GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University)

VISAKHAPATNAM*HYDERABAD*BENGALURU

Accredited by NAAC with A^{++}Grade

REGULATIONSANDSYLLABUSOF

B.Sc. Medical Lab Technology

(w.e.f.2024-25 admitted batch)

B.Sc. MEDICAL LAB TECHNOLOGY

(Effective from 2024-25 admitted batch)

ADMISSIONS

Admissions into B.Sc. Paramedical (Specialization in Medical Lab Technology) program of GITAM (Deemed to be University) are governed by GITAM (Deemed to be University) admission regulations.

ELIGIBILITY CRITERIA

Eligibility:

- He/She has passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian University or a duly constituted Board with pass marks (50%) in Physics, Chemistry, Biology.
- He/She has attained the age of 17 years as on current year & maximum age limit is 30 years.
- For the candidates who have studied abroad, the rules of GITAM (deemed to be University) will be followed.

ABOUT THE COURSE:

Our Four years Bachelor of Science in Medical Laboratory Technology (MLT) PROGRAM, called Clinical Laboratory Science, educates students with the knowledge and skills necessary to diagnose, treat, and prevent disease using clinical laboratory tests. Students receive training in recognizing, identifying, and treating various ailments. Additionally, they learn how to gather the necessary data, take samples, test them, and write an appropriate, in-depth report for any investigation. The PROGRAM is very career-oriented and provides many options for students who want to pursue it as a professional choice in the future.

COURSE ADMINISTRATION

The course is delivered in 8 semesters with each semester dealing with prescribed subjects.

- All subjects are mandatory for the student. The student is trained in both theory and practical/clinical aspects of the course. Student is assessed by formative and summative assessment every semester.
- There will be one internal exam before the semester –end exam. Candidates should score A minimum of 35% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- A candidate shall be declared to have passed in the concerned subject ,if he/she fulfills the Following criteria

- He/ She secured 35% marks in the internal assessment and
- (a) He/ She secured 40% marks in theory
  (b)50% marks in practical & viva
  (c) 50% marks in theory, practical & viva put together in each subject separately.

STRUCTURE OF THE PROGRAM

The Program consists of

i. Foundation Course (FC)
ii. Core Courses -Compulsory(C)

Each academic year consists of two semesters. The curriculum structure of the BSC Paramedical program and the contents for various courses offered are recommended by the Board of Studies concerned and approved by the Academic Council.

MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English. The method of instruction shall comprise classroom lectures, guest lectures, demonstrations, presentations, role-playgroup discussions, seminars, class tests, case analysis, situational analysis, practical training, etc.

ATTENDANCE REQUIREMENTS

- A candidate must have not less than 75% attendance in theory and 80% in practicals separately.

ELIGIBILITY TO APPEAR FOR SEMESTER EXAMINATION

- Candidates should score a minimum of 40% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- There will be one internal exam before the semester- end exam.
- Internal marks will be considered for eligibility for the semester exam but will not be added for the semester exam.

EXAMINATION DURATION AND PATTERN

a. Pattern of question paper (60 Marks): 2 ½ hrs duration

Short notes	**6Marks each (5Q)**	**=**	**30Marks**
Very Short Notes	**2Marks each (10Q)**	**=**	**20Marks**
MCQs	**1Mark each (10Q)**	**=**	**10 Marks**

Subjects:

- Biochemistry

- Microbiology
- Pathology
- General Surgery
- Principles of Laboratory management (For B.Sc. MLT)
- Parent Depts.

b. Pattern of question paper (40 Marks) : 2 hrs duration

Short notes	**4Marks each (5Q)**	**=**	**20Marks**
Very Short Notes	**2Marks each (10Q)**	**=**	**20 Marks**

Subjects:

- Introduction to Healthcare Delivery System, Research Methodology & Biostatistics
- Introduction to Quality and patient safety
- Basic Computers and Information Science
- English, Communication and soft skills
- Professionalism & Values
- Principles of management (For B.Sc. Anesthesiology Technology, Optometry, Radiology and Imaging Technology, Renal Dialysis Technology, Emergency Medical Technology)
- Medical Law & Ethics
- Pharmacology
- General Medicine

c. Pattern of question paper (60 Marks [30 + 30]): 2 ½ hrs duration.

