall, Márk Lapsley	3rd Ed, 2014	Churchill Livingstone

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Reading Material

Biochemistry	U. Satyanarayana	5th Ed	Good for foundational concepts
Practical Clinical Biochemistry	Harold Varley	6th Ed	Classic for lab procedures and practical understanding
Clinical Chemistry: Principles, Techniques, and Correlations	Michael L. Bishop	9th Ed	Comprehensive clinical lab reference

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PAPER – 40400102: GENERAL AND CLINICAL MICROBIOLOGY

Course Outcomes:

CO1 Classify bacteria based on their taxonomy and systematic characteristics. Demonstrate a comprehensive understanding! of bacterial diversity
Analyse the pathogenesis of different bacterial infections, including virulence factors and host interactions

CO2 Execute laboratory methods for the identification and diagnosis of bacteria, utilizing techniques such as staining!, culturing. and molecular analysis
Interpret the results of bacterial identification and relate them to clinical conditions, aidin2 in the selection of appropriate treatments

CO3 Apply microbiological knowledge to practical healthcare settings, contributing to clinical diagnosis and treatment decisions
Perform a wide range of microbiological tests and analyses relevant to clinical practice, such as antimicrobial susceptibility testing and microbial load determination

CO4 Interpret laboratory findings accurately. Enabling the identification and treatment of microbial infections.
Collaborate effectively with healthcare professionals to integrate microbiological data into patient care plans

UNIT 1: History, Classification and Morphology of Bacteria and General microbiology

a) History and Pioneers in Microbiology: Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch (Koch's Postulates)
b) Bacteria; Taxonomy: Nomenclature and classification of microbes (in Brief)
c) Microscopy, stained preparation, size and shape
d) Morphology of bacteria: structures of a bacterial cell and their functions
e) Physiology of Bacteria: Nutrition, Gaseous requirement, temperature requirement and other growth requirements
f) Sterilization and disinfection
g) Culture media (In brief)

h) Culture methods (In Brief)
i) Identification of Bacteria: Biochemical tests and Antibiotic sensitivity testing

UNIT 2: Immunology and Systemic microbiology

a) Immunology
b) Infection, Immunity, Antigen, Antibody, Antigen-Antibody reactions (General features, Precipitation, Agglutination, Complement fixation test, Immunofluorescence, Radio Immunoassay, ELISA), Complement system
c) Hypersensitivity (In brief)
d) Allergens and diagnosis
e) Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Clostridia, Coliforms, Proteus, Salmonella, Shigella, Vibrio, Pseudomonas, Haemophilus, Mycobacteria, Spirochaetes

UNIT 3: Mycology, Virology and Parasitology

a) Cultivation of fungi, Principle of fungal nutrition, Cultivation media and methods, Slide culture technique, Prevention of bacterial contamination
b) Morphological Classification of fungi: Laboratory diagnosis of Fungal infections
c) General properties of virus: Morphology, Replication and cultivation of virus disease caused
d) Laboratory diagnosis & prevention of- Hepatitis viruses, HIV, Rotavirus and Poliomyelitis
e) Morphology, life cycle, laboratory diagnosis of following parasites:
1) Protozoa: *Entamoeba, Giardia, Trichomonas, Leishmania, Plasmodium*
2) Helminthology Cestodes: *Taenia, Echinococcus*
3) Nematodes: *Trichuris, Ancylostoma, Ascaris, Enterobius, Wuchereria bancroftian (filaria)*

UNIT 4: Clinical and Applied Microbiology

a) Specimen: Types, Methods of collection, Storage and transportation (sputum, other respiratory specimen, urine, faeces, blood, CSF and other body fluids, Hospital- acquired infections and laboratory hazards)
b) Methods used for diagnosis and pathogen identification

c) Microscopy
d) Growth and biochemical characteristics
e) Clinical immunology
f) Pathological changes in blood, body fluids and tissues
g) Significance of computers
h) Disposal of Biomedical waste
i) Quality control in Diagnostic Microbiology
j) Automation in Diagnostic Microbiology
k) Brief of Biosafety level cabinets

Reference Book

Ananthanarayan and Paniker's Textbook of Microbiology	C.K. Jayaram Paniker, R. Ananthanarayan	11th Ed (2020)	Universities Press
Textbook of Microbiology	Baveja	6th Ed (2022)	Arya Publications
Medical Microbiology	Murray, Rosenthal, Pfaller	10th Ed (2021)	Elsevier
Practical Medical Microbiology	R. C. Collee, J. P. Duguid	14th Ed	Churchill Livingstone
Textbook of Parasitology	KD Chatterjee	13th Ed (2022)	CBS Publishers
Textbook of Immunology	Kuby (Abbas)	8th Ed (2023)	W.H. Freeman

Reading Material

Jawetz, Melnick & Adelberg's Medical Microbiology	Geo. Brooks et al.	28th Ed (2021)	Excellent for systemic and clinical microbiology
Foundations in Diagnostic Microbiology	Connie R. Mahon	3rd Ed	Diagnostic lab procedures focus
Bailey & Scott's Diagnostic Microbiology	Patricia M. Tille	14th Ed (2017)	Practical clinical diagnostics

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PAPER – 40400103: CLINICAL HAEMATOLOGY, HISTOPATHOLOGY AND CYTOLOGY

Course Outcomes:

CO1 Ability to recognize the composition and function of blood, Describe the normal and abnormal hematological values

CO2 Ability to understand the histopathology, lab organization. Equipment usage.

CO3 Proficiency in clinical laboratory procedures, Haematology and serology proficiency

CO4 Efficiency in blood profiling.

UNIT 1: Clinical Pathology and Bacterial growth techniques

a) Urine Examination: Physical, Chemical and Microscopic
b) Stool examination: Gross, chemical and microscopic
c) CSF examination
d) Semen examination
e) Sex chromatin determination
f) Other body fluids examination
g) Quality control in Clinical Pathology

UNIT 2: Blood Banking and Quality control in Blood Bank

a) Immunohematology of red cell and blood group systems
b) Apparatus used in blood banking its care and cleaning
c) Storage and record keeping of blood bags and cleaning
d) Methods of ABO and Rh blood grouping
e) Screening of a blood donor, tapping of blood donor
f) Cross matching tests
g) Coomb's test
h) Blood component- Separation, Storage and Therapy
i) Antibody titrations
j) Blood transfusion reactions
k) Quality control in Blood Banking

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UNIT 3: Haematology and Clinical Haematology

a) Vein puncture
b) Instruments used in haematology
c) Common anticoagulants and their use
d) Composition of blood cellular elements, functions of blood
e) Estimation of Haemoglobin
f) Methods and counting of red blood cells, white blood cells, platelets and reticulocytes
g) Estimation of erythrocyte sedimentation rate, packed cell volume, blood indices
h) Preparation of blood films, staining methods and preparation of different stains and diluting fluids
i) Study of blood smear examination for red blood cells, different white blood cells, normal and abnormal cells, platelets and parasites
j) Studies for blood coagulation and haemostasis
k) Sickling tests, RBC fragility test, LE cell test, Foetal Haemoglobin estimation and Haemoglobin electrophoresis
l) Basics of automated blood cell counters
m) Quality control in Haematology
n) Bone Marrow preparation and examination
o) Laboratory diagnosis approach on Anaemias, Leukaemia and bleeding disorders

UNIT 4: Basic Histopathology and Cytology

a) Introduction to Histology
b) Handling and storage(autopsy) Biopsy Specimen
c) Instruments in Histopathology
d) Fixation and common fixatives
e) Tissue processing: Dehydration, clearing, embedding, methods of tissue processing: Automated and manual, preparation of block
f) The manipulationuses and care of microtomes, Microtome knives and methods of sharpening, Paraffine block, Section cutting, Picking up sections, drying sections
g) Staining: Principle of staining, preparation and use of Haematoxylin and eosine stain
h) Mounting and Frozen section apparatus: a theoretical knowledge of its application, construction and use, preservation of slides and blocks
i) Methods in common use for decalcification
j) Recognition and correction of faults in section cutting
k) Introduction to Cytology

l) Collection of various pathological material for cytology
m) Preparation of glass frame and mounting of fluids
n) Diagnostic Cytology: Preparation of smears and PAP test

Reference Book

Clinical Hematology: Theory and Procedures	Mary Louise Turgeon	6th Ed (2018)	Lippincott
Dacie and Lewis Practical Haematology	Barbara Bain et al.	12th Ed (2016)	Churchill Livingstone
Practical Pathology	Harsh Mohan	3rd Ed (2021)	Jaypee Brothers
Textbook of Histology	Inderbir Singh	9th Ed (2023)	Jaypee Brothers
Cytology: Diagnostic Principles and Clinical Correlates	Edmund Cibas	5th Ed (2020)	Elsevier
Textbook of Medical Laboratory Technology	Ramnik Sood	2nd Ed (2020)	Jaypee Brothers
Medical Laboratory Science: Theory and Practice	Ochei & Kolhatkar	6th Ed (2018)	McGraw Hill

Reading Material

Clinical Pathology and Hematology	M. A. Wintrode	Recent	Quick reference guide
Basic Histopathology Techniques	Bancroft	8th Ed	Comprehensive histology lab guide
Clinical Laboratory Hematology	Shirlyn McKenzie	3rd Ed	Lab techniques, automation

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PAPER – 40400104: CLINICAL BIOCHEMISTRY PRACTICALS

Course Outcomes:

CO1 Explain the principles, operation, and maintenance of essential laboratory instruments used in clinical biochemistry, including spectrophotometers, auto analyzers, pH meters, ELISA readers, and centrifuges.

CO2 Demonstrate the preparation of molar solutions, reagents, and standard stains, and carry out biochemical estimations for glucose, total protein, cholesterol, urea, creatinine, uric acid, bilirubin, SGPT, and SGOT from blood samples.

CO3 Perform immunological and serological diagnostic tests including ELISA for HBsAg, Latex agglutination tests (RA, CRP), WIDAL test, RPR, and rapid card tests for Covid-19, PF antigen, and HIV.

CO4 Describe the principles and applications of electrophoretic techniques (rocket and immune electrophoresis) and multidisc antibiotic sensitivity methods used in clinical diagnostics.

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1. Study of principles and working of:
    - pH meter
    - Spectrophotometer
    - ELISA reader
    - Auto analyser for biochemistry
    - Centrifuge
2. Preparation of standard stains, molar solutions and reagents
3. Cleaning and preparation of glassware for sterilization
4. Disposal of laboratory waste and cultures
5. Estimation of blood plasma/serum glucose by GOD-POD for FBS/PPBS and GTT
6. Estimation of total protein and A/G ratio
7. Estimation of total cholesterol and its fractions
8. Estimation of Creatinine
9. Estimation of Urea
10. Estimation of Uric acid
11. Estimation of SGPT, SGOT
12. Estimation of Bilirubin (direct and total)

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Reference Books

Tietz Fundamentals of Clinical Chemistry	Carl A. Burtis, David E. Bruns	7th Ed (2014)	Saunders
Textbook of Biochemistry for Medical Students	DM Vasudevan	9th Ed (2019)	Jaypee Brothers Medical Publishers
Ramnik Sood's Medical Laboratory Technology	Ramnik Sood	5th Ed (2006)	Jaypee Brothers Medical Publishers

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PAPER – 40400105: GENERAL & CLINICAL MICROBIOLOGY PRACTICALS

Course Outcomes:

CO1	Explain the working principles and applications of laboratory equipment used in microbiology, including autoclaves, incubators, rotary shakers, HEPA filters, and bacteriological filters.
CO2	Demonstrate methods of sterilization, disposal of laboratory waste, preparation and use of different culture media (routine, differential, selective, specialized), and the cultivation and identification of fungi.
CO3	Perform specialized microbiological techniques such as ZN staining for AFB, motility determination by hanging drop and stab methods, and specialized staining for capsule, endospore, and metachromatic granules.
CO4	Carry out biochemical tests for bacterial identification, serological tests for brucellosis, and study permanent slides of medically important microorganisms and parasites.

1. Study of principles and working of:
    - Light microscope
    - Autoclave
    - Hot air oven
    - Incubator
    - Rotary shaker
    - Bacteriological filters
    - HEPA filter
2. Disposal of laboratory waste and cultures
3. Latex agglutination tests: RA, CRP
4. Rapid card tests: PF antigen and HIV
5. ELISA – HBsAg
6. Serological tests: WIDAL (Slide & Tube), RPR
7. Electrophoresis – Rocket and Immune electrophoresis
8. Brucellosis tests – *Brucella abortus*, *Brucella melitensis*
9. Multidisc method for antibiotic sensitivity
10. ZN staining for AFB
11. Specialized staining – Capsule, Cell wall, Endospore, Metachromatic granules

12. Motility by Hanging drop and Agar stab method
13. Study of different Culture media – Routine, Specialized, Differential, Complex
14. Biochemical tests for bacterial identification (Gram Positive & Gram Negative)
15. Cultivation and identification of Fungi
16. Permanent slide study – *Amoeba*, *Euglena*, *Paramecium*, *Diatoms*, *Spirogyra*, Female *Anopheles* mosquito, Head louse, Tick, Flea, Mite, *Actinomycetes*, Yeast, *Bacteroides*, Acid-fast bacilli, Spirochaetes, *Streptococcus pneumoniae*, *Clostridium tetani*, *Plasmodium vivax*, *Plasmodium falciparum*

Reference Books:

Ananthanarayan and Paniker's Textbook of Microbiology	R Ananthanarayan , C.K. Jayaram Paniker	11th Ed (2020)	Universities Press (India) Pvt. Ltd.
Baveja's Textbook of Microbiology	C P Baveja	7th Ed	Arya Publishing Company
R.C. Collee's Practical Medical Microbiology			
KD Chatterjee's Parasitology	Chatterjee KD	13th Ed (2019)	CBS

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PAPER - 40400106: CLINICAL HAEMATOLOGY, HISTOPATHOLOGY & CYTOLOGY PRACTICALS

Course Outcomes:

CO1 Describe the principles, operation, and maintenance of hematology instruments such as automated blood cell counters, microscopes, centrifuges, and refrigerators for blood banks.

CO2 Demonstrate procedures for blood collection, preparation of collection bulbs, and perform tests including estimation of hemoglobin, RBC and WBC total counts, and differential WBC counts using Giemsa and Leishman stains.

CO3 Perform hematological tests including reticulocyte count, G6PD screening, ESR, bleeding time, clotting time, sickling test, and ABO and Rh blood grouping.

CO4 Carry out routine and microscopic examination of body fluids such as urine, stool, semen, and CSF, and perform Coomb's test, while following standard biosafety and waste disposal practices.

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1. Study of principles and working of:
    - Auto analyser for blood cell count (Haematology)
    - Electrolyte Analyser
    - Auto Technicon
    - Rotary Microtome
    - Refrigerator for pathology lab and blood bank
2. Collection of blood and preparation of bulbs for blood collection
3. Estimation of Haemoglobin
4. RBC and WBC total count
5. Smear preparation and Differential WBC count – Giemsa stain, Leishman stain
6. Reticulocyte count, G6PD test
7. ESR, Sickling tests, Bleeding time and Clotting time
8. Urine routine and microscopy
9. Stool routine and microscopy
10. Semen examination routine and microscopy
11. CSF examination routine and microscopy
12. Blood group 'ABO' and 'Rh'

13. Coomb's test
14. Antibody test – Covid-19 rapid card test
15. DEMO – Paraffin embedding, section cutting, staining and mounting
16. H&E stain for PAP smear

Reference Book

Dacie and Lewis Practical Haematology	Barbara Bain	12th Ed (2016)	Elsevier Science Health Science
Mary Louise Turgeon's Clinical Hematology	Mary Lou Turgeon	6th Ed (2017)	Jones & Bartlett Learning
Harsh Mohan's Practical Pathology	Harsh Mohan	4th Ed (2016)	Jaypee Brothers Medical Publishers (P) Ltd.
Cibas Cytology – Diagnostic Principles and Clinical Correlates	Edmund Cibas	5th Ed (2020)	Elsevier
Ramnik Sood's Medical Laboratory Technology	Ramnik Sood	5th Ed (2006)	Jaypee Brothers Medical Publishers

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PAPER - 40400201: ANATOMY& PHYSIOLOGY

Course Outcomes:

CO1 Learning about the functions of the body's systems, such as the cardio-respiratory, renal, reproductive, and metabolic systems.
Learning about the structure and function of cells, tissues, organs, and systems

CO2 Knowledge about how body systems work together to maintain homeostasis. how to use laboratory tools and techniques to examine anatomical structures and physiological functions

CO3 Define basic biological processes essential for maintenance of homeostasis.

CO4 Correlate specific structural features of human cells, tissues, organs and systems of the human body with their normal functions, and identify the changes that occur during human development, ageing and disease.

UNIT 1: Introduction to Anatomy

a) Scope of Anatomy and Physiology
b) Definitions and Terms in Anatomy and Physiology
c) Structure and function of human cell
d) Elementary tissues and function of human cells
e) Brief account on composition of blood
f) Functions of blood elements
g) Blood group and coagulation of blood

UNIT 2: Cardio Vascular System and Respiratory System

a) Structure and functions of various parts of the heart
b) Arterial and venous system
c) Brief account on common cardiovascular disorders
d) Various parts of respiratory system and their functions
e) Physiology of Respiration

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UNIT 3: Digestive system, Urinary system and Reproductive system

a) Names and various parts of digestive system- Liver, Spleen, Gall Bladder, Pancreas, Buccal Cavity, Pharynx, Oesophagus, Stomach, Intestine etc.
b) Physiology of digestion and absorption, Various parts of urinary system and its function-structure and function of kidneys- Physiology of urine formation- Pathophysiology of renal disease and edema
c) Physiology and anatomy of Male & Female reproductive system- Prostate and Uterus & Ovaries etc.

UNIT 4: Musculoskeletal System and Nervous System

a) Classification of bones and joints, structures of skeleton- structure of skeletal muscle- Physiology of muscle contraction
b) Various parts of nervous system- Brain and its parts- Functions of nervous system- Spinal Cord and Nerves

UNIT 5: Ear, Nose, Throat and Eye, Haemopoietic and Lymphatic System and Endocrine System

a) Elementary knowledge of structure and functions of organs of taste, smell, hearing, vision
b) Endocrine glands, their hormones and functions- Thyroid, Parathyroid, Suprarenal, Pituitary and Thymus, Name of the blood vessels and Lymph gland locations

UNIT 6: Surface Anatomy and Surface Markings of Human Body Practically

a) Study of Human Skeleton parts with skeletal models
b) Study with charts and models of all organ systems mentioned above
c) Microscopic slides examination of elementary human tissues and cells

Reference Book

Book Title & Author	Edition	Publisher
Essentials of Human Anatomy & Physiology - Elaine N. Marieb	13th Ed. (2023)	Pearson Education
Human Physiology (Vol. 1 & 2) - C.C. Chatterjee	14th Ed. (2022)	CBS Publishers
Ross & Wilson Anatomy and Physiology in	14th Ed.	Elsevier

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Book Title & Author	Edition	Publisher
Health and Illness - Anne Waugh, Allison Grant	(2022)	
Principles of Anatomy and Physiology - Gerard J. Tortora, Bryan Derrickson	16th Ed. (2023)	Wiley India
Textbook of Human Anatomy (Vol. 1-3) - B.D. Chaurasia	8th Ed. (2023)	CBS Publishers
Textbook of Physiology (Vol. 1 & 2) - A.K. Jain	7th Ed. (2023)	Avichal Publishing
Gray's Anatomy for Students - R.L. Drake, A.W. Vogl, A.W.M. Mitchell	5th Ed. (2023)	Elsevier
Microscopic Atlas of Human Tissues - M.J. Tighe	2nd Ed. (2005)	Elsevier
Laboratory Manual for Anatomy & Physiology - Elaine N. Marieb	7th Ed. (2021)	Pearson Education

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PAPER – 40400202: IMMUNOLOGY&PATHOLOGY

Course Outcomes:

CO1 Learning about the immune system's structure, function, cells, and molecules. As well as about the development and maturation of immune cells.

CO2 To learn about the biological and immunological mechanisms that cause disease. They can also learn about the consequences of immune failure and overreaction

CO3 To learn about diagnostic methods for immunology and pathology, and how to apply them to relevant tissues and organs.
Exhibit a broad and coherent body of knowledge of how the cells and molecules of our immune system cooperate to maintain health.

CO4 Exhibit an integrated knowledge of the role of the immune system in both the cause of pathology and the cure of disease.

UNIT 1: Introduction and brief history of Microbiology

a) Historical Aspect- Branches of Microbiology
b) Prokaryotic organisms- Prokaryotes Vs Eukaryote- Cell Wall, Structures external to Cell Wall, Structures internal to Cell Wall
c) Spores- Eukaryotic Organisms- Structure of eukaryotes, Characteristics of Eukaryotes

UNIT 2: COMMON LABORATORY EQUIPMENTS, STERILIZATION, ANTISEPTICS AND DISINFECTANTS

a) Incubator, Hot Air Oven, Water Bath- Anaerobic Jar, Centrifuge, Autoclave
b) Microscope- Fundamentals of Microscopy, Resolution & Magnification, Light Microscopy, Electron Microscopy
c) Glassware- Description of Glassware, Its use, handling and care
d) Definition- Classification and General Principle of Sterilization
e) Definition- Types- Mode of Action- Uses

UNIT 3: ROUTINE EXAMINATION OF URINE AND BODY FLUIDS

a) Introduction- Formation of urine, Collection of Urine- Special type of collection of urine- Biohazard management- Components of routine urine analysis- Colour- Clarity- Odour-Volume

b) Chemical Examination- Sugar in urine- Tests for Sugar in Urine- Benedict's Test
c) Fehling's test- Chemical strip method- Protein in Urine- Test for Protein in Urine Heat and Acetic acid test- Sulpho salicylic Acid test- Heller's Test
d) Ketone Bodies in urine – Test for ketones in urine Rothra's test- Gerhardt's test- Bile in urine- Test for Bilirubin- Fourchette's Test- Test for Bile salts- Hay's test- Blood in urine- Test for Haematuria- Benzidine Test- Guaiacum Test- Gregersen's test
e) Microscopic examination of urine: crystals found in Urine(Acidic & Alkaline)
f) Casts and cells in urine
g) Characteristics of CSF, Synovial- Pleural-Pericardial and Peritoneal fluids, Semen analysis (Physical, Chemical, Microscopic with count of sperm and motility)

UNIT 4: GROWTH AND CULTIVATION OF MICROORGANISMS

a) Nutritional requirement of microorganisms- Types of media- Microbial growth and growth curve-collection- Collection, handling and transportation of clinical samples for microbiological investigations

UNIT 5: BACTERIOLOGY AND IMMUNOLOGY

a) Definition- Bacteria, General characteristics of bacteria- Classification and morphology- (1) *Staphylococcus* (2) *Streptococcus* (3) *Pneumococcus* (4) *Neisseria gonorrhoea* (5) *Neisseria meningitis* (6) *Corynebacterium diphtheriae* (7) *Mycobacterium* (8) *Clostridium* (9) *E.coli* (10) *Klebsiella* (11) *Salmonella* (12) *Proteus* (13) *Pseudomonas* (14) *Vibrio* and *Spirochaetes*- Morphology, Cultural characteristics, Biochemical reaction, pathogenesis/disease caused and lab diagnosis
b) Introduction- Nonspecific resistance to infection- Specific immunity
c) Antigens & Antibodies- Structure and function, Complement and antigen- Antibody reaction, Hybridoma and Monoclonal antibodies
d) Applied immunology, Autoimmunity, Transplantation and Tumour immunity

UNIT 6: VIROLOGY, MYCOLOGY AND PARASITOLOGY

a) Definition- General introduction of virus, Physiochemical characteristic of Viruses, Isolation of Viruses in Laboratory by tissue culture, cell and tissue culture technology, Embryonated Egg, Principles of animal cell

culture and their use in virology- Retro viruses, HIV, Hepatitis virus, Pox virus, Picorna virus, Polio, Orthomyxovirus, Influenza, Arbo virus, Chikungunya, Dengue, Herpes and Adeno virus with reference to their mode of infection, Pathogenesis and diagnosis, Bacteriophages

b) Definition- Structure-Classification- Cutaneous and sub cutaneous and Systemic Mycosis- Opportunistic fungal infections- Diagnosis of fungal infections
c) Introduction of Parasitology and classification, Protozoa-Rhizopoda-Mastigophore (Hemoflagellates, Intestinal and genital flagellates)
d) Sprozoa (Malarial parasite, Toxoplasma)- Helminthes, Nematodes (Ascaris, Hookworm, Whipworm, pinworm, strongyloidiasis trichinella, Filaria, Dracunculus medinensis)
e) Cestodes (*Tenia saginata, T. Sclium, Echinococcus, D.atum, Hymenolepsis nana*) Trematodes

Reference Book

Book Title & Author	Edition	Publisher
Dacie and Lewis practical haematology e-book - Bain, B. J., Bates, I., & Laffan, M. A.	2016	Elsevier Health Sciences
Textbook of biochemistry for medical students - Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K.	2013	JP Medical Ltd
Introduction to medical laboratory technology - Baker, F. J., & Silverton, R. E.	2014	Butterworth-Heinemann
Concise Book of Medical Laboratory Technology: Methods and Interpretations - Sood, R	2009	Jaypee Brothers Medical Publishers (P) Limited
Medical laboratory technology. Academic Medicine - Lynch, M. J., Raphael, S. S., MELLOR, L. D., SPARE, P. D., Hills, P., & INWOOD, M. J.	1963	
Introduction to medical laboratory technology. EPHTI, The Carter Center. Seyoum, B.	2006	
Textbook of Medical Laboratory Technology - Godkar, P. B., & Godkar, D. P.	2011	

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PAPER – 40400203: SPOKEN ENGLISH AND COMMUNICATION

Course Outcomes:

- **CO1** Developing conversation skills
- **CO2** Developing pronunciation skills by focusing on using effective features of pronunciation
- **CO3** Make meaning by organizing language
- **CO4** Using appropriate grammatical patterns.

UNIT 1: Communication

a) Definition of communication need for communication its classification and purpose
b) Various barriers of communication and major difficulties in communication
c) The characteristics of successful communication- The seven C's
d) The human needs and communication "Mind mapping"
e) Information communication. Communication in the health care set up
f) Role play / skit as a practical exercise

UNIT 2: Comprehension passage

a) Reading purposefully- understanding what is read
b) Drawing conclusion- Finding and analysis

UNIT 3: Explaining

a) How to explain clearly- Defining and giving reasons
b) Explaining differences- Explaining procedures- Giving directions

UNIT 4: Letter writing

a) Types of letters- Business letters- How to construct correctly
b) Formal language- Address
c) Salutation- Body- Conclusion
d) Providing information to superiors in written form
e) Formulate a business latter and a latter to a friend/ family

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UNIT 5: Report Writing

a) Reporting an accident- Reporting what happened at a session
b) Reporting what happened at a meeting
c) Write a report on your recent visit to a place of interest

UNIT 6: Conversational English Exercises

a) Self-introduction, Explanation of various procedures
b) Reporting of any mishap, explaining to a patient, conversing with the doctor on patient care status

REFERENCES

Book & Title	Edition	Publisher
English Grammar Collins		International Language Data Base and co.
Grammar and Composition - Wren and Martin		Chanda & so
Letters for all Occasions - A.S. Myers		Pub Harper Perennial
Spoken English - V. Shashikumar and P.V. Dhanija		TAT McGraw Hill

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PAPER – 40400204: BASICS OF COMPUTER

Course Outcomes:

CO1 Discuss basic computer concepts and definitions. Determine what operating system you have
CO2 Navigate programs.
CO3 Locate and manage files and folders.
CO4 Discuss proper file and folder management techniques in a variety of environments.

UNIT 1: Introduction to the computer

a) Parts of a computer, I/O devices- memories- RAM and ROM
b) Networking- LAN, WAN, MAN (Only basic ideas)

UNIT 2: Introduction to Microsoft Word

a) Typing text in MS word, manipulating text, formatting the text and using different font sizes, bold, italics, using Bullets and numbering, insertion of pictures and file insertion
b) Aligning of the text and justify

UNIT 3: Microsoft PowerPoint

a) Preparing new slides using MS-Power Point
b) Inserting slides, slide transition and animation
c) Using templates, different text and font sizes, inserting slides with sounds, inserting clip arts, pictures, tables and graphs
d) Presentation using wizards

UNIT 4: Introduction to the Internet

a) Definition about the Word Wide Web & brief history
b) Using search engine and beginning Google search
c) Exploring and next using Internet Explorer and Navigator
d) Uploading and download of files and images
e) E-mail ID creation
f) Sending messages- Attending files in E-mail

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UNIT 5: Introduction to the Hospital Information System

a) Definition of Hospital information system
b) Architecture of a HIS, aim and uses of HIS
c) Types of HIS benefits of using a hospital information system

Reference Book

Book & Title	Edition	Publisher
Fundamentals of Computers - Rajaraman, V.	6th Ed. (2019)	PHI Learning
Introduction to Information Technology - Rajaraman, V.	2nd Ed. (2018)	PHI Learning
Microsoft Office 2019 Step by Step - Lambert, J.	1st Ed. (2019)	Microsoft Press
Computer Fundamentals - Sinha, P.K.	6th Ed. (2020)	BPB Publications
Internet for Everyone - Leon, A.	4th Ed. (2017)	Vikas Publishing House
Hospital Information System: Concepts and Technology - Bansal, M.	1st Ed. (2021)	Jaypee Brothers Medical Publishers