Bachelor in Medical Laboratory Technology

Rules-Regulations & Curriculum (as per OBE)

(w.e.f. 2025-26)

REGISTRAR
Sai Tirupati University
Udaipur (Raj.)

PRINCIPAL
VENKATESHWAR INSTITUTE OF
PARAMEDICAL SCIENCES
UMARDA, UDAIPUR

Venkteshwar Institute of Paramedical Sciences

(A Constituent Unit of Sai Tirupati University, Udaipur)

Program Outcomes (POs)

PO1 Apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support in number of Hospitals and diagnostics centers for sustainable development.
PO2 Perform routine clinical laboratory procedures within acceptable quality control parameters in hematology, biochemistry, immunohematology and microbiology.
PO3 Develop leadership skills required for roles such as research labs, diagnostic Laboratories and management of a team.
PO4 Apply problem solving technique in identifications and corrections of pre analytical, post analytical & analytical variable.

Program Educational Objectives (PEOs)

PEO1 Create knowledge about field of Medical Laboratory analyze, interpret and apply concepts of clinical testing for healthcare decision making.
PEO2 Exhibit the knowledge of entrepreneurial qualities and explore entrepreneurial opportunities by Working effectively and professionally in teams
PEO3 Employ interpersonal communication skills in relaying laboratory test information and when interacting with patients, lab personnel and other health care professionals.
PEO4 Develop technical skills associated with medical laboratory technology to perform and analyze clinical investigations

Program Specific Outcomes (PSOs)

PSO 1 After successful completion the students shall be proficient in making diagnosis and skills of testing procedure and techniques.
PSO 2 They expertise in advance clinical intervention techniques based on evidence based practices.
PSO3 Students will develop strong leadership and interpersonal skills and exhibit knowledge of entrepreneurial qualities

Program of Study & Scheme of Examination

1. TITLE OF THE PROGRAM - The title of the Program shall be "Bachelor in Medical Laboratory Technology".

2. DURATION OF PROGRAM /TRAINING - The Program shall be of three years duration 6 semester plus a one-year Internship from the date of commencement of the Program.

3. MEDIUM OF INSTRUCTION - English shall be the medium of instruction.

4. ELIGIBILITY FOR ADMISSION –

• For admission, a candidate must have passed the 10+2 (Senior Secondary) Examination or its equivalent Examination in the Science stream i.e. Physics, Chemistry, and Biology with 50% marks in the aggregate & pass in each subject individually for General Category and 45% for SC/ST/OBC/MBC candidates from a recognized Board or as per Govt. Guidelines.

• Candidate should have completed the minimum age of 17 years as of 31st December of the year of admission.

• Lateral Entry- Lateral entry Admission directly to Second year i.e third semester of a UG paramedical Program should be done from a candidate having diploma in Paramedical Subject of same specialty in addition to entry qualification.

5. CRITERIA FOR ADMISSION - Selection shall be done by an Admission Board of the University/Rajasthan Paramedical Council strictly on merit/written examination.

6. RESERVATION POLICY - Reservations in admissions shall be applicable as per the policy of the State Government.

7. ENROLMENT -

1. Every candidate who is admitted to the Program is required to get himself/herself enrolled with the admitted university after paying the prescribed eligibility and enrollment fees.
2. No student shall be allowed to appear in the university examination without enrollment in the university.

8. MIGRATION RULES -

• No student once admitted to the Program and enrolled by the university, will be permitted to migrate to any other university.

• No student will be admitted to the Program on migration from any other university.

9. ATTENDANCE –

A minimum of 75% attendance is required in each semester, both for theory and practical classes separately. Students with deficient attendance will not be permitted to appear in university examinations.

A student detained due to short attendance will have to repeat the semester.

10. WORKING DAYS - Each academic semester shall consist of minimum 120 working days, including examinations.

11. CONDUCTION OF THE UNIVERSITY EXAMINATION - A university semester examination shall be conducted twice in a year with the interval of six months. Even semester examination shall be conducted after six months of odd semester examinations.

12. ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION - A student is required to have minimum 75 % attendance in theory and practical's separately of each semester to make him/her eligible to appear in the university semester examination.

Candidates failing in one or more subjects (theory/practical) of semester will require to appear in failing subjects in the next examination of same semester.

A candidate will have to clear all the subjects of first to fifth semester before appearing at sixth semester university examination otherwise he will not be allowed to appear in the Part-III sixth semester university examination.

13. APPOINTMENT OF EXAMINER & PAPER SETTER -

a. All the examiners, paper setters, theory examination answer book evaluators, external and internal examiners for practical examinations shall be appointed by the respective university.

b. Professor/ Assoc. Professor/ Assistant Professor/Lecturer/Paramedical Professional having PG qualification and 3 years professional/teaching experience after PG in respective fields is eligible to act as an internal or external examiner of theory/practical examination.

14. SCHEME OF EXAMINATION - The University examination for the Program shall be conducted semester wise at the end of every six months.

i. Theory –

(a) There shall be four Theory papers in each semester of study.

(b) Each Theory paper examination shall be of 3 hours duration and a maximum of 80 marks.

(c) Internal assessment (IA) shall be 20 marks for each Theory Paper.

(d) The Paper Setter shall set the questions within the prescribed Program of study of the concerned paper. There will be a set pattern of question papers duly approved by the Academic Council.

Proposed Pattern of question papers –

i. Every question paper shall contain Six questions out of which five need to be attempted.
ii. Question No. 1,3,4 shall be of long answer type. It shall carry 16 marks each.
iii. Question No. 2 shall have two parts carrying 8 marks each.
iv. Question No. 5 shall have four short notes each carrying 4 marks.
v. Question No. 6 shall have four short notes each carrying 4 marks.

(g) Passing Marks: A candidate will have to obtain at least 50% marks in each Theory paper including internal assessment to pass.

ii. Practical and Viva-Voce Examination -

(a) At the end of each semester there shall be the practical and viva-voce examination of 200 marks. It shall be conducted after the Theory examination is over. A candidate will have to obtain at least 50% marks in the practical and viva-voce examinations.

(b) The pattern of practical examination shall be as follows –

Semester	Practical & viva-voce	Internal Assessment	Total Marks	Min. Pass Marks	Practical Examiners
Ist Sem	150	50	200	100	One Internal & one External Examiner
IInd Sem	150	50	200	100	One Internal & one External Examiner
IIIrd Sem	150	50	200	100	One Internal & one External Examiner
IVth Sem	150	50	200	100	One Internal & one External Examiner
Vth Sem	150	50	200	100	One Internal & one External Examiner
VIth Sem	150	50	200	100	One Internal & one External Examiner

The university shall appoint the panel of examiners in such a manner that the complete syllabus of semester is taken care of by the internal/external practical examiner(s).

If the Practical examination consists of more than one subject/department, the Board of studies/ Committee of Program shall decide the distribution of marks of different parts of the practical examination ensuring that the maximum marks of all the parts of the practical examination do not exceed 200 Marks.

iii. Result

1. A candidate will have to obtain at least 50% marks separately in each Theory paper including internal assessment and a minimum of 50% marks in the practical examination for him to be declared pass.
2. A Candidate who has failed in theory paper(s)/ Practical examination will reappear in respective theory papers(s)/ Practical examination in next examination of same semester will held in next year of a subject.

iv. Supplementary/Remanded Examination -

(a) There shall be a supplementary examination of sixth semester only within Six months of the main examination of sixth semester.

(b) Internal assessment marks obtained in the main examination in the concerned failed paper(s)/practical shall be carried forward for working out the result of next Theory paper(s) and/or practical examination.

(c) If the candidate reappearing in the university examination due to failure in subjects then He/She shall be allowed to improve his/her internal assessment marks also or He/she can opt to carry forward his/her earlier obtained internal marks.

v. Promotion to next semester -

1. A candidate who has appeared in the University examination of a semester and has passed it OR failed in one or more subjects shall be promoted to next semester.
2. A candidate will be allowed to appear for the sixth semester examination only when the backlog of all subjects (theory and practical) of first semester to fifth semesters exams including elective papers (if any) is cleared.
3. A student detained due to short attendance will not be promoted to next semester in this case he/she have to repeat the whole semester.
4. The student is required to clear all the University examinations within 6 academic years from the joining of the Program otherwise he/she will have to leave the Program.

15. GRACE MARKS

1. A student who appears in all papers of the examination on the first attempt and obtains the required minimum pass marks in the total aggregate of an examination but fails to obtain the minimum pass marks in one subject (in theory or practical as the case may be) may be awarded the grace marks as per policy of the university up to a maximum of 06 marks, provided the candidate passes the examination by an award of such grace marks.
2. No grace marks will be awarded to a candidate who appears in part/ supplementary examination.

3. A candidate who passes the examination after the award of grace marks in a paper/practical or the aggregate will be shown in the marks sheet to have passed the examination by grace. Grace marks will not be added to the marks obtained by a candidate from the examination.
4. Non-appearance of a candidate in any part of the examination on account of any reason will make him ineligible for grace marks.
5. A candidate who is awarded grace marks in any subject to pass the examination will not be entitled to distinction in any subject.

16. REVALUATION / SCRUTINY - Revaluation of answer book(s) and scrutiny of the marks will be as per policy of the university.

17. TEACHING HOURS - Teaching hours shall be not less than 630 hours in every academic semester.

18. INTERNSHIP –

Every candidate after successful completion of the all-semester examination have to undergo a one-year compulsory rotating internship.

Candidates coming from other institutions with the permission of the Head of the concerned institution will be allowed for the internship program in the respective University after receipt of the fees prescribed by this University. Internships shall be rotating in the concerned department.

Internship Rules:

1. The intern will be eligible for 1-day casual leave each month and can carry over the leave to the next months, but he/she cannot avail of the next month's leave in advance.
2. The interns should conduct themselves in a manner befitting the profession.
3. The intern should dress appropriately in the clinical areas.
4. The intern must wear a white apron with a nametag when in the clinical area/wards.
5. The intern can avail of medical leave on producing a medical certificate but will have to compensate for the number of days of absence from the internship.

Authority for issue of Internship Completion Certificate - The Principal/Director of the college/ Institution shall issue a certificate of successful completion of a one-year internship to each candidate after satisfying that the candidate has completed the training program and has acquired the skills.

19. Award of Degree - The degree shall be awarded by the University only after receipt of the Internship completion certificate from the Principal/Director of the college/ Institution.

20. Log Book –

This predefined task performed by learners that contributes to the achievement, acquisition of the requisite knowledge, skills, attitude and/or competencies of stated objectives should be recorded in log book for the study period.

It includes selected assignments, self-assessment, feedback, work-based and in-training formative assessments, reflections and learnings from planned activity in the curriculum.

21. Skills Enhancement add on Programs/electives –

Students can select any one or more Discipline Specific Elective, Ability Enhancement Program, Generic Elective add-on Program at the beginning of a semester and the candidate will have to pass these add on Program before appearing at the sixth semester examination. The examination of these subjects shall be conducted at the Institute level.The Marks obtained by the candidates in these add-on Program shall be mentioned separately in the mark's sheets of the respective university. These marks shall not be counted for preparing the merit list.

Program Scheme

L- Lecture, T-Tutorial, P-Practical, C- Credits

Core- Discipline Core Course

SEC- Skill Enhancement Course

AEC- Ability Enhancement Course

VAC- Value Added Course

SEMESTER-I										
Course Code	**Course Name**	**Course Category**					**Contact Hour Per Week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206AN101	Human Anatomy-1	Core	4	-	-	4	4	20	80	100
206PY102	Human Physiology-1	Core	4	-	-	4	4	20	80	100
206BC103	Biochemistry-1	Core	4	-	-	4	4	20	80	100
206PA104	Pathology-1	Core	4	-	-	4	4	20	80	100
206MI105	Microbiology-1	Core	4	-	-	4	4	20	80	100
206PR106	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						26	32			

SEMESTER-II										
Course Code	**Course Name**	**Course Category**					**Contact Hour Per Week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206AN201	Human Anatomy-2	Core	4	-	-	4	4	20	80	100
206PY202	Human Physiology-2	Core	4	-	-	4	4	20	80	100
206BC203	Biochemistry-2	Core	4	-	-	4	4	20	80	100
206PA204	Pathology-2	Core	4	-	-	4	4	20	80	100
206MI205	Microbiology-2	Core	4	-	-	4	4	20	80	100
206PR206	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						26	32			

SEMESTER-III										
Course Code	**Course Name**	**Course Category**					**Contact Hour Per week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206BC301	Biochemistry-3	Core	4	-	-	4	4	20	80	100
206PA302	Pathology-3	Core	4	-	-	4	4	20	80	100
206MI303	Microbiology-3	Core	4	-	-	4	4	20	80	100
206CS304	Communication Skills in English	Ability Enhancement Course	2	-	-	2	2	20	80	100
206PR305	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						20	26			

SEMESTER-IV										
Course Code	**Course Name**	**Course Category**					**Contact Hour Per week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206BC401	Biochemistry-4	Core	4	-	-	4	4	20	80	100
206PA402	Pathology-4	Core	4	-	-	4	4	20	80	100
206MI403	Microbiology-4	Core	4	-	-	4	4	20	80	100
206CA404	Computer Application	Ability Enhancement Course	2	-	-	2	2	20	80	100
206PR405	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						20	26			

SEMESTER-V									
Course Code	**Course Name**	**Course Category**				**Contact Hour Per week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206BC501	Biochemistry-5	Core	4	-	-	4	4	20	80	100
206PA502	Pathology-5	Core	4	-	-	4	4	20	80	100
206MI503	Microbiology-5	Core	4	-	-	4	4	20	80	100
206ES504	Environmental Studies	Ability Enhancement Course	3	-	-	3	3	20	80	100
206PR505	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						21	27			

SEMESTER-VI										
Course Code	**Course Name**	**Course Category**					**Contact Hour Per week**	**Evaluation**		
			L	**T**	**P**	**C**		**Internal**	**External**	**Total**
206BC601	Biochemistry-6	Core	4	-	-	4	4	20	80	100
206PA602	Pathology-6	Core	4	-	-	4	4	20	80	100
206MI603	Microbiology-6	Core	4	-	-	4	4	20	80	100
206EP604	Entrepreneurship and Professional Management	Ability Enhancement Course	3	-	-	3	3	20	80	100
206PR605	Practical for all courses/ Clinical Posting	SEC	-	-	6	6	12	50	150	200
Total:						21	27			

SEMESTER	CREDIT
I	26
II	26
III	20
IV	20
V	21
VI	21
Total Credits	**134**

INTERNSHIP – After completion of six semesters of Bachelor in Medical Laboratory technology the candidates will undergo one year internship in a government recognized hospital/Institution as partial fulfilment for the award of Bachelor in Medical Laboratory technology per government norms.

Detailed Syllabus

SEMESTER-I

Course Name: Human Anatomy-1 **L T P C**
Course Code: 206AN101 **4 0 0 4**

COURSE OBJECTIVE: Course deals with the understanding of anatomy of human body and to learn the terminology of the course and basic knowledge of cells & tissues. This course will develop an understanding of the structure and function of organs and organ systems in normal human body.

COURSE OUTCOMES: On completion of this course, the students shall be able to:

CO1	Learn the basic terminology of human anatomy
CO2	Understand about different cells, tissues and blood
CO3	Know about anatomy of human body
CO4	Develop understanding of structure of different organ systems

UNIT: 1

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: 2

Locomotion and support

- Cartilage-types with example &histology bone classification
- Names of bone cells, parts of long bone, microscopy of compact bone
- Names of all bones, vertebral column, intervertebral 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: 3

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

- 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: 4

Gastro-intestinal system

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

UNIT: 5

Respiratory system & Peritoneum

- Parts of RS nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments
- Histology of trachea, lung and pleura
- Names of paranasal or sinuses
- Peritoneum: Description in brief

Urinary System

- Kidneys: Location, gross structure, blood supply, and nerve supply.
- Ureter: Course, structure, and histological features.
- Urinary Bladder: Gross anatomy, relations, and histology.
- Male and Female Urethra: Anatomical differences, structure, and histology.
- Histology of Kidney, Ureter, and Urinary Bladder: Microscopic structure, nephron organization, and transitional epithelium.

Reference Books:

1. Human Anatomy Regional and Applied Vol. 1, Vol. 2 & Vol. 3 ,B.D. Chaurasia, C.B.S. Publishers, New Delhi ,9th Edition, 2022
2. Hand Book of General Anatomy ,B.D. Chaurasia, C.B.S. Publishers, New Delhi, 9th Edition, 2022
3. Text Book of Human Histology ,Inderbir Singh ,Jaypee Brothers, Medical Publishers, Delhi ,7th Edition ,2021
4. Gray's Anatomy ,Susan Standring ,Elsevier Churchill Livingstone, Edinburgh ,42nd Edition ,2021

Course Name: Human Physiology -1 **L T P C**
Course Code: 206PY102 **4 0 0 4**

COURSE OBJECTIVE: The prime concern of this syllabus is to integrate basic knowledge of cells, tissues, blood, physiological functions and diseases of system included in syllabus.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Learn the basic terminology of human physiology
CO2	Describe and analyze the physiological functions of cells, tissues, and blood and their role in maintaining homeostasis.
CO3	Know about physiology of human body
CO4	Develop understanding of functions of different organ systems

UNIT:1

Blood & Lymphatic System

Blood

- composition and function of blood
- Red blood cells- Erythropoiesis
- White blood cells- Production, function, life span, count
- Platelets- Origin, normal count, Morphology, Functions
- Plasma proteins-Production, concentration, Types
- Haemostasis
- blood coagulation-mechanism of clotting, clotting factors, disorder of clotting factors
- Blood groups, ABO system, Rh system, blood grouping and typing, cross matching
- Anticoagulants- Classification, examples and uses
- Anaemias- morphological and etiological classification

Lymphatic system

- parts and function of lymphatic system.
- Lymph channels: Lymph vessels, Lymph capillaries
- Lymph nodes: position, structure and functions
- Tonsils, Spleen, Thymus gland : position, structure and functions

UNIT: 2

Cardiovascular system

- Heart-Physiological Anatomy, Nerve supply, properties of Cardiac muscle,
- Cardiac cycle-systole, diastole, Intraventricular pressure curves.
- Cardiac Output, Heart sounds Normal heart sounds Areas of auscultation.
- Blood Pressure - Definition, normal value, clinical measurement of blood pressure.

- Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension.
- Pulse-Jugalar, radial pulse, Triple response
- Heart sounds - Normal heart sounds, cause characteristics and signification. Heart rate Electrocardiogram (ECG) - Significance

UNIT: 3

Digestive System

- Physiological anatomy of Gastro intestinal tract, Functions of digestive system, Salivary glands, Structure and functions.
- Deglutination-Stages and regulationStomach-structure and functions
- Gastric secretion-Composition function regulation of gastric juice secretion Pancreas-structure, function, composition, regulation of pancreatic juice Liver-functions of liver, bile secretion, composition, function regulation of bile secretion Bilirubinmetabolism, types of bilirubin, Vandernberg reaction, Jaundice- types and significance.
- Gall bladder-functions
- Intestine-small intestine and large intestine
- Small intestine-Functions- Digestive, absorption, movements. Large intestine - Functions, Digestion and absorption of Carbohydrates, Proteins, Fats, Lipids, Defecation

UNIT:4

Respiratory System

- Functions of Respiratory system
- Physiological Anatomy of Respiratory system, respiratory tract, respiratory muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane
- Stages of respiration Mechanism of normal and rigorous respiration.
- Forces opposing and favoring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall
- Transportation of Respiratory gases:
- Transportation of Oxygen: Direction, pressure gradient, Forms of transportation, oxygenation of Hb.
- Lung volumes and capacities, Regulation of respiration.
- Mechanisms of Regulation, nervous and chemical regulation.
- Respiratory centre, Hearing Brier Reflexes

UNIT: 5

Excretory System

- Excretory organs: Overview.
- Kidneys:
    - Functions, structural and functional unit (nephron), cortical and juxtamedullary nephrons, comparison.
    - Juxtaglomerular apparatus: Structure and function.
    - Renal circulation: Peculiarities.

- Mechanism of urine formation:
    - Ultrafiltration: Criteria for filtration, glomerular filtration rate (GFR), plasma fraction, effective filtration pressure (EFP), factors affecting EFP.
    - Selective reabsorption: Sites, substances reabsorbed (glucose, urea, H^+, Cl^-, amino acids), mechanisms, tubular maximum for glucose (TMG), tubular load, renal threshold.
    - Selective secretion.
- Properties and composition of normal urine, urine output, abnormal constituents.
- Mechanism of urine concentration: Counter-current mechanism.
- Micturition: Innervation of the bladder,
- Diuretics: Water diuretics, osmotic diuretics, artificial kidney.

Renal function tests: Plasma clearance, actions of ADH, aldosterone, and PTH on kidneys

Reference Books:

1. Human Anatomy Regional and Applied Vol. 1, Vol. 2 & Vol. 3 ,B.D. Chaurasia, C.B.S. Publishers, New Delhi ,9th Edition, 2022
2. Hand Book of General Anatomy ,B.D. Chaurasia, C.B.S. Publishers, New Delhi, 9th Edition, 2022
3. Text Book of Human Histology ,Inderbir Singh ,Jaypee Brothers, Medical Publishers, Delhi ,7th Edition ,2021
4. Gray's Anatomy ,Susan Standring ,Elsevier Churchill Livingstone, Edinburgh ,42nd Edition ,2021

Course Name: Biochemistry-1 **L T P C**
Course Code : 206BC103 **4 0 0 4**

COURSE OBJECTIVE: This syllabus has been dealt to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the clinical Biochemistry.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Know about various glassware including volumetric and non volumetric
CO2	Understand about different cleaning agents and how to clean glasswares
CO3	Learn about the molar solution concept
CO4	Apply the molar solution concept for preparation of different concentrations of solution

UNIT: 1

Specimen collection:

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

Anticoagulants

- **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 bottled, Erlenmeyer conical etc), Funnels-different types (Conical, Buchner etc.),
- Bottles Reagent bottles - graduated and common, Wash bottles - different type 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 ranga, Cuvette holders Racks Bottle, Test tube, Pipette Dessicator Stop watch, rimers, scissors
- Dispensers-reagent and sample
- Any other apparatus which is important and may have been missed should also be Maintenance of lab glass ware and apparatus:
- Glass and plastic ware in Laboratory
- Use of glass: significance of boro silicate glass; care and cleaning of glass ware, different cleaning solutions of glass
- Care and cleaning of plastic ware, different cleaning solutions

UNIT: 2

Instruments (Theory and demonstration) Diagrams to be drawn

- **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

UNIT: 3

Laboratory balances [Theory & Practical's) 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 different types of chemicals, liquids.
- Hygroscopic compounds etc Colorimeter and spectrophotometer (Theory and Practical's) Diagrams to be drawn Principle, Parts Diagram. Use, care and maintenance.

UNIT: 4

pH meter (Theory & practical's)

- Diagrams to be drawn principle, parts, Types of electrodes, salt bridge solution
- Use, care and maintenance of Ph meter and electrodes
- Guidelines to be followed
- Precautions to be taken while using pH meter

UNIT: 5

- Safety of measurements
- Different measuring systerms
- Conventional and SI units

Reference Books

1. Essentials of Biochemistry,U. Satyanarayana, U. Chakrapani Allied Pvt. Ltd. , 4th Edition 2021,
2. A Textbook of Biochemistry**,** Dr. S.K. Gupta**,** Jaypee Brothers**,** 2nd Edition**,** 2019
3. Concise Textbook of Biochemistry for Paramedical Students**,** D.M. Vasudevan, Sukhas Mukherjee, Jaypee Brothers, 2nd Edition, 2021
4. Essentials of Biochemistry, Pankaja Naik, Jaypee Brothers, 6th Edition, 2022

Course Name: Pathology-1 **L T P C**
Course Code: 206PA104 **4 0 0 4**

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

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Learn about the blood
CO2	Understand the composition of blood and different types with its function
CO3	Estimate the ways to know the different components of blood
CO4	Analyze different blood cells

UNIT:1

Glassware Used in Hematology

- Introduction to clinical hematology, instruments and glassware's used in hematology washing of laboratory glassware.
- Preparation of various stains, buffers and other solution used in hematology.

Sample Collection

- Methods of collection of blood sample and anticoagulants used in different tests and various types of vacutainers.

UNIT:2

Blood Cell Counts

- Red blood cell counting.
- White blood cell count and absolute eosinophil count.
- Platelet and reticulocyte count.
- Methods of hemoglobin estimation, their merits and demerits.
- Packed cell volume.
- Blood indices.
- Erythrocyte sedimentation rate.

UNIT:3

Introduction to Clinical Pathology

- Introduction to Clinical Pathology
- Collection of various clinical specimens
- Transport and safe handling of specimens
- Preservation and containers for various clinical specimens
- Processing of various clinical specimens

UNIT:4

Urine Examination

- Collection of urine sample for male and female patients, mid stream urine collection.
- Preservation of urine sample.
- Physical Examination
- Chemical Examination
- Microscopic Examination

UNIT:5

Examination of body fluids

- Examination of cerebro spinal fluid (CSF)
- Semen Analysis

Reference Books

1. Textbook of Medical Laboratory Technology (Vol I & II), Praful B. Godkar, Darshan P. Godkar, Bhalani Publishing House, 3rd Edition, 2014
2. Essentials of Clinical Pathology, Shirish M. Kawthalkar, Jaypee Brothers Medical Publishers, 2nd Edition, 2018
3. Practical Hematology, B. K. Mandal, CBS Publishers & Distributors, 1st Edition, 2019
4. Rodak'sHematology: Clinical Principles and Applications, Elaine M. Keohane, Larry J. Smith, Jeanine M. Walenga, Elsevier Health Sciences, 5th Edition, 2015
5. Clinical Hematology and Fundamentals of Hemostasis, Denise M. Harmening, F.A. Davis Company, 5th Edition, 2009

Course Name: Microbiology-1 **L T P C**
Course Code: 206MI105 **4 0 0 4**

COURSE OBJECTIVE: This course gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Know the different microbiological instruments and chemicals used in laboratory
CO2	Understand the working of various instruments
CO3	Preparation of different culture media
CO4	Identification of different microbes

UNIT: 1

General Microbiology & Bacteriology

a) Microscope: uses, types , parts and maintenance.
b) Sterilization and Disinfection: Principles and use of equipments (Autoclave, Hot air oven and serum inspissator)Pasteurization, Anti septic and disinfectants.
c) Morphology of bacteria: Classification of microorganisms, size, shape and structure of bacteria.
d) Growth and nutrition of bacteria : Nutrition, growth and multiplications of bacteria
e) Culture Media and culture methods: Types , preparation and uses of culture media and culture methods.
f) Biochemical tests and Antibiotic sensitivity test for Identification of bacteria.

UNIT: 2

General Parasitology :

a) General characteristics of parasites
b) classification of parasites.
c) Morphology, life cycle, laboratory diagnosis of following parasites
    i. E. histolytica
    ii. Plasmodium
    iii. Tape worms
    iv. Intestinal nematodes.

UNIT: 3

General Mycology :

a) General characteristics of fungi
b) Classification of fungi.
c) Morphology, diseases caused and lab diagnosis of following fungi.
   i. Candida
   ii. Cryptococcus
   iii. Dermatophytes
   iv. Opportunistic fungi.

UNIT: 4

General Virology :

a) General properties of viruses
b) Classification of viruses
c) Diseases caused, lab diagnosis and prevention of following viruses
   i. Herpes
   ii. Hepatitis
   iii. HIV
   iv. Rabies
   v. Poliomyelitis.

UNIT: 5

General Immunology

a) Infection
b) Immunity
   i. Innate immunity
   ii. 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

Principles and practice Biomedical waste management

a) Causative agents, transmission methods, investigation, prevention and control Hospital infection.
b) Biomedical waste segregation and management.

Reference Books

1. Baveja, C.P. &Baveja, V., *Text & Practical Microbiology*, 3rd Edition, 2022.
2. Sastry, Apurba S. & Bhat, Sandhya, *Essentials of Medical Microbiology*, 3rd Edition, 2021.
3. Ananthanarayan, R. &Paniker, C.K.J., *Textbook of Microbiology*, 12th Edition, 2022.
4. Murray, P.R., Rosenthal, K.S., &Pfaller, M.A., *Medical Microbiology*, 9th Edition, 2020.
5. Jawetz, Melnick, &Adelberg's*Medical Microbiology*, 28th Edition, 2021.

Course Name: Practical for all courses/ clinical posting **L T P C**
Course Code: 206PR106 **0 0 6 6**

List of Practicals Anatomy-1

1. Demonstration of Major organs through models and permanent slides.
2. Demonstration of parts of circulatory system from models.
3. Demonstration of parts of respiratory system from models.
4. Demonstration of digestive system from models.
5. Demonstration of excretory system from models.
6. Demonstration of nervous system from models.
7. Demonstration of various bones
8. Demonstration of various joints

List of Practicals Physiology-1:

1. To measure pulse rate
2. To measure blood pressure
3. To perform Hemoglobin by Sahli's Method
4. To perform Total RBC count.
5. To perform total leucocyte count.
6. To perform differential leucocyte count.
7. To perform PCV
8. To calculate Red cell indices.

List of Practicals Biochemistry-1:

1. To study general laboratory safety rules.
2. To demonstrate glasswares,apparatus and plasticwares used in laboratory.
3. Collection of blood sample
4. To separate serum and plasma.
5. Preparation of normal and molar solutions.(0.1 N NaOH, 0.2N HCl,0.1 M H_2SO_4)
6. Demonstration of photocolorimeter
7. Demonstration of spectrophotometer
8. Demonstration of pH meter

List of Practicals Pathology-1:

1. To learn general laboratory safety rules.
2. To demonstrate glasswares, apparatus and plasticwares used in laboratory.
3. To prepare EDTA, Sod. Citrate & Sod. Fluoride anticoagulants and bulbs/vials used in laboratory.
4. Demonstration of Vaccutainer.
5. To demonstrate method of blood collection.
6. To separate serum and plasma.
7. Demonstration of microscope
8. Preparation of thick and thin smear

List of Practicals Microbiology-1:

1. Inoculation of different culture media
2. Isolation of pure cultures
3. Processing of following clinical samples for culture and identification of bacterial pathogens: Blood, Throat swab, Sputum, Pus, Urine , Stool for Salmonella, Shigella and Vibrio cholerae, C.S.F. and other body fluids
4. Demonstration of PCR
5. Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing
6. Antimicrobial susceptibility testing

Clinical Posting:

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.

SEMESTER-II

Course Name: Human Anatomy-2 **L T P C**
Course Code: 206AN201 **4 0 0 4**

COURSE OBJECTIVE: The syllabus justifiably divides the body systems into two semesters to ensure complete and comprehensive knowledge of all functionalities of the body.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Identify organ and structures in anatomical models
CO2	Apply anatomical concepts in understanding disease conditions
CO3	Correlate anatomical knowledge with laboratory investigations.
CO4	Apply anatomical concepts in diagnostic procedures.

UNIT: 1

Endocrine Glands

- **Theory**:
  - Overview of endocrine glands: Names, locations, and functions.
  - Detailed anatomy of pituitary gland, thyroid gland, parathyroid gland, and suprarenal (adrenal) gland (gross and histology).
  - Hormones and their roles in physiological regulation.
- **Learning Objectives**:
  - Describe the gross and microscopic anatomy of major endocrine glands.
  - Understand the histological basis of hormone production and secretion.
  - Analyse the clinical significance of endocrine gland anatomy in surgical and diagnostic contexts.

UNIT: 2

Reproductive System

- **Male Reproductive System**: Testis, vas deferens, epididymis, prostate (gross anatomy and histology).
- **Female Reproductive System**: Uterus, fallopian tubes, ovary (gross anatomy and histology).
- Mammary Gland: Gross structure and functional anatomy.

UNIT: 3

Endocrine Glands

- Overview of endocrine glands: Names, locations, and functions.
- Detailed anatomy of pituitary gland, thyroid gland, parathyroid gland, and suprarenal (adrenal) gland (gross and histology).
- Hormones and their roles in physiological regulation.

UNIT: 4

Nervous System

- Neuron: Structure and classification.
- Classification of Nervous System: Central (CNS) and Peripheral (PNS).
- CNS: Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord (gross and histology).
- Meninges, Ventricles, and Cerebrospinal Fluid (CSF): Structure and function.
- Basal Nuclei: Names and roles.
- Blood Supply of Brain and Cranial Nerves.
- Sympathetic Trunk and Parasympathetic Ganglia: Overview and naming.

UNIT: 5

Sensory Organs and Embryology

- **Sensory Organs**:
  - **Skin**: Gross anatomy, histology, and appendages (hair, nails, glands).
  - **Eye**: Parts of the eye, lacrimal apparatus, extra-ocular muscles, and nerve supply.
  - **Ear**: External, middle, and inner ear anatomy and contents.
- **Embryology**:
  - Spermatogenesis and Oogenesis: Processes and regulation.
  - Ovulation and Fertilization: Mechanisms and stages.
  - Fetal Circulation: Structure and significance.
  - Placenta: Formation, structure, and function.
  - Understand the embryological processes and their clinical relevance.
  - Evaluate the impact of embryological anomalies on surgical planning.

Reference Books

1. Human Anatomy Regional and Applied Vol. 1, Vol. 2 & Vol. 3, B.D. Chaurasia, C.B.S. Publishers, New Delhi, 9th Edition, 2022.
2. Handbook of General Anatomy, B.D. Chaurasia, C.B.S. Publishers, New Delhi, 9th Edition, 2022.
3. Textbook of Human Histology, Inderbir Singh, Jaypee Brothers, Medical Publishers, Delhi, 7th Edition, 2021.
4. Gray's Anatomy**,** Susan Standring, Elsevier Churchill Livingstone, Edinburgh, 42nd Edition, 2021.
5. Langman's Medical Embryology, T.W. Sadler, Wolters Kluwer, 14th Edition, 2018.

Course Name: Human Physiology -2 **L T P C**
Course Code: 206PY202 **4 0 0 4**

COURSE OBJECTIVE: The prime concern of this syllabus is to integrate basic knowledge of gland, nervous system, reproductive system, sense organs, physiological functions and diseases of system included in syllabus.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Integrate knowledge of different organ systems to understand systemic regulation.
CO2	Analyze physiological data and interpret laboratory reports
CO3	Correlate physiological parameters with laboratory findings
CO4	Correlate physiological principles with common laboratory investigations and diagnostic procedures used in clinical practice.

UNIT: 1

Endocrine glands

- Definition Classification of Endocrine glands & their Hormones Properties of Hormones.
- **Thyroid gland hormone** - Physiological, Anatomy, Hormone scerated, Physiological function, regulation of secretion. Disorders - hypo and hyper secretion of hormone,

- **Adrenal gland:** Adrenal cortex physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones functions and regulation. Adrenal medulla - Hormones, regulation and secretion. Functions of Adrenaline & noradrenaline Pituitary hormones - Anterior and posterior pituitary hormones, secretion, function.
- **Pancreas -** Hormones of pancreas
- **Insulin** - secretion, regulation, function and action
- **Diabetes mellitus** - Regulation of blood glucose level
- **Parathyroid gland**- function, action, regulation of secretion of parathyroid hormone. Calcitonin function and action

UNIT: 2

Nervous System

- Functions of the nervous system.
- Neuron: Structure, classification, and properties.
- Neuroglia: Types and functions.
- Nerve fiber: Classification, continuous and saltatory conduction, velocity of impulse transmission, factors affecting conduction.
- Synapse: Structure, types, and properties.

- Receptors: Definition, classification, and properties.
- Reflex action: Unconditioned reflexes, properties, Babinski's sign.
- Spinal cord: Nerve tracts (ascending and descending tracts, pyramidal and extrapyramidal tracts).
- Functions of medulla, pons, hypothalamus, cerebral cortex (lobes and functions), sensory cortex, motor cortex, cerebellum, and basal ganglia.
- Cerebrospinal Fluid (CSF): Formation, circulation, properties, composition, functions, and lumbar puncture.
- Autonomic Nervous System: Sympathetic and parasympathetic distribution, functions, and comparison.

UNIT: 3

Reproductive System

- Functions of the reproductive system, puberty.
- **Male Reproductive System**:
  - Functions of testes, spermatogenesis (site, stages, factors influencing), semen composition.
  - Endocrine functions: Androgens (testosterone structure and functions).
- **Female Reproductive System**:
  - Ovulation, menstrual cycle, physiological changes during pregnancy, pregnancy test.

Lactation: Composition of milk, factors controlling lactation

UNIT: 4

Special Senses and Skin

- **Special Senses**:
  - Vision: Structure of the eye, functions of different parts, structure of the retina.
  - Hearing: Structure and function of the ear, mechanism of hearing.
  - Taste: Structure and function of taste buds.
  - Smell: Physiology of olfactory receptors.
- **Skin**:
  - Structure and functions of the skin.
  - Body temperature measurement: Physiological variations, regulation of body temperature by physical, chemical, and nervous mechanisms.

  - Role of the hypothalamus in thermoregulation, hypothermia, and fever

UNIT: 5

Muscle-Nerve Physiology

- Classification of muscles.
- Structure of skeletal muscle: Sarcomere, contractile proteins.
- Neuromuscular junction: Transmission across the neuromuscular junction.
- Excitation-contraction coupling.
- Mechanism of muscle contraction, muscle tone, fatigue, rigor mortis.

Reference Books

1. A.K. Jain, *Textbook of Physiology (Volume I & II)*, 9th Edition, 2021.
2. Venkatesh, D. and Sudhakar, H.S., *Basics of Medical Physiology*, Wolters Kluwer Publication, 4th Edition, 2018.
3. Chaudhuri, Sujit K., *Concise Medical Physiology*, New Central Book Agency, 7th Edition, 2016.
4. Guyton and Hall, *Textbook of Medical Physiology*, Elsevier, 14th Edition, 2020.
5. Sembulingam, K. and Sembulingam, P., *Essentials of Medical Physiology*, Jaypee Brothers Medical Publishers, 8th Edition, 2019.

Course Name: Biochemistry-2 **L T P C**
Course Code: 206BC203 **4 0 0 4**

COURSE OBJECTIVE: This paper aims at understanding the chemical properties of the bio molecules, their functions and biomedical importance.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Identify, classify, and demonstrate the proper use of volumetric and non-volumetric laboratory glassware.
CO2	Identify and classify different acids, bases, salts, and indicators and explain their role in laboratory procedures.
CO3	Explain the concept of molar solutions and perform related calculations in laboratory practice
CO4	Calculate molarity using the standard formula.

UNIT: 1

Atomic Structure and Chemical Bonding

- **Atomic Structure**: Dalton's atomic theory, properties of electrons, protons, neutrons, and nucleus; Rutherford's and Bohr's models of atomic structure; orbits and orbitals; quantum numbers; Heisenberg's uncertainty principle; electronic configuration (Aufbau principle, Pauli's exclusion principle).
- **Valency and Bonds**: Types of strong bonds (ionic, covalent, metallic) and weak bonds (hydrogen, van der Waals) with examples; molecular weight, equivalent weight, normality, and molarity concepts.

UNIT: 2

Solution Preparation and Dilution Techniques

- **Solution Preparation**: Preparation of molar solutions (e.g., 1 M NaOH, 0.1 M HCl, 0.15 M NaCl); preparation of normal solutions (e.g., 0.1 N Na2CO3, 0.1 N oxalic acid); percent solutions (v/v, w/v for solids, liquids, and acids); conversion of percent to molar solutions.
- **Dilutions**: Diluting solutions (e.g., 0.1 N NaCl from 1 N NaCl); preparation of working standards from stock standards; body fluid and reagent dilution techniques; calculation of dilution factors.
- **Saturated and Supersaturated Solutions**: Definitions and applications.

UNIT: 3

Acids, Bases, Salts, and Indicators

- **Acids and Bases**: Definitions, physical and chemical properties; Arrhenius and Lowry-Bronsted theories; classification of acids and bases; acidity, basicity, monoprotonic and polyprotonic acids/bases; pH, ionization of water, and buffer solutions.
- **Salts**: Definition, classification, water of crystallization, deliquescent and hygroscopic salts.
- **Indicators**: Mechanism of dissociation, color change in acidic and basic conditions; preparation and application of indicators; pH range of common indicators; universal indicators; titration techniques (e.g., acid-base titration with oxalic acid and NaOH).

UNIT: 4

Acid-Base Balance and Electrolytes

- **Acid-Base Regulation**: Henderson-Hasselbalch equation; buffers in body fluids; pH regulation; disturbances in acid-base balance (metabolic acidosis/alkalosis, respiratory acidosis/alkalosis).
- **Electrolytes**: Principles and estimation of blood gases and electrolytes; water balance, sodium regulation, and bicarbonate buffers.
- **Quality Control**: Accuracy, precision, specificity, sensitivity; allowable limits of error; percentage error; normal values and interpretations.

UNIT: 5

Nutritional Biochemistry and Special Investigations

- **Nutrition**: Calorific value, nitrogen balance, respiratory quotient, basal metabolic rate; dietary fibers; nutritional importance of lipids, carbohydrates, proteins, and vitamins; parenteral nutrition.
- **Special Investigations**: Serum electrophoresis, immunoglobulins, drug analysis (e.g., digitoxin, theophyllines); basic principles of blood gas and electrolyte estimation.
- **Standard Solutions**: Preparation of standard solutions (e.g., glucose, urea); significance of volumetric flasks; preparation of standards for deliquescent compounds (e.g., CaCl2, NaOH).

Reference Books

1. U. Satyanarayana& U. Chakrapani, Essentials of Biochemistry, 4th Edition, 2021.
2. DM Vasudevan&Sukhes Mukherjee, Concise Textbook of Biochemistry for Paramedical Students, 2nd Edition, 2021.
3. PankajaNaik, Essentials of Biochemistry, 6th Edition, 2022.
4. *Lehninger Principles of Biochemistry by David L. Nelson & Michael M. Cox, 8th Edition, 2021.

Course Name: Pathology-2 **L T P C**

Course Code: 206PA204 **4 0 0 4**

COURSE OBJECTIVE: Students will learn about various histotechniques, handling and processing of tissue specimens as well as staining procedures.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the various equipments used in histopathology Laboratory
CO2	Understand the routine working, care and maintanence of microtomes.
CO3	Understand the basic procedures of the Honing and stropping techniques, different types of specimen used in histopathological specimens and collection and processing of Histopathology specimens.
CO4	Understand the proper use and handling of common laboratory equipments used in histopathology laboratory.

UNIT: 1

Introduction to Histopathology

- Overview of histopathology and its role in diagnosis
- Receiving and handling specimens in the laboratory
- Grossing techniques: Principles and procedures
- Maintenance of records and filing of slides
- Biomedical waste management: Segregation, handling, and disposal

UNIT: 2

Tissue Processing and Fixation

- Various fixatives: Types, mode of action, preparation, and indications
- Tissue processing for routine paraffin sections
- Decalcification of tissues: Methods and applications
- Mounting techniques: Types of mountants and their uses
- Care and maintenance of microscopes

UNIT: 3

Section Cutting and Staining

- Principles of section cutting for histopathology
- Hematoxylin and Eosin (H&E) staining: Procedure and significance
- Special staining techniques in histopathology
- Quality control in tissue sectioning and staining
- Safety protocols in histopathology laboratories

UNIT: 4

Blood Banking

- Introduction to blood banking: Importance and scope
- Blood grouping: ABO and Rh systems
- Rh typing: Principles and clinical relevance
- Cross-matching: Techniques and importance in transfusion safety
- Blood bank record-keeping and quality assurance

UNIT: 5

Hematological Techniques

- Reticulocyte count: Procedure and clinical significance
- Calculation of red cell indices: MCV, MCH, MCHC
- Determination of ESR, bleeding time (BT), clotting time (CT), and whole blood clotting time
- Determination of prothrombin time (PT) and partial thromboplastin time (PTT)
- Specialized tests: Osmotic fragility test, sickling test, LE cell preparation, and G-6-PD test

Reference Books

1. Textbook of Medical Laboratory Technology (Vol I & II), Praful B. Godkar, Darshan P. Godkar, Bhalani Publishing House, 3rd Edition, 2014
2. Essentials of Clinical Pathology, Shirish M. Kawthalkar, Jaypee Brothers Medical Publishers, 2nd Edition, 2018
3. Practical Hematology, B. K. Mandal, CBS Publishers & Distributors, 1st Edition, 2019
4. Rodak'sHematology: Clinical Principles and Applications, Elaine M. Keohane, Larry J. Smith, Jeanine M. Walenga, Elsevier Health Sciences, 5th Edition, 2015
5. Clinical Hematology and Fundamentals of Hemostasis, Denise M. Harmening, F.A. Davis Company, 5th Edition, 2009

Course Name: Microbiology-2 **L T P C**
Course Code : 206MI205 **4 0 0 4**

COURSE OBJECTIVE: This course will provide introduction, general characteristics, life cycle and laboratory diagnosis of various medically important viruses.
COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the basic virology procedures as well as to get aware of the recent trends in virology
CO2	Understand about the different staining procedures
CO3	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	Identify the various cells under microscope

UNIT: 1

Introduction to Virology-

a) General properties of virus: Morphology, shape and size.
b) Cultivation of virus: Animal inoculation, egg inoculation and cell culture
c) Nomenclature of viruses: DNA viruses and RNA viruses
d) Virus - host interactions

UNIT: 2

DNA viruses

a) Pox viruses: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.
b) Herpes viruses: Clinical manifestations (e.g., herpes simplex, varicella-zoster), diagnosis, and prevention.
c) Adenoviruses: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.

UNIT: 3

RNA viruses I

a) Picornaviruses: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.
b) Orthomyxovirus: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.
c) Paramyxoviruses: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.
d) Arboviruses: Classification, pathogenesis, morphology, laboratory diagnosis and prevention strategies.
e) Rhabdoviruses: Pathogenesis, morphology, laboratory diagnosis and post exposure prophylaxis

f) Hepatitis viruses: Types, pathogenesis, morphology, laboratory diagnosis, prevention strategies and vaccines
g) Oncogenic viruses: Pathogenesis, morphology, laboratory diagnosis and prevention strategies.

UNIT: 4

RNA viruses II

a) HIV: pathogenesis, morphology andlaboratory diagnosis,
b) Parvovirus: pathogenesis, morphology, laboratory diagnosis, prevention strategies.
c) Viral haemorrhagic fevers: pathogenesis, morphology, laboratory diagnosis, prevention strategies.
d) SARS: pathogenesis, morphology, laboratory diagnosis, prevention strategies and vaccines
e) Rotavirus: pathogenesis, morphology, laboratory diagnosis, prevention strategies and vaccines
f) Norwalk virus: pathogenesis, morphology, laboratory diagnosis, prevention strategies and vaccines
g) Astrovirus: pathogenesis, morphology, laboratory diagnosis, prevention strategies
h) Corona virus: pathogenesis, morphology, laboratory diagnosis, prevention strategies and vaccines

UNIT: 5

Immunology :

a) Immunity Vaccines
b) Types of Vaccine
c) immunization schedule
d) Principles and interpretation of commonly done serological tests namely
   i. Widal,
   ii. VDRL,
   iii. ASLO
   iv. CRP
   v. RF &
   vi. ELISA Rapid tests for HIV and HbsAg (Technical details to be avoided)

Reference Books

1. **Apurba S. Sastry& Sandhya Bhat**. *Essentials of Medical Microbiology*, 3rd Edition. Jaypee Brothers Medical Publishers. (2021)
2. **C.P. Baveja& V. Baveja** *Text & Practical Microbiology*, 3rd Edition. Arya Publications(2022).
3. **Ananthanarayan&Paniker** *Textbook of Microbiology*, 12th Edition. Universities Press(2022).
4. **Girdhar J. Gyani& Alexander Thomas** *Handbook of Healthcare Quality & Patient Safety*, 2nd Edition. Wolters Kluwer. (2017).

		L	T	P	C
Course Name:	Practical for all courses/clinical posting				
Course Code:	206PR206	**0**	**0**	**6**	**6**

List of Practicals Anatomy-2

1. Demonstration of various parts of reproductive system (Male and female from models and charts)
2. To study circulatory system from charts and transverse section (TS) of artery and vein from permanent slides.
3. To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.
4. Study of Urinary system (charts)
5. Study of Genital system (male & female) from charts and TS of testis and ovary from permanent slides.
6. To study nervous system (From models / charts)
7. To study various body fluids.

Note: Demonstrations can be done with the help of models, charts and histological slides

List of Practicals Physiology-2:

To perform total platelet count.

1. To perform bleeding time.
2. To perform clotting time.
3. To study about CSF examination.
4. To study about intrauterine contraceptive devices.
5. To demonstrate microscopic structure of bones with permanent slides.
6. To demonstrate microscopic structure of muscles with permanent slides.

List of Practicals Biochemistry-2:

1. To identify carbohydrates in given solution by various methods.
2. To determine protein by Biuret method.
3. To perform protein test by various methods.
4. Urine sugar determination by Benedict's method.
5. Protein by heat and acetic method
6. Bile salt, Bile pigments and Urobilinogen determination
7. Determination of Ketone bodies
8. Determination of various parameters of urine by urostick method.

List of Practicals Pathology-2:

1. Demonstration of glass wares and equipment used in histopathology lab.
2. To prepare alcohol of different concentration.
3. To prepare formalin from stock solution.
4. Grossing of tissue

5. To perform tissue processing by manual method.
6. To perform section cutting of paraffin embedded tissue.
7. To perform hematoxylin and eosin staining.
8. Mounting and preservation of slide.

List of Practicals Microbiology-2:

1. To perform HBsAg/ Australia Ag by rapid method
2. To perform HBsAg by ELISA
3. To perform HIV Tridot method.
4. To perform HIV by ELISA
5. To perform Dengue IgG/IgM
6. To perform TORCH profile
7. Demonstration of PCR HBV

Clinical Posting:

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.

SEMESTER-III

Course Name: Biochemistry-3	**L**	**T**	**P**	**C**
Course Code: 206BC301	**4**	**0**	**0**	**4**

COURSE OBJECTIVE: This course emphasizes on metabolism, metabolic disorders, laboratory test and instruments used in clinical biochemistry.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the different biomolecules
CO2	Understand the metabolism of different biomolecules
CO3	They study the influence and role of structure in reactivity of biomolecules
CO4	Develop critical thinking about the functioning of biomolecules.

UNIT: 1

Blood Chemistry

- Constituents of blood
- Normal and abnormal chemical composition

Urine Chemistry

- Constituents of urine
- Normal vs abnormal findings

UNIT: 2

Carbohydrates-I

- Introduction of carbohydrate metabolism
- Basics of Metabolism, metabolism of Carbohydrates,
- Glycolysis, bioenergetics,regulation of blood sugar,
- Introduction and significance of gluconeogenesis, glycogenesis, glycogenolysis,
- HMP Pathway, Role of G-6-PD.

UNIT: 3

Carbohydrates -II

- Fate of Pyruvate,
- TCA cycle and its significance,
- Electron transport Chain
- Diabetes, types, clinical features,
- diabetic profile test, HbA1C, GTT,
- Types of sugar, Hyperglycemia and Hypoglycemia,
- Ketone bodies

UNIT: 4

Lipids

- Digestion and absorption of fatty acids,
- Metabolism of fatty acids,
- Beta oxidation of fatty acids,
- Ketone bodies and ketosis,
- Cholesterol, Plasma lipids, Lipoproteins,
- Lipid profile Test, Triglycerides, HDL, VLDL, LDL,
- Risk factors, Hyperlipidemia and Dyslipidemia

UNIT: 5

Enzymes

- Introduction, Activation energy, Classification
- Enzyme activity, Specificity
- Enzyme kinetics: Km, Vmax, Michaelis-Menten equation

Reference Books

1 D.T. **Plummer**, *Introduction to Practical Biochemistry*, Tata McGraw Hill, latest ed. (widely used for practical biochemistry)

2 E.J. **Silva &Maryne**, *Clinical Chemistry in Diagnosis & Treatment*, CRC Press, latest ed.

3 B. **Raghu**, *Practical Biochemistry for Medical Students*, CBS Publishers, latest ed.

4 G. **Raja Gopal & B.D. Toora**, *Practical Biochemistry*, Ahuja Publishing House

Course Name: Pathology-3 **L T P C**

Course Code : 206PA302 **4 0 0 4**

COURSE OBJECTIVE: The students shall learn about various staining procedures for demonstration of different substances & various cytological investigations which include special staining procedures &handling & testing of various cytological specimens.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the basic cytopathology procedures as well as to get aware of the recent trends in cytopathology.
CO2	Understand about the Laboratory Management & cytopathology techniques skills
CO3	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	Understand the need, advantages and recent advances of automation in a cytopathology laboratory

UNIT: 1

Cytology, Automation in cytology, cytogenetics, cytochemistry,immunohematology and Blood transfusion

Cytology

- Normal cell structure, functions, cytologic criteria of malignancy
- Types of specimens, methods of collection & preparation of cell block
- Different fixatives and methods of fixation
- Staining:
  (a) Papanicoloau's stain-principle, preparation and staining techniques
  (b) May Grunwald Giemsa stain
  (c) Shorr's stain
  (d) Acetoorcin stain

UNIT: 2

Female Genital tract

- Anatomy, Histology, Physiology & normal cytology
- Techniques of collection of specimen for cervical cytology study
- Hormonal cytology and cytological indices
- Cervical cytology screening for malignant and non-malignant conditions, Radiation changes & follow up
- Cytology of Endometrium-normal, nonmalignant and in malignant conditions
- Cytology in Ovarian cancers, Respiratory tract, Gastrointestinal tract and Urinary tract

(a) Anatomy, Histology and Physiology .
(b) Collection of sample, preparation of smears and staining
(c) Cytology of normal, nonmalignant & malignant conditions

UNIT: 3

CSF and Effusions

- Cytology of CSF in
  - inflammatory
  - nonmalignant &
  - malignant conditions
- Cytology of effusions in
  - nonmalignant and
  - malignant conditions

UNIT: 4

Glands-Breast, Thyroid, Salivary glands and Lymph nodes

- Anatomy, Histology and Physiology
- Fine needle aspiration cytology of glands and other soft tissue mass
- Cytologic features in nonmalignant and malignant conditions of different glands and nipple discharges

UNIT: 5

Automation in Cytology

- Flow cytometry
- Image Analysis
- Principles, Equipments, procedures & Evaluation
- Automation in Fine Needle Aspiration Cytology (FNA)
- Automated Pap Smear Screening
- Molecular Cytology and Automation
- Challenges and Future Trends in Automation in Cytology

Reference Books

1. Praful B. Godkar, Darshan P. Godkar, Textbook of Medical Laboratory Technology (Vol I & II), Bhalani Publishing House, 3rd Edition, 2014
2. Shirish M. Kawthalkar, Essentials of Clinical Pathology, Jaypee Brothers Medical Publishers, 2nd Edition, 2018

Course Name: Microbiology-3 **L T P C**
Course Code: 206MI303 **4 0 0 4**

COURSE OBJECTIVE: This course will provide introduction, general characteristics, life cycle and laboratory diagnosis of various medically important Fungi and bacteria.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1 Study the basic mycology and bacteria procedures as well as to get aware of the recent trends in mycology and bacteria.

CO2 Understand about the different staining procedures

CO3 Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.

CO4 Differentiate between various types of cells (e.g., bacteria, epithelial cells, RBCs, WBCs).

UNIT: 1

Introduction of Mycology

a) General characteristics and properties of fungi
b) Classification of fungi
c) Lab Diagnosis of Fungal Infections
d) Classification of fungal diseases

UNIT: 2

Superficial & Subcutaneous Mycoses

I. Superficial Mycoses,
   i. Malsezzia furfur: etiology, disease and laboratory diagnosis
   ii. T.nigra: etiology, disease and laboratory diagnosis
   iii. T.pidera: etiology, disease and laboratory diagnosis
   iv. Dermatophytes: etiology, disease and laboratory diagnosis

II. Subcutaneous Mycoses
   i. Mycetoma: etiology, disease and laboratory diagnosis
   ii. Rhinosporidium : etiology, disease and laboratory diagnosis
   iii. Sporotrichosis: etiology, disease and laboratory diagnosis.

UNIT: 3

Systemic Mycoses

i. Histoplasmosis: etiology, disease and laboratory diagnosis.
ii. Blastomycosis: etiology, disease and laboratory diagnosis.
iii. Coccidiodosis: etiology, disease and laboratory diagnosis.
iv. Paracoccidiodosis: etiology, disease and laboratory diagnosis.

UNIT: 4

Opportunistic Fungi

i. Aspergillosis: etiology, disease and laboratory diagnosis.
ii. Penicillosis: etiology, disease and laboratory diagnosis.
iii. Zygomycosis: etiology, disease and laboratory diagnosis.
iv. Pneumocystis: etiology, disease and laboratory diagnosis.
v. Mycotoxins

UNIT: 5

Systematic Bacteriology

Morphology, cultivation, diseases caused, laboratory diagnosis including specimen collection of:

1. Staphyloccci
2. Streptococci
3. Pneumococci
4. Gonococci
5. Menigococci
6. Diphtheriae
7. Mycobacteria
8. Clostridia
9. Bacillus
10. Shigella
11. Salmonella
12. Esch coli
13. Klebsiella
14. Proteus
15. Vibrio cholerae
16. Pseudomonas
17. Spirochetes.
18.

Reference Books

1. **Apurba S. Sastry& Sandhya Bhat** *Essentials of Medical Microbiology*, 3rd Edition. Jaypee Brothers Medical Publishers. (2021).
2. **C.P. Baveja& V. Baveja** *Text & Practical Microbiology*, 3rd Edition. Arya Publications. (2022).
3. **Ananthanarayan&Paniker** *Textbook of Microbiology*, 12th Edition. Universities Press. (2022).
4. **Girdhar J. Gyani& Alexander Thomas** *Handbook of Healthcare Quality & Patient Safety*, 2nd Edition. Wolters Kluwer. (2017).

Course Name: Communication Skills in English **L T P C**
Course Code: 206CS304 **2 0 0 2**

COURSE OBJECTIVE: The students will be able to appreciate communication skills as these are important to everyone - they are how we give and receive information and convey our ideas and opinions with those around us.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Understand and evaluate key theoretical approaches used in the medical lab field .
CO2	Able to find, use, and evaluate primary academic writing associated with the communication discipline
CO3	Able to communicate effectively orally and in writing
CO4	To develop analytical, management and interpersonal skills, together with the technical knowledge of the work in the medical lab.

UNIT: 1

Basics of Grammar and Sentence Structure

1. Narration (Direct & Indirect Speech)
2. Voice (Active & Passive)
3. Nine Basic Sentence Patterns
4. Sentence Transformation (Affirmative, Interrogative, Exclamatory, etc.)
5. Determiners (Articles, Quantifiers, Demonstratives, Possessives)

UNIT: 2

Tenses, Prepositions & Common Errors

1. Tenses (All 12 Tenses)
2. Prepositions (Time, Place, Direction, Cause, etc.)
3. Common Grammar Errors:
    - Nouns, Pronouns
    - Articles, Adverbs
    - Prepositions, Punctuation

UNIT: 3

Modals, Prefixes, Suffixes & Sentence Variety

1. Modals in Conversational Use:
    - Can / Could / Should
    - Will / Would / May / Might
    - Must / Need not / Dare not / Ought to / Used to
2. Prefixes & Suffixes
3. Sentence Types:
    - Assertive, Interrogative, Negative, Imperative, Exclamatory

UNIT: 4

Phrases, Idioms & Phrasal Verbs

1. Common Phrases:
    - At all, instead of, in spite of, as well as, etc.
2. Phrasal Verbs:
    - Set up, upset, look up, call off, come across, set right, etc.
3. Idioms:
    - Work up, break down, turn down, pass away, bring about, etc.

UNIT: 5

Writing Skills

1. Letter Writing:
    - Formal & Informal
2. Paragraph Writing
3. Report Writing

Reference Books

1. **P.C. Wren & H. Martin** *High School English Grammar and Composition*, Revised Edition. S. Chand Publishing. (2017).
2. **S.P. Bakshi** *Objective General English*, Latest Edition. Arihant Publications. (2022).
3. **K.P. Thakur** *English Grammar and Composition*, 1st Edition. Bharati Bhawan Publishers & Distributors. (2016).
4. **K.R. Narayanaswamy***A Practical English Grammar*, Revised Edition. Macmillan India.
5. **S.C. Gupta** (2021).
6. *General English for All Competitive Examinations*, Updated Edition. Arihant Publications. (2018).
7. **Dr. M.P. Bhushan** *Functional English Grammar & Composition*, 2nd Edition. Sultan Chand & Sons. (2015).
8. **N.K. Aggarwala** *Comprehensive Grammar and Composition*, Revised Edition. Sultan Chand Publications. (2014).

List of Practicals Biochemistry-3:

1. To determine the presence of carbohydrates by Molisch test.
2. To determine the presence of reducing sugar by Fehling solutions
3. To determine the presence of reducing sugar by Benedicts method.
4. To determine starch by Iodine test.
5. Determination of Glucose in serum & plasma
6. Estimates of blood Glucose by Folin& Wu method
7. Determination of Urea in serum, plasma & urine.
8. Determination of Creatinine in serum or plasma
9. Determination of serum Albumin
10. Determination of Cholesterol in serum or plasma

List of Practicals Pathology-3:

1. To perform Papnicolaou‘s stain on cervical smear
2. To perform Guard‘s staining for demonstration sex chromatin (Barr bodies on a buccal smear)
3. To perform Shorr‘s staining for Hormonal assessment
4. To cut frozen sections of Gynaec tissue
5. To perform CSF sample and body fluids by cytospin
6. Should know the various stains used in Cytology lab:‖ May Grunwald Giemsa, H&E, PAS, Grocott‘s.

List of Practicals Microbiology-3:

1. To prepare culture media used routinely in mycology
2. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.
3. To identify given yeast culture by performing various identification techniques studied in theory.
4. To identify given mould culture by performing various identification techniques studied in theory.
5. To demonstrate dimorphism in fungi
6. . To collect and process clinical samples for laboratory diagnosis of fungal infections i.e. Skin Nail Hair Body fluids and secretions
7. To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria: • Catalase • Coagulase • Indole • Methyl Red (MR) • VogesProskauer (VP) • Urease • Citrate • Oxidase • TSIA • Nitrate reduction • Carbohydrate fermentation • Huge and Leifson • Bile solubility • H2S production • Demonstration and motility • Decarboxylases • CAMP • Hippurate hydrolysis • Nagler‘s

reaction

8. To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples i.e. • Staphylococcus • Streptococcus • Corynebacterium • Escherichia coli • Klebsiella • Citrobacter • Enterobacter • Proteus • Salmonella • Shigella

Clinical Posting:

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.

SEMESTER-IV

Course Name: Biochemistry-4 | **L** | **T** | **P** | **C**
Course Code: 206BC401 | **4** | **0** | **0** | **4**

COURSE OBJECTIVE: This course emphasizes on metabolism, metabolic disorders, laboratory test and instruments used in Clinical Biochemistry.

COURSE OUTCOMES: On completion of this course, the students will be able to :

CO1	Study the different biophysics
CO2	Understand the different Instrumentation technique.
CO3	They study the influence and role of structure in reactivity of Non-Protein Nitrogenous Compounds
CO4	Develop critical thinking about the functioning of Special Investigations.

UNIT: 1

Biophysics

- Surface tension
- Osmolality
- Viscosity

UNIT: 2

Instrumentation Techniques

- Photometry
- Spectrometry
- Turbidometry
- Flame photometry
- Atomic absorption spectroscopy

UNIT: 3

Non-Protein Nitrogenous Compounds (NPN)

- Estimation and significance of urea, uric acid, and creatinine
- Clinical relevance of NPN in diagnosis

UNIT: 4

Nutrition

- Nutritional components: Carbohydrates, proteins, fats, vitamins
- Balanced diet and its role in health
- Nutritional deficiencies and biochemical implications

UNIT: 5

Special Investigations

- Serum electrophoresis
- Immunoglobulins
- Drug estimation and clinical applications

Reference Books

1D.T. Plummer, *Introduction to Practical Biochemistry*, Tata McGraw Hill

2 E.J. Silva &Maryne, *Clinical Chemistry in Diagnosis & Treatment*, CRC Press

3 B. Raghu, *Practical Biochemistry for Medical Students*, CBS Publishers

4 Dr. Raja Gopal & B.D. Toora, *Practical Biochemistry*, Ahuja Publishing House

5 Wootton I.D.P. & Freeman H., *Microanalysis in Medical Biochemistry*, Churchill Livingstone

Course Name: Pathology-4 | **L** | **T** | **P** | **C**
Course Code: 206PA402 | **4** | **0** | **0** | **4**

COURSE OBJECTIVE: Students will learn various staining methods, special staining techniques, handling and examination of cytological specimens in pathology laboratory.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the basic cytopathology procedures as well as to get aware of the recent trends in cytopathology.
CO2	Understand about the laboratory Management & cytopathology techniques skills
CO3	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	Understand the need, advantages and recent advances of automation in a cytopathology laboratory

UNIT: 1

Introduction to Histopathology

- Overview of histopathology and its role in diagnosis
- Receiving and handling specimens in the laboratory
- Grossing techniques: Principles and procedures
- Maintenance of records and filing of slides
- Biomedical waste management: Segregation, handling, and disposal

UNIT: 2

Tissue Processing and Fixation

- Various fixatives: Types, mode of action, preparation, and indications
- Tissue processing for routine paraffin sections
- Decalcification of tissues: Methods and applications
- Mounting techniques: Types of mountants and their uses
- Care and maintenance of microscopes

UNIT: 3

Section Cutting and Staining

- Principles of section cutting for histopathology
- Hematoxylin and Eosin (H&E) staining: Procedure and significance
- Special staining techniques in histopathology
- Quality control in tissue sectioning and staining
- Safety protocols in histopathology laboratories

UNIT: 4

Blood Banking

- Introduction to blood banking: Importance and scope
- Blood grouping: ABO and Rh systems
- Rh typing: Principles and clinical relevance
- Cross-matching: Techniques and importance in transfusion safety
- Blood bank record-keeping and quality assurance

UNIT: 5

Hematological Techniques

- Reticulocyte count: Procedure and clinical significance
- Calculation of red cell indices: MCV, MCH, MCHC
- Determination of ESR, bleeding time (BT), clotting time (CT), and whole blood clotting time
- Determination of prothrombin time (PT) and partial thromboplastin time (PTT)
- Specialized tests: Osmotic fragility test, sickling test, LE cell preparation, and G-6-PD test

Reference Books

1. Bancroft, J. D., & Gamble, M. (2020). *Theory and Practice of Histological Techniques* (8th ed.). Elsevier.
2. Harmening, D. M. (2018). *Modern Blood Banking & Transfusion Practices* (7th ed.). F.A. Davis Company.
3. Turgeon, M. L. (2020). *Clinical Hematology: Theory and Procedures* (7th ed.). Wolters Kluwer.
4. Carson, F. L., &Hladik, C. (2019). *Histotechnology: A Self-Instructional Text* (5th ed.). ASCP Press.

Course Name: Microbiology-4 **L T P C**
Course Code: 206MI403 **4 0 0 4**

COURSE OBJECTIVE: This course will provide introduction, general characteristics, life cycle and laboratory diagnosis of various medically important Fungi and bacteria.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Prepare culture media for bacterial and fungal growth.
CO2	Perform staining techniques such as gram staining and fungal staining.
CO3	Demonstrate proper handling and processing of microbiological samples in the laboratory.
CO4	Use laboratory equipment correctly for microbiological investigations.

UNIT: 1

Introduction to parasites

a) General characteristics and properties of parasites
b) Classification of parasites
c) Lab Diagnosis of parasitic Infections

UNIT: 2

Protozology

i. **Entamoeba histolytica:** morphology, pathogenesis, life cycle and laboratory diagnosis.
ii. **Balantidium coll :** morphology, pathogenesis, life cycle and laboratory diagnosis.
iii. **Giardia:** morphology, pathogenesis, life cycle and laboratory diagnosis.
iv. **Toxoplasma:** morphology, pathogenesis, life cycle and laboratory diagnosis.
v. **Malana:** morphology, pathogenesis, life cycle and laboratory diagnosis.
vi. **Leishmania:** morphology, pathogenesis, life cycle and laboratory diagnosis.

UNIT: 3

Helminthology

I. Cestodes
- i. **Tenia** morphology, pathogenesis, life cycle and laboratory diagnosis.
- ii. **Echinococcus** morphology, pathogenesis, life cycle and laboratory diagnosis.
- iii. **D latum,** morphology, pathogenesis, life cycle and laboratory diagnosis.
- iv. **H.nana** morphology, pathogenesis, life cycle and laboratory diagnosis.

II. Trematodos-

i. **Schistosoma** morphology, pathogenesis, life cycle and laboratory diagnosis.
ii. **Fasciola** morphology, pathogenesis, life cycle and laboratory diagnosis.

III. Nematodes

i. **Ascaris,** morphology, pathogenesis, life cycle and laboratory diagnosis.
ii. **hookworm,** morphology, pathogenesis, life cycle and laboratory diagnosis.
iii. **Strongyloides,** morphology, pathogenesis, life cycle and laboratory diagnosis.
iv. **Trichuris,** morphology, pathogenesis, life cycle and laboratory diagnosis.
v. **Trichinella,** morphology, pathogenesis, life cycle and laboratory diagnosis.
vi. **Dracunculus,** morphology, pathogenesis, life cycle and laboratory diagnosis.

IV. Filarial worms

UNIT: 4

The immune system

a) Dual nature of the immune system.

i. Humoral immunity
   a) Antigen types
   b) Antigen sensitization
   c) Plasma cells

ii. Cell-mediated immunity
   a) Cell development
   b) B lymphocytes(general knowledge of their role)
      I. Bursa of Fabricius
      II. Stem cell differentiation
      III. Gut-associated lymphoid tissue (GALT)
   c) T lymphocytes
      I. Stem cell differentiation (general knowledge of their role)
      II. Cytotoxic T (TC) cells
      III. Delayed-type hypersensitivity T (TD) cells
      IV. Helper T (TH) cells
      V. Suppressor T (TS) cells

iii. Natural killer cell

UNIT: 5

General properties of immune responses

1. Recognition of self versus non-self
   a. Clonal selection theory B-cells
   b. Tolerance
   c. Clonal deletion
2. Specificity
   a. Definition
3. Heterogeneity

Reference Books

1. **Apurba S. Sastry& Sandhya Bhat** (2021). *Essentials of Medical Microbiology*, 3rd Edition. Jaypee Brothers Medical Publishers.
2. **C.P. Baveja& V. Baveja** (2022). *Text & Practical Microbiology*, 3rd Edition. Arya Publications.
3. **Ananthanarayan&Paniker** (2022). *Textbook of Microbiology*, 12th Edition. Universities Press.
4. **Girdhar J. Gyani& Alexander Thomas** (2017). *Handbook of Healthcare Quality & Patient Safety*, 2nd Edition. Wolters Kluwer.

COURSE OBJECTIVE: The students will be able to appreciate the role of computer technology. The course focuses on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and Power Point presentation.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Students shall have knowledge about the basic hardware system of computer and laptop.
CO2	Learners shall able to use Microsoft office
CO3	They shall be able to install and use various software.
CO4	Learners shall be able to get clerical and data entry jobs

UNIT: 1

Computer Fundamentals and Organization

- - Introduction to Computer Applications
- - Characteristics of Computers
- - Input, Output, Storage Units, and CPU
- - Types of Computer Systems
- - Central Processing Unit
- - Main Memory (RAM & ROM)
- - Memory Organization and Capacity
- - Storage Evaluation Criteria

UNIT: 2

Input, Output and Storage Devices

- - Input Devices: Keyboard, Mouse, Scanner, Card Reader
- - Output Devices: Monitors, Dot Matrix, Inkjet, Laser Printers, Multimedia Projector
- - Secondary Storage Devices: Floppy, Hard Disk, CD-ROM, USB Drives, Memory Cards

UNIT: 3

Computer Software and Operating Systems

- - Computer Software: Relationship between Hardware and Software, Applications of Computers
- - Operating Systems Overview: Microsoft Windows, File Management
- - Overview of Other Operating Systems
- - Using Windows Accessories: Disk Cleanup, Calculator, Paint, Notepad, WordPad, Explorer, Recycle Bin

UNIT: 4

Word Processing (MS Word)

- - Word Processing Concepts
- - Creating, Opening, Saving & Closing Documents
- - Editing, Finding & Replacing Text
- - Printing & Mail Merge
- - Formatting Text and Pages
- - Editing & Proofing Tools, Macros
- - Handling Graphics, Tables, Charts
- - Document Templates and Wizards

UNIT: 5

Presentation Package (MS PowerPoint)

- - Creating, Opening, and Saving Presentations
- - Designing the Look of the Presentation
- - Working in Different Views, Managing Slides
- - Adding and Formatting Text & Paragraphs
- - Spelling Check and Correction
- - Creating Notes Pages and Handouts
- - Drawing and Working with Objects
- - Adding Clip Art and Pictures
- - Designing and Running Slide Shows
- - Printing Presentations

Reference Books

1. -V. Rajaraman Fundamentals of Computers, 6th Edition. PHI Learning. (2013).
2. P.K. Sinha & P. Sinha x Computer Fundamentals, 6th Edition. BPB Publications
3. Satish Jain x MS Office 2016 Training Guide. BPB Publications. (2013).
4. Sanjay Saxena A First Course in Computers. Vikas Publishing House. (2019).
5. Ramesh Bangia Learning Computer Fundamentals and MS Office. Laxmi Publications(2016).
6. Krishna Kumar Computer Applications in Business. Himalaya Publishing House. (2021).

List of Practicals Biochemistry-4:

1. To demonstrate the principle, working & maintenance of spectrophotometer.
2. To demonstrate the principle, working & maintenance of colorimeter.
3. To demonstrate the principle, working & maintenance of flame photometer.
4. To demonstrate the principle, procedure of paper chromatography.
5. To demonstrate the principle & procedure of Gas chromatography.
6. To demonstrate the principle & demonstration of TLC.
7. To demonstrate the principle & procedure of column chromatography.
8. To demonstrate the principle & procedure of Electrophoresis

List of Practicals Pathology-4:

1. Demonstration of instruments used for dissection
2. Use of antiseptics, disinfectants and insecticides in a tissue culture processing laboratory
3. Reception and labeling of histological specimens
4. Preparation of various fixatives Helly‘s fluid Zenker‘s fluid Bouin‘s fluid Corney‘s fluid 10% Neutral formalin Formal saline Formal acetic acid Pereyn‘s fluid
5. Testing of melting point of paraffin wax and perform embedding of given tissue in paraffin block
6. To process a bone for decalcification
7. To prepare ascending and descending grades of alcohol from absolute alcohol
8. Processing of tissue by manual and automated processor method
9. To demonstrate various part and types of microtome
10. To learn sharpening of microtome knife (Honing and stropping technique), and types of disposable blades in use (High and Low Profile).
11. To perform section cutting (Rough and Fine)
12. To practice attachment of tissue sections to glass slides
13. To learn using tissue floatation bath and drying of sections in oven (60-65C)
14. To perform & practice the Haematoxylin and Eosin staining technique
15. To perform & practice the Mallory‘s Phospho tungstic Acid Haematoxylin (PTAH)

List of Practicals Microbiology-4:

1. Routine stool examination for detection of intestinal parasites with concentration methods: Saline preparation , Iodine preparation , Floatation method , Centrifugation method ,Formal ether method & Zinc sulphate method

2. Identification of adult worms from models/slides: Tapeworm, Tapeworm segments, Ascaris (Round worm), Hookworms, Pinworms

3. Malarial parasite: Preparation of thin and thick smears Staining of smears Examination of smears for malarial parasites (P. vivax and P. falciparum)

4. To prepare culture media used routinely in mycology

5. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.
6. To identify given yeast culture by performing various identification techniques studied in theory.
7. To identify given mould culture by performing various identification techniques studied in theory.
8. To demonstrate dimorphism in fungi 6. To collect and process clinical samples for laboratory diagnosis of fungal infections i.e. Skin Nail Hair Body fluids and secretions

Clinical Posting:

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.

SEMESTER-V

Course Name: Biochemistry- 5 **L T P C**
Course Code: 206BC501 **4 0 0 4**

COURSE OBJECTIVE: This course emphasizes on metabolism, metabolic disorders, laboratory test and instruments used in clinical biochemistry.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry.
CO2	Understand the routine biochemical investigations like uric acid, sugar, thyroid
CO3	Understanding the basic requirements for the biochemical investigations including different biological specimens, their collection and processing of biochemical estimations and have brief knowledge of preparation of solutions and different types of assays
CO4	Identification of test results

UNIT: 1

Liver Function Tests (LFTs)

- Role of the liver in metabolism
- Formation and excretion of bilirubin
- Tests for liver function

UNIT: 2

Gastric Analysis

- Composition of gastric juice
- Free and bound acids
- Gastric acid secretion and stimulation tests

UNIT: 3

Renal Function Tests (RFTs) and Calculi

- Renal clearance tests
- Theory of renal stone formation
- Phenolsulfonphthalein test

UNIT: 4

Acid-Base Balance

- Acid-base disturbances: Metabolic and respiratory acidosis/alkalosis
- Buffer systems and compensation

UNIT: 5

Inorganic Ions and Electrolyte Balance

- Calcium and phosphate metabolism
- Sodium-potassium balance
- Trace elements: Iron, Copper, etc.

Reference Books

1 D.M. Vasudevan, *Textbook of Medical Biochemistry*, 6th ed., Jaypee

2 M.N. Chatterjea& Rana Shinde, *Textbook of Medical Biochemistry*, 8th ed., Jaypee

3 Singh &Sahni, *Introductory Practical Biochemistry*, 2nd ed., Alpha Science

4 Lininger, *Principles of Biochemistry*, 6th ed., W.H. Freeman

5 U. Satya Narayana, *Essentials of Biochemistry*, 2nd ed., Standard Publishers

6 Teitz, *Fundamentals of Clinical Chemistry*, 6th ed., Elsevier

Course Name: Pathology-5 **L T P C**

Course Code: 206PA502 **4 0 0 4**

COURSE OBJECTIVE: The students will be able to perform advanced cytological and histopathological techniques and interpret laboratory findings for accurate reporting.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Analyze cytological and histopathological specimens using advanced laboratory techniques.
CO2	Perform quality control and maintain accuracy in pathology laboratory procedures.
CO3	Interpret microscopic findings in cytology and histopathology.
CO4	Follow standard laboratory protocols for processing and reporting pathological specimens.

UNIT: 1

Instrumentation:

- Automated Tissue Processor
- Microtome, Knives, Knife sharpeners and Ultra microtome
- Tissue floatation water bath, paraffin dispenser
- Block wax trimmer, slide warmer
- Freezing microtome and Cryostat
- Automatic slide stainer

UNIT: 2

Techniques:

- Routine paraffin section cutting - Importance, procedure, applications, advantages and disadvantages.
- Frozen section- Importance, procedure, applications, advantages and disadvantages.
- Cryostat section studies- Importance, procedure, applications, advantages and disadvantages.
- Types of cryostat

UNIT: 3

Staining techniques:

- Procedure, advantages and disadvantages of Special stains for
  i. Carbohydrates,
  ii. Connective tissue,
  iii. Nervous tissue,
  iv. Bone tissue,
  v. Collage fibers,
  vi. Elastic Fibers,
  vii. Lipids,
  viii. Organisms,
  ix. fungi,
  x. parasites,
  xi. pigments and deposits in tissues
- Mounting techniques: Various mounts and mounting techniques

UNIT: 4

Microscope

- Microscope and its parts
- maintenance and cleaning of microscope
- compound microscope
- phase contrast microscope
- Scanning electron microscope
- Dark ground and Fluorescent microscope

UNIT: 5

Museum technology

- Microphotography and its applications
- Maintenance of records and filing of slides
- ICDS Classification and coding
- Application of computers in Pathology

Reference Books

1. Bancroft, J. D., & Gamble, M. (2020). *Theory and Practice of Histological Techniques* (8th ed.). Elsevier.
2. Harmening, D. M. (2018). *Modern Blood Banking & Transfusion Practices* (7th ed.). F.A. Davis Company.
3. Turgeon, M. L. (2020). *Clinical Hematology: Theory and Procedures* (7th ed.). Wolters Kluwer.
4. Carson, F. L., &Hladik, C. (2019). *Histotechnology: A Self-Instructional Text* (5th ed.). ASCP Press.

Course Name: Microbiology-5 **L T P C**

Course Code: 206MI503 **4 0 0 4**

COURSE OBJECTIVE: This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It shall also cover medically important fungi, infections caused by them and their laboratory diagnosis.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the history, introduction and types of antigens and immunoglobulins.
CO2	Understand about the different types immune response, basic concepts of Humoral and cellular immune response.
CO3	Apply the knowledge to understand the types ,vaccination and brief knowledge about vaccination.
CO4	Analyze the Principles, Procedures and interpretation of various serological tests

UNIT: 1

Antigen & Antibody

a) Antigens
   i. Epitopes (antigenic determinants)
   ii. Hapten
b) Antibodies
   i. Properties of Antibodies (immunoglobulins)
      1. Light Chains
      2. Heavy Chains
      3. Constant and variable regions
      4. Antigen binding sites
      5. Fab and Fc regions
      6. Consequences of antibody binding
   ii. Classes of immunoglobulins
      1. IgG
      2. IgM
      3. IgA -
         - J chain
         - Secretory piece
      4. IgE
      5. IgD
      6. Antibody titer

UNIT:2

Immune Response

a) Primary and secondary responses
   1. Primary response
   2. Secondary response

b) Kinds of antigen-antibody responses

c) How humoral responses eliminate foreign antigens-Basic mechanisms
   - Agglutination
   - Opsonization
   - Activation of complement
   - Neutralization
   - Summary of humoral immunity

d) Cell-Mediated Immunity
   A. General characteristics
   B. The cell-mediated immune reactions
      1. Antigen processing
      2. Helper T (TH) cells
         a. TH1 cells (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

UNIT: 3

Monoclonal Antibodies

a) Production
   I. Hybridoma formation
   II. Cloning of cells

b) Uses
   I. Research tools
   II. Diagnostic uses
   III. Therapy

UNIT: 4

Factors That Modify Immune Responses

A. Compromised host

B. Modifying factors

1. Age
2. Stress
3. Diet
4. Exercise
5. Injuries
6. Environmental factors

UNIT: 5

Applied immunology

1. Hypersensitivity reactions -Types of hypersensivity , diagnosis of hypersensitivity
2. Autoimmune disorders and its types
3. Transplantation immunology
4. Graft v/s host reactions

Practical's

1. Immunology and Serological tests: Specimen collection, preservation and transportation.
2. Principles and methods of various sereological tests.
3. Normal values/Significant titer, sensitivity and specificity of different serological test.
4. Interpretations and reporting of different test results.
5. Limitations of all the following tests
    1.Widal
    2. ASO
    3.CRP
    4. RPR/VDRL/TRUST
    5. RA
    6. HBsAg /anti HIV detection
    7. ELISA

Reference Books

1. **Apurba S. Sastry& Sandhya Bhat** *Essentials of Medical Microbiology*, 3rd Edition. Jaypee Brothers Medical Publishers. (2021).
2. **C.P. Baveja& V. Baveja** *Text & Practical Microbiology*, 3rd Edition. Arya Publications. (2022).
3. **Ananthanarayan&Paniker** *Textbook of Microbiology*, 12th Edition. Universities Press. (2022).
4. **Girdhar J. Gyani& Alexander Thomas** *Handbook of Healthcare Quality & Patient Safety*, 2nd Edition. Wolters Kluwer (2017).

Course Name:	Environmental Studies	**L**	**T**	**P**	**C**
Course Code:	206ES504	**3**	**0**	**0**	**3**

COURSE OBJECTIVE: The student will be made aware of the environment in general, natural resources, ecosystems, environmental pollution, and social issues related to environment, human population and the environment and understanding the hospital environment.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the intellectual and methodological tools to understand and address the crucial current environmental issues.
CO2	Understand and create environmental ethics and raise people's awareness of the importance of environmental protection and biodiversity
CO3	Apply the knowledge to understand the the impact of individuals, society on significant environmental issues.
CO4	Understanding of proper use of skills and analytical tools needed to face the environmental issues

UNIT: 1

General Introduction

- Biotic and abiotic environment
- Adverse effects of environmental pollution
- Pollution control strategies
- Overview of environmental acts and regulations

UNIT: 2

Water Pollution

- Water quality standards for potable water
- Surface and underground water sources
- Impurities in water and their removal
- Defluoridation techniques
- Effects of domestic wastewater and industrial effluents
- Eutrophication of lakes
- Self-purification of streams

UNIT: 3

Air Pollution

- Sources of air contaminants
- Effects on human health
- Measurement of air quality and permissible limits
- Air pollution control measures
- Greenhouse effect and global warming
- Acid rain and ozone depletion

UNIT: 4

Bio-Medical and Solid Waste Management

- Types and introduction to biomedical waste
- Collection, treatment, and safe disposal
- Solid waste: definition, collection, and disposal
- Resource recovery, sanitary landfilling, vermicomposting
- Hazardous waste management

UNIT: 5

Ecology and Social Issues

- Soil conservation, land erosion, afforestation
- Basics of species, biodiversity, population, ecosystems
- Sustainable development and environmental ethics
- Urban energy-related problems
- Resettlement, rehabilitation, consumerism
- Waste products and non-conventional energy sources
- Solar, wind, biomass, hydrogen energy
- Water harvesting, rural sanitation, bio-gas
- Community awareness and participation

Reference Books

1. Erach Bharucha *Environmental Studies for Undergraduate Courses*. University Grants Commission, New Delhi. (2005).
2. Kaushik & Kaushik *Perspectives in Environmental Studies*, 6th Edition. New Age International Publishers. (2021).
3. R.C. Sharma & Gurbir Sangha *Environmental Studies*. Kalyani Publishers. (2020).
4. Anubha Kaushik & C.P. Kaushik *Environmental Science & Engineering*. New Age International. (2023).
5. De A.K. *Environmental Chemistry*, 9th Edition. New Age International. (2018).
6. Agarwal, K.C. *Environmental Biology*. Nidhi Publishers(2022).

List of Practicals Biochemistry-5:

1. Estimation of Glucose tolerance test (GTT).
2. Estimation of Insulin tolerance test (ITT).
3. Determination of Uric acid in Urine.
4. Determination of Creatinine clearance.
5. Determination of Urea clearance.
6. Determination of Serum acid phosphatase.
7. Determination of Serum Alkaline phosphatase.
8. Determination of Serum Lactate dehydrogenase.
9. Determination of T3, T4 and TSH

List of Practicals Pathology-5:

1. Preparation of 10% Neutral Buffered Formalin
2. Demonstration of Tissue Fixation Techniques
3. Manual Tissue Processing (Dehydration, Clearing, Infiltration)
4. Use of Automatic Tissue Processor (if available)
5. Paraffin Embedding and Block Preparation
6. Section Cutting Using Rotary Microtome
7. Honing and Stropping of Microtome Knives
8. Floatation and Lifting of Paraffin Sections onto Slides
9. Routine Staining – Hematoxylin & Eosin (H&E)
10. Special Stains:
    a. Periodic Acid Schiff (PAS) Staining
    b. Ziehl-Neelsen (ZN) Staining for AFB
    c. Masson's Trichrome Staining
    d. Reticulin Staining

List of Practicals Microbiology-5:

1. Immunology and Serological tests: Specimen collection, preservation and transportation.
2. Principles and methods of various sereological tests.
3. Normal values/Significant titer, sensitivity and specificity of different serological test.
4. Interpretations and reporting of different test results.
5. Limitations of all the following tests
    1.Widal
    2. ASO
    3.CRP
    4. RPR/VDRL/TRUST
    5. RA
    6. HBsAg /anti HIV detection
    7. ELISA

Clinical Posting:

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.

SEMESTER-VI

Course Name: Biochemistry-6 **L T P C**
Course Code: 206BC601 **4 0 0 4**

COURSE OBJECTIVE: The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This course gives information about various clinically important enzymes & automation techniques.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry.
CO2	Understand about the Laboratory Management and Biochemical techniques skills
CO3	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	Understand the need, advantages and recent advances of automation in a Clinical biochemistry laboratory

UNIT: 1

Protein and Amino Acid Metabolism

- Pathways of protein and amino acid metabolism
- Metabolic disorders associated with proteins and amino acids
- Inborn errors of metabolism (e.g., PKU, alkaptonuria)

UNIT: 2

Molecular Biology & Genetic Engineering

- Overview of replication, transcription, and translation
- Genetic code, mRNA processing
- Basics of genetic engineering: vectors, recombinant DNA, applications

UNIT: 3

Clinical Enzymology

- Diagnostic enzymology
- Role of enzymes in various disease states (e.g., myocardial infarction, hepatitis)
- Interpretation of enzyme activity profiles

UNIT: 4

Radioisotope Techniques and Immunoassays

- Radioactive isotopes: Units, standards, and measurements
- Crystal counting, safety, and applications
- Immunoassay types: RIA, ELISA – principles and clinical relevance

UNIT: 5

Biostatistics

- Population mean, correlation coefficient
- Standard deviation, standard error
- Data analysis and interpretation in clinical biochemistry

Reference Books

1. Text book of Medical Laboratory Technology by P.B. Godkar.
2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
4. Biochemistry, U. Satyanarayan& U. Chakrapani.
5. Text book of Medical Biochemistry by Chaterjee & Shinde.
6. Principal of Biochemistry by Lehninger
7. Biochemistry by Voe t& Voet 8. Biochemistry by Stryer

Course Name: Pathology-6 **L T P C**
Course Code: 206PA602 **4 0 0 4**

COURSE OBJECTIVE: The students shall learn about the concept to blood grouping, compatibility testing in blood transfusion & screening of donated blood for various infectious diseases. Genetics shall make students learn about Fundamentals of heredity. The students shall learn about the concept of inheritance in various genetic diseases.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Study the introduction and development of ABO antigens and antibodies and genetic concepts
CO2	Understand about the different types of anticoagulants used in Blood banking and various types of methods and Procedures used in Crossmatching. And study related to mendels law and chromosomes
CO3	Apply the knowledge to understand the Various types of Blood group systems like ABO Blood group systems and RH blood group systems.
CO4	Apply the knowledge to understand the Various types of Blood group systems like ABO Blood group systems and RH blood group systems.

UNIT: 1

Tissue culture and Immuno-histochemistry

- Equipments for Tissue culture studies
  (a) Laminar air flow equipment
  (b) Carbon dioxide incubator
  (c) Inverted microscope
- 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
- Characterization of cell lines
  (a) Determination of biochemical markers in cells
  (b) Chromosomal & DNA content of cells
  (c) Immunological properties of cells
- Preservation of Immortalized cell lines
  (a) Storage in Glycerol in Liquid Nitrogen
  (b) Storage in Dimethyl sulfoxide in Liquid Nitrogen

UNIT: 2

Cytogenetics

- Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes

- Methods of karyotypic analysis
  (a) Culture of bone marrow.cells peripheral blood lymphocytes, solid tumors & skin fibroblasts
  (b) Direct preparation from tumor matenals
- Characterization of human chromosomes by various banding techniques
- Sex chromatin identification
- Chromosomes in neoplasia and oncogenes

UNIT: 3

Immunocytochemistry

- Basic conceptsof immunocytohcemistry,
- monoclonal antibodies & preparation
- florescent antibodies
- Florescence reaction

UNIT: 4

Immunohematology and Blood transfusion

- A, B and H antigens
- ABO Blood group - slide and tube blood grouping methods
- Rh system- tube blood grouping method
- Gel card method
- microtube method
- Subgroups of A and B Other blood groups and Bombay group
- HLA antigens and their significance

UNIT: 5

Principles of Blood transfusion

- Blood donor selection
- Methods of bleeding donors
- Blood containers, anticoagulants and storage of blood
- Coomb's test and its significance
- Screening of blood for transfusion transmitted diseases
- Blood components, preparation & component therapy

- Autologous transfusion
- Transfusion reactions and work up
- Blood bank organization, standards, procedures, techniques quality control & record keeping

Reference Books

1. Bancroft, J. D., & Gamble, M. (2020). *Theory and Practice of Histological Techniques* (8th ed.). Elsevier.
2. Harmening, D. M. (2018). *Modern Blood Banking & Transfusion Practices* (7th ed.). F.A. Davis Company
3. Medical laboratory manual for tropical Countries Vol l&l

Course Name:	Microbiology-6	**L T P C**
Course Code:	206MI603	**4 0 0 4**

COURSE OBJECTIVE: This course shall provide introduction, general characteristics, life cycle and laboratory diagnosis of various medically important bacteria.

COURSE OUTCOMES: On completion of this course, the students shall be able to :

CO1	Describe the general characteristics and classification of medically important bacteria.
CO2	Explain the life cycle and growth pattern of different bacteria.
CO3	Perform laboratory methods for identification and diagnosis of bacterial infections.
CO4	Interpret laboratory findings related to medically important bacteria.

UNIT: 1

Gram Positive Bacteria

i. Staphyloccus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ii. Streptococcus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iii. Pneumococcus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iv. Corynebacteria: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

v. Clostridia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

vi. Bacillus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

vii. Listeria: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

viii Actinomyces: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ix. Nocardia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

UNIT: 2

Gram Negative Bacteria

i. Neisseria: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ii. Enterobacteriaceae: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iii. Escherichia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iv. Klebsiella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

v. Enterobacter: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

vi. Proteus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

vii. Salmonella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

viii. Shigella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ix. Yersinia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

x. Pseudomonas: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xi. Haemophilus: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xii. Brucella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xiii. Pasturella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xiv. Legionella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xv. Bordetella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xvi. Burkholderia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xvii. Gardnerella: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xviii. Vibrio: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xix. Campylobacter: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xx. Helicobacter: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xxi. Bacteroides: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

xxii, Fusobacterium: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

UNIT: 3

Spirocheates

i. Treponema: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ii. Borrelia: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iii. Leptospira: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

UNIT: 4

Mycobacteria and other important bacteria

a) **Mycobacteria**

i. M.tuberculosis: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

ii. M.leprae: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

iii. Atypical Mycobacteria: Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

b) **Mycoplasma:** Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

c) **Chalmyadiae:** Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

d) **Ricketssiaceae:** Classification, morphology, genotypic & phenotypic characteristics, pathogenesis and disease caused.

UNIT: 5

Applied and environmental Bacteriology

a) Molecular techniques in diagnostic microbiology-PCR, DNA hybridisation
b) Bacteriology of Water Milk and Air
c) Air culture
d) water culture
e) Biomedical waste management.

Desirable to know: (There will be no main questions or short notes from this portion. One paper may have only one question under short answers)

1. Erysipelothrix
2. Propionibacteria
3. Rhodococcus
4. Tropheryma
5. Moraxella
6. Serratia
7. Stenotrophomonas
8. Acinetobacter
9. Streptobacillus
10. Parvobacteria

Reference Books

1. **Apurba S. Sastry& Sandhya Bhat** (2021). *Essentials of Medical Microbiology*, 3rd Edition. Jaypee Brothers Medical Publishers.
2. **C.P. Baveja& V. Baveja** (2022). *Text & Practical Microbiology*, 3rd Edition. Arya Publications.
3. **Ananthanarayan&Paniker** (2022). *Textbook of Microbiology*, 12th Edition. Universities Press.
4. **Girdhar J. Gyani& Alexander Thomas** (2017). *Handbook of Healthcare Quality & Patient Safety*, 2nd Edition. Wolters Kluwer.

Course Name:	Entrepreneurship & Professional Management	**L**	**T**	**P**	**C**
Course Code:	206EPM604	**3**	**0**	**0**	**3**

COURSE OBJECTIVE: Legal and ethical considerations are firmly believed to be an integral part of medical-practice in planning patient care. Advances in medical science, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

COURSE OUTCOMES: On completion of this course, the students will be able to :

CO1	Learn the basic terminology of course
CO2	Understand about different legal principles governing the doctor-patient relationship
CO3	Evaluate ethical and legal dilemmas faced by medical practitioners
CO4	Develop understanding of legal arguments on complex and contentious medico-legal issues

UNIT: 1

Foundations of Entrepreneurship

- Definition, need, scope, and characteristics of entrepreneurship
- Women entrepreneurship
- Support from national organizations: SIDO, NSIC, NRDC, KVIC
- Support from state organizations: DOI, DIG, RTC, SISI, RHDC, Pollution Control Board, Rajasthan Khadi & Village Industries
- Facilities for women entrepreneurs
- Innovation, creativity, and introduction to IPRs & patents
- Role of National Knowledge Commission

UNIT: 2

Project Planning & Emerging Trends

- Planning steps for small enterprises
- Project report structure and sample analysis
- Techno-economic feasibility
- Introduction to energy auditing
- Opportunities in service sector

UNIT: 3

Legal & Financial Framework

- Financial sources: State Govt., RFC, Banks
- Licensing and registration procedures
- Key provisions:
    - Factory Act
    - Shop & Establishment Act
    - Sales of Goods Act
    - Partnership Act
    - VAT, Service Tax, Professional Tax, Income Tax
    - Sales Tax, Excise Rules
    - Municipal bylaws, insurance coverage

UNIT: 4

Business Management & Quality Control

- Profession, trade, industry: Definitions and objectives
- Types of business organizations
- Small business characteristics and ethics
- Management techniques: Leadership, functions, authority/responsibility
- Quality control: Importance, deviation causes
- ISO standards (9000–9006), Total Quality Management (TQM)

UNIT: 5

Marketing, Human Relations & Foreign Trade

- Basics of marketing: Promotion, branding, packaging, pricing
- Advertisement media and sales forecasting
- Sales promotion, salesmanship, after-sales service
- Motivation, interpersonal relations, grievance handling
- Staffing, training, and monitoring
- Export procedures, distribution channels, export promotion
- Registration with RBI, AEPC, and others

Reference Books

1. C.B. Gupta & N.P. Srinivasan (2023). *Entrepreneurship Development in India*. Sultan Chand & Sons.
2. Vasant Desai (2021). *Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House.
3. S.S. Khanka (2022). *Entrepreneurial Development*. S. Chand Publishing.
4. P. Saravanavel (2020). *Entrepreneurship Development*. Ess Pee Kay Publishing House.
5. R.K. Sharma & Shashi K. Gupta (2022). *Principles of Management*. Kalyani Publishers.

6. B. Janakiraman (2021). *Total Quality Management*. Lakshmi Publications.
7. Philip Kotler (2023). *Principles of Marketing*. Pearson India.

Course Name:	Practical for all courses/clinical posting	**L**	**T**	**P**	**C**
Course Code:	206PR605	**0**	**0**	**6**	**6**

List of Practicals Biochemistry-6:

1. Peripheral blood mononuclear cell (PBMC) isolation by gradient centrifugation
2. T and B cell separation
3. Immunofluorescence Anti- Nuclear Antibody (ANA) Anti- Neutrophil Cytoplasmic Antibody (ANCA)
4. AIDS Immunology and Pathogenesis (AIP)
5. Thyroid Microsomal antigen (TMA)- Agglutination reactions
6. Electrophoresis
7. Gel diffusion
8. Nephlometery
9. HLA Typing Serology & Cross match Molecular Typing
10. Nitro blue Tetrazolium Chloride Test (NBT)
11. FACS for CD4 and CD8 12. ELISA for lab. diagnosis of AIDS
12. Polymerase Chain Reaction and its advanced versions
13. Gel electrophoresis
14. Western blotting
15. Isolation of DNA and RNA
16. Estimation of DNA and RNA
17. Determination of molecular weight and quantification of DNA using agarose gel electrophoresis

List of Practicals Pathology-6:

1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions
2. Screening of blood donor: physical examination including medical history of the donor
3. Collection and preservation of blood for transfusion purpose
4. Screening of blood for Malaria, Microfilaria, HBs Ag, Syphilis and HIV
5. To determine the ABO & Rh grouping Direct or preliminary grouping Indirect or proof grouping Rh grouping and determination of Du in case of Rh negative
6. To perform Direct and Indirect Coomb'stest
7. To perform cross matching Major cross matching Minor cross matching
8. Preparation of various fractions of blood

List of Practicals Microbiology-6:

1. Inoculation of different culture media
2. Isolation of pure cultures
3. Processing of following clinical samples for culture and identification of bacterial pathogens: Blood Throatswab Sputum Pus Urine Stool for Salmonella, Shigella and Vibrio cholerae C.S.F. and other body fluids
4. Demonstration of PCR

5. Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing
6. Antimicrobial susceptibility testing Introduction and terms used Preparation and standardization of inoculum To demonstrate reference bacterial strains To determine MIC and MBC of known bacteria against a known antibiotic To perform antibiotic susceptibility testing of clinical isolates by using Stokes method Kirby-Bauer method
7. Collection, transportation and processing of following articles for bacteriological examination: Water Milk Food and Air
8. To demonstrate sterility testing of intravenous fluid with positive and negative controls
9. Demonstration of serotyping and bacteriocin typing
10. Demonstration of lyophilization and other available preservation methods

Clinical Posting:

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.