Short notes	**3Marks each (5Q)**	**= 15 Marks**
Very Short Notes	**2Marks each (5Q)**	**= 10 Marks**
MCQs	**1Mark each (5Q)**	**= 05 Marks**

Subjects:

Anatomy-I (Part-A) & Physiology-I (Part-B)

Anatomy-II (Part-A) & Physiology-II (Part-B)

PAPER SETTING

Paper setting, paper valuation and practical examination is done by internal examiners from the I to VII semesters.

CRITERIA FOR EXAMINER

Professor or Associate Professor or Assistant Professor are eligible to be as examiners.

GRACE MARKS

Maximum 5 marks can be awarded to one subject provided he/she passed all the other subjects or these 5

marks can be split for maximum 2 subjects.

PASS CRITERIA

A candidate shall be declared to have passed the examination if he/ she secured…

(a) 40% marks in theory.
(b) 50% marks in practical & viva
(c) 50% marks in theory, practical & viva put together in each subject separately.

EVALUATION:
Single valuation is done for the theory exams and for the practical exams.

REVALUATION:
Revaluation of the theory answer scripts of the end-semester examinations is also permitted on request, on payment of the prescribed fee within seven days from the date of announcement of the results.

REAPPEARANCE FOR BACKLOGS :
A student who has secured 'F' grade shall have to reappear for the examination as per the regulations to improve the grade.

A student who has secured 'F' grade in Project work / Industrial Training etc., has to re-appear for Viva – Voce to improve the grade.

ANSWER SCRIPT VERIFICATION & CHALLENGE VALUATION:

A provision for Answer Book Verification & Challenge Valuation was given on the following conditions.

- The verification is allowed only after announcement of revaluation results in case of UG programs.
- If the student is not satisfied with the marks awarded in revaluation, he/she can apply for Answer Book verification on payment of prescribed fee for each paper (Program) within one week after announcement of Revaluation results.
- If the student is not satisfied with the marks awarded after Answer Script Verification (i.e. Revaluation marks), he/she can apply for Challenge Valuation on payment of prescribed fee for each paper (Program) within two weeks from the date of Answer Book Verification.

ASSESSMENT GUIDELINES

RELATIVE GRADING

S.No.	Grade	Description	Grade Formula	Grades based on percentile for a normal distribution	Grade Point
1.	O	Outstanding	Total Marks≥(μ+ 1.5σ)	93.3	10
2.	A+	Excellent	(μ+ 1.0σ)≤Total Marks<(μ+1.5 σ)	84.1	9
3.	A	Very Good	(μ+0.5 σ)≤ Total Marks<(μ+ 1.0 σ)	69.1	8
4.	B+	Good	(μ-0.5σ) ≤Total Marks<(μ+0.5σ)	30.8	7

5.	B	Above Average	(μ- 1.0 σ) ≤Total Marks<(μ- 0.5σ)	15.8	6
6.	C	Average	(μ- 1.5σ)≤Total Marks<(μ-1.0σ)	6.6	5
7.	P	Pass	40≤Total Marks<(μ- 1.5 σ)	2.2	4
8.	F	Fail	Total Marks <40	0	0
9.	Ab	Absent			NA
10.	S	Satisfactory for Non-graded courses			NA
11.	U	Unsatisfactory for Non-graded courses			NA
12.	R	Insufficient attendance in the course			0
13.	W	Withdrawal from the course			0

In the relative grading system (RG), grades are given based on the other students' scores in the same class. It indicates the academic standing/merit of the student in that class. Here, class means a cohort of students who are taught by the same faculty member and have undergone the same assessment pattern. RG overcomes problems encountered with AG, including inconsistency in the level of the question paper and evaluation etc. This evaluation procedure is adopted for T (Theory), TP (Theory and practical) and certain chosen practical courses. The grades and grade points in the relative grading system are as given below. The class average mark (μ) is taken as the midpoint of 'B+ (Good)' grade, and relative to this and depending on the sigma (σ, standard deviation) value, the other grades are finalized. Grades are assigned based on the percentiles determined for a normal distribution given in the table below.

Computing Grade point averages (SGPA,CGPA)

The procedure adopted for computing the grade point average for the semester and cumulative is as follows:

Semester Grade point average(SGPA)for a semester is calculated as:

$$\text{SGPA} = \frac{\sum_{i=1}^{n} Ci * Gi}{\sum_{i=1}^{n} Ci}$$

where 'n' is the number of courses taken by the student in a semester. 'Ci' represents the number of credits allotted to the course 'i'.

'Gi' represents the grade points secured by the student in course 'i'.

Cumulative Grade Point Average (CGPA):It is calculated as:

$$\text{CGPA} = \frac{\sum_{i=1}^{m} Ci * Gi}{\sum_{i=1}^{m} Ci}$$

where 'm' is the number of courses graded to date.

'Ci' represents the number of credits allotted to the course 'i'.

'Gi' represents the grade points secured by the student in course 'i'.

The SGPA will be awarded to the students for all the registered courses in a semester. The credits of the failed courses shall also be considered while calculating SGPA/CGPA in a given semester. For cases where multiple attempts have been made to get a letter grade, the last successful attempt will be used for the CGPA calculation.

The additional credits earned by a student over and above the minimum required for a said category in a program will not be considered for the calculation of CGPA. However the courses which contribute towards higher CGPA will be considered for inclusion.

Calculation of CGPA

The CGPA shall be calculated taking into consideration the grades of courses obtained by the candidates in GITAM. In the case of Study Abroad, Twinning, Joint or Dual Degree Programs, the CGPA will be calculated according to the respective policy applicable and prevailing at the time of joining the program.

Incomplete (I) Grade

'I' grade is assigned if the student has any pending assessment components in Internship, Project and research. The student can initiate the request through the Mentor, and an 'I' grade will be posted after receiving the recommendation from the HoD.

Repeat (R) grade

'R' grade is assigned if the student has to repeat the course due to a shortage of attendance. The student has to re-register for the course in the subsequent semesters when the course is next offered by paying the prescribed fees.

Withdrawal (W) grade

'W' grade is assigned if the student has withdrawn from the course within twenty (20) working days of the semester.

Award of class

The cumulative grade point requirement for the award of the class is as follows:

Class	CGPA required
First-class with distinction	7.5 and above
First-class	6.00 - 7.49
Second class	≥ 5.5
Pass class	≥ 5.0

*In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the registered courses in the first attempt. Distinction will not be awarded if the student fails in ANY subject.

Transcript Format

Based on the above recommendation on letter grades, grade points, SPGA and CGPA, the transcript shall be issued for each semester with a consolidated transcript indicating the performance in all semesters.

VISION:

To become a leader of excellence in healthcare and health professions' education pioneering in experiential learning, redefining compassion, service and self-reliance to produce and nurture the next generation of visionary healthcare professionals

MISSION:

1. Develop a need-oriented learning ecosystem promoting critical thinking and holistic development
2. Offer evidence-based healthcare training at par with global standards
3. Encourage autonomy and innovation for healthcare delivery to achieve atma-nirbhar
4. Inculcate a philosophy of empathetic healthcare service within GITAM, fostering passionate health professionals.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To impart knowledge and skill in accordance with the requirement in basic medical sciences and paramedical specialty as relevant.
PEO2	To impart training required to carry out necessary investigative procedures accurately to facilitate proper diagnosis and prognosis of diseases.
PEO3	To train the student to perform routine as well as special investigative procedures in the concerned paramedical specialty.
PEO4	To impart knowledge and practical training required to operate and maintain all equipment used in the concerned specialization.
PEO5	To impart knowledge about communication skills, basic research skills, professionalism, and ethical aspects required in various health care settings for effective delivery of health care.

PROGRAM OUTCOMES (POs)

PO1	To prepare a cadre of health care technologists who can effectively assist senior health professionals in the delivery of quality health services.
PO2	To prepares killed paramedical human resources for all levels of the health care delivery system from primary to tertiary cadre level.
PO3	To train the students to carryout necessary procedures accurately and to facilitate proper diagnosis and prognosis of diseases.

PO4	To enable to perform routine as well as special investigative procedures in the concerned paramedical specialty.
PO5	To develop knowledge and skill in accordance with the demand in the field of Paramedical specialty as applicable.
PO6	To enable to operate and maintain all types of equipment used in the concerned Specialization.
PO7	To be capable to support advanced testing activities and Research.
PO8	ToenabletoworkasSupervisor/Trainer/TeacherinthefieldofParamedical Sciences.
PO9	Toenabletocommunicateandinteracteffectivelywithnon-clinicalandclinical persons in various health care environments.
PO10	To be able to present oneself in an ethical and professional manner.
PO11	To equip the paramedical staff with modern skills and knowledge to bring them at par with other national and international standards.
PO12	Students who complete these programs will be able to work in both an individual and team environment.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of course, the students will be able to:

PSO-1	Perform routine clinical laboratory testing.
PSO-2	Make specimen-oriented decisions on predetermined criteria including working knowledge of critical values
PSO-3	Communicate with other members of healthcare team, customers, and patients in an effective manner.
PSO-4	Process information and ensure quality control as appropriate to routine laboratory procedures
PSO-5	Train students in routine laboratory procedure.
PSO-6	Upgrade knowledge and skills in a changing healthcare scenario.
PSO-7	Should know the logical interpretation of clinical lab investigations.
PSO-8	Should be able to extrapolate data acquired. Should be able to work on automated machine.

SUBJECTS FOR SEMESTER EXAMS WITH HOURS AND CREDITS

B.Sc. Medical Lab Technology									
Semester - I									
Sl. No.	Subject Code	Subject	**Hours**			**Credits**			**Course Type**
			Theory	Practical/ Clinical	Total	Theory	Practical/ Clinical	Total	
1	24CMED1001	Introduction to Healthcare Delivery System in India, Community orientation and clinical visit, Research Methodology & Biostatistics	15	-	15	1	-	1	FC
2	24PSGY1001	Anatomy-I (Part-A)	30	15	45	2	0.5	2.5	C
		Physiology-I (Part-B)	45	15	60	3	0.5	3.5	C
3	24MIBG1001	Introduction to Quality and patient safety (including Basic emergency care and life support skills, Infection prevention and control, Biomedical waste management, Disaster management and Antibiotic resistance)	60	60	120	4	-	4	FC
4	24CSEN1071	Basic Computers and Information Science	15	30	45	1	-	1	FC
5	LANG1281	English, Communication and soft skills	30	-	30	2	-	2	FC
6	24CMED1011	Professionalism & Values	15	-	15	1	-	1	FC
7	24BCHE1031	Principles of Laboratory Management	15	195	210	1	6.5	7.5	FC
Total			**225**	**315**	**540**	**15**	**7.5**	**22.5**	
Semester – II									
1	24PSGY2001	Anatomy-II (Part-A)	30	15	45	2	0.5	2.5	C
		Physiology – II (Part-B)	45	15	60	3	0.5	3.5	C
2	24BCHE1001	Basic Clinical Biochemistry	30	120	150	2	4	6	C
3	24FMED1001	Medical Law and Ethics	15	0	15	1	0	1	FC
4	24MIBG1011	General Medical Microbiology	30	105	135	2	3.5	5.5	C

5	24PATH1001	Basic Haematology	30	105	135	2	3.5	5.5	C
Total			**180**	**360**	**540**	**12**	**12**	**24**	
Semester – III									
1	24NURS1001	Basics of Patient Care	30	15	45	2	0.5	2.5	FC
2	24MIBG1021	Systematic Bacteriology	30	105	135	2	3.5	5.5	C
3	24PATH1011	Basics of Haematological diseases	30	90	120	2	3	5	C
4	24BCHE1011	Biochemical metabolism	30	90	120	2	3	5	C
5	24PATH1021	Fundamentals of Histology	30	90	120	2	3	5	C
Total			**150**	**390**	**540**	**10**	**13**	**23**	
Semester – IV									
1	24MIBG2001	Applied Bacteriology	30	105	135	2	3.5	5.5	C
2	24PATH2001	Applied Haematology – I	30	105	135	2	3.5	5.5	C
3	24BCHE2001	Analytical Clinical Biochemistry	30	105	135	2	3.5	5.5	C
4	24PATH2011	Applied Histopathology – I	30	105	135	2	3.5	5.5	C
		Total	**120**	**420**	**540**	**8**	**14**	**22**	
Semester – V									
1	24MIBG3001	Immunology & Bacterial serology	30	105	135	2	3.5	5.5	C
2	24PATH3001	Applied Haematology – II	30	105	135	2	3.5	5.5	C
3	24BCHE2011	Applied Clinical Biochemistry – I	30	105	135	2	3.5	5.5	C
4	24PATH3011	Applied Histopathology - II	30	105	135	2	3.5	5.5	C
Total			**120**	**420**	**540**	**8**	**14**	**22**	
Semester – VI									
1	24MIBG3011	Medical Parasitology & Entomology	30	105	135	2	3.5	5.5	C
2	24PATH3021	Advanced Haematology	30	105	135	2	3.5	5.5	C
3	24BCHE3001	Applied Clinical Biochemistry – II	30	105	135	2	3.5	5.5	C
4	24PATH3031	Cytopathology	30	105	135	2	3.5	5.5	C
		Total	120	420	540	8	14	22	
Semester – VII									
1	24MIBG3021	Medical Mycology and Virology	30	120	150	2	4	6	**C**
2	24PATH3041	Blood Banking	30	90	120	2	3	5	**C**
3	24PATH3051	Immunopathology & Molecular Biology	60	210	270	4	7	11	**C**
		Total	120	420	540	8	14	22	
Semester-VIII									
1		MLS Internship		540					

SEMESTER – I

INTRODUCTION TO HEALTHCARE DELIVERY SYSTEM, RESEARCH METHODOLOGY & BIOSTATISTICS

INTRODUCTION:

The art and science of application of technical knowledge and skills to the delivery of health care to given community, designed in collaboration with related professionals as well as human and social science on one hand and the community on the other hand. Preventive medicine is science and art of preventing disease, prolonging life and promoting physical and mental health and efficacy.

COURSEOBJECTIVES:

- To orient the students with national health programs
- To learn categories and coding of hospital waste and their disposal methods.
- To know various occupational health hazards and prevention and control of them.
- To make the students aware of tabulation of data, measuring mean and SD

SYLLABUS

Hours: Theory 15

Credits: Theory 01

UNIT	CONTENT	No. OF HOURS
I	**Introduction to healthcare delivery system** a) Healthcare delivery system in India at primary, secondary and tertiary care, Principles and Elements of Primary Health Care b) National Health Mission c) National Health Policy 2017	3
II	**National Health Program:** Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programs. **Introduction to AYUSH system of medicine and Need for integration of various systems of medicine**	3
III	**Demography & Vital Statistics:** a) Demography – its concept b) Vital events of life & its impact on demography c) Significance and recording of vital statistics	5

	d) Census & its impact on health policy **Epidemiology:** a. Principles of Epidemiology b. Natural History of disease c. Methods of Epidemiological Studies **d.** Infectious disease epidemiology - dynamics of disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.	
IV	**Research Methodology:** 1. Introduction to research methods 2. Identifying research problem 3. Ethical issues in research 4. Research design 5. Basic Concepts of Biostatistics 6. Types of Data 7. Research tools and Data collection methods 8. Sampling methods 9. Developing a research proposal	**3**
V	**Biostatistics** The objective of this is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.	**1**

COURSE OUTCOMES:

This course is aimed to make the student to understand national health programs, hospital waste management, occupational health hazards prevention and control of occupational diseases and calculation of measures of central tendency and diagrammatic representation of data.

REFERENCES:

- Park's Textbook of Preventive and Social Medicine – 26th edition
- Statistics and Research: Mahajan

ANATOMY – I

INTRODUCTION:

Anatomy deals with the structural organization of the human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to providing quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides, and VARIOUS models provide the ideal environment to learn anatomy during the 1st year of their course.

COURSE OBJECTIVES:

- The objective of this subject is to provide an outline of anatomy to improve the students understanding of the technical and diagnostic procedures used, with special emphasis on applied aspects.

SYLLABUS

Hours: Theory: 30 & Credits: 2

Practical: 15 & Credits: 0.5

Theory:

UNIT	CONTENT	No. OF HOURS
I	**Introduction to anatomical terms and organization of the human body** 1.Undertanding the anatomical terms relative to position–anterior, ventral, posterior dorsal, superior, inferior, median, lateral, proximal, distal, superficial, deep, prone, supine, palmar and plantar Anatomical planes (axial/ transverse/horizontal, sagittal/vertical plane and coronal/frontal/oblique plane) 2.Describe the Movements (flexion, extension, abduction, adduction, medial rotation, lateral rotation, inversion, eversion, supination, pronation, plantar flexion, dorsal flexion and circumduction 3. Describe the Cell structure, Cell division, 4.Define the Tissue and classify various types, characteristics, classification, location 5. Describe the location of Hyaline cartilage ,fibrocartilage, elastic cartilage, 6.Describe the Histology of Bone, 7. Describe the Features of skeletal, smooth and cardiac muscle.	5

II	The Respiratory system 1. Describe the Structure of the organs of respiration. 2. Describe the morphology of Pleura, 3. Describe the Morphology of Lungs, Bronchopulmonary Segments. 4. Histology of Lungs	5
III	Cardiovascular system 1. Describe the Morphology of Heart, Internal features of Heart – right atrium and right ventricle Chambers & Openings of the heart, 2. 2.Classify Types of Circulation and understand Coronary Circulation in detail 3. Describe Aorta its parts and its branches.	8
IV	Muscular system types of muscles 1. Describe Muscles of Upper Limb including Arm and Fore Arm, 2. Describe Muscles of back, diaphragm, Muscles of arm, Muscles of Forearm 3. Understand the Significance of Deltoid Muscle, 4. Describe the Muscles of Lower Limb, Muscles of thigh, Muscles of Leg 5. Understand the significance of Gluteus Maximus Muscle.	5
V	1. Describe the Blood vessels of Upper Limb : Arm- Axillary artery, brachialartery 2. Describe arteries of fore Arm - Radial artery, ulnar Artery, medial cubital vein, 3. Describe the Blood vessels of Lower Limb : Thigh femoral artery, popliteal artery	7

Practical:

UNIT	CONTENT	No. OF HOURS
I	Microscopy, Histology of tissues – cartilage, Bone and Lung	2
II	Intercostal space, Heart, Lungs	3
III	Upper Limb – Bones, Muscles, Axillary artery, brachial artery, fore Arm - Radial artery, ulnar Artery, medial cubital vein, Nerves : Axillaries Nerve , Median Nerve, Ulnar Nerve, radial Nerve	4
IV	Lower Limb – Bones, Muscles, Thigh femoral artery, popliteal artery Nerves of Lower Limb: Femoral Nerve, Sciatic Nerve, Obturator Nerve	4

V	Normal X- Rays, Surface markings	2

COURSE OUTCOMES:

- Explains knowledge on the basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuroanatomy, endocrine system, basic radiology which provides a foundation in completion of the course.
- Explain the anatomy and functions of various Tissues and cells, an organization of a cellular system.
- Understand the functioning of lungs, heart, and blood vessels.

REFERENCES:

1. BD Chaurasia : Handbook of general anatomy
2. Textbook of Anatomy & Physiology by InduKhurana & Arushi
3. Textbook of Anatomy & Physiology by PR Ashalatha & G Deepa
4. Textbook of Anatomy & Physiology by Ashalatha N Nandedkar, Vijay D Joshi & Sadhana – 3rd edition

PHYSIOLOGY-I

INTRODUCTION:

Physiology is the study of functions and mechanisms in a living system. Physiology focuses on individual organs, cells, and bio molecules carrying out the chemical and physical functions in a living system. The physiological state is the condition of normal function, while the pathological state refers to abnormal conditions, including human diseases.

COURSE OBJECTIVE

- Understand the basic physiological functions of different organs and parts of the human body and important applied aspects.

SYLLABUS

Credits: Theory 03 & Practical 0.5

Hours: Theory 45 & Practical 15

No. OF UNITS	CONTENT	No. OF HOURS
I	Cell Physiology 1. Describe the structure and functions of cell 2. Describe the functions of the cell organelles 3. Describe briefly the types of transport across cell membrane and carrier systems.	05
II	Blood Physiology and Immunology 1. Describe the normal composition of human blood and its functions 2. Describe the normal plasma proteins & their functions 3. Describe the structure and functions of RBC and hemoglobin 4. Describe the process of Erythropoiesis 5. Describe the Structure, production, & functions of WBCs 6. Describe the structure, production & functions of Platelets 7. Describe the Types of blood groups and their importance, 8. Describe the Mechanism of coagulation 9. Define immunity and describe the types of immunity 10. Classify antigen & antibodies 11. Describe T cell immunity & B cell immunity	12
III	Muscle & Nerve Physiology; ANS 1. Describe the physiological structure of muscle tissue and its types	08

	2. Describe the parts of neuron and their functions, and the synapse and its function 3. Describe the action potential, its basis, refractory period, latent period, etc. and neuromuscular transmission 4. Describe briefly the autonomic nervous system and the functions and effects of the sympathetic and parasympathetic nervous systems	
IV	Digestive System 1. Describe briefly the Physiological anatomy of G.I.T and its functions. 2. Describe briefly the composition and functions of Saliva 3. Describe briefly the physiological anatomy of the stomach and the composition, functions of gastric juice. 4. Describe briefly the functions of pancreas, and the composition & functions of pancreatic juice. 5. Describe briefly the functions of liver and gall bladder and the Composition, and functions of bile juice**.**	08
V	Respiratory System 1. Describe the physiological structure and functions of Respiratory tract. 2. Describe the Mechanics of respiration and its regulation 3. Describe the Fundamentals of oxygen and CO2 transport in blood 4. Describe the lung volumes, spirometry & their importance	12
PRACTICAL		
No. OF UNITS	**CONTENT**	**No. OF HOURS**
I	Estimate Hemoglobin in given blood sample, Estimate bleeding time & clotting time	04
II	Perform RBC count of given blood sample	02
III	Perform WBC count of given blood sample Perform a differential WBC count of the given sample	04
IV	Calculation of blood indices, Determination of Blood Groups	03
V	Amphibian Nerve muscle charts	02

COURSE OUTCOMES:

- Explain the anatomy, physiology and functions of various Tissues and cell, organization of

cellular system.

- Explain Hematopoietic and lymphatic system homeostatic and its altered physiology.
- Explain the anatomy and Physiology of the cardiovascular and respiratory system and its disorders.
- Explain the anatomy and Physiology of digestive, urinary, and reproductive systems and their disorders.
- Describe the Physiology of muscle contraction and its disorders.

REFERENCES:

- Textbook of physiology for BDS AK Jain 6th edition
- Textbook of physiology for BDS Sembulingam 3rd edition
- Physiology in nutshell by AK Jain 5th edition

INTRODUCTION TO QUALITY AND PATIENT SAFETY

SYLLABUS

Theory: 60 hrs Credits 4

Practical/Clinical: 60hrs

Rationale: The subject will introduce the students to the basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system. It will sensitize them in basic emergency care, infection prevention & control with knowledge of bio medical waste management and antibiotic resistance.

No. OF UNITS	CONTENT	No. OF HOURS
I	**Quality assurance and management** 1. Concepts of Quality of Care 2. Quality Improvement Approaches 3. Standards and Norms 4. Quality Improvement Tools 5. Introduction to NABH guidelines	10
II	**Basics of emergency care and life support skills** 1. Vital signs and primary assessment 2. Basic emergency care – first aid and triage 3. Ventilations including use of bag-valve-masks (BVMs) 4. Choking, rescue breathing methods 5. One- and Two-rescuer CPR 6. Using an AED (Automated external defibrillator). 7. Managing an emergency including moving a patient	10
III	**Bio medical waste management and environment safety** 1.Definition of Biomedical Waste 2.Waste minimization 3.BMW – Segregation, collection, transportation, treatment and disposal (including color coding) 4.Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste 5.BMW Management & methods of disinfection 6.Modern Technology for handling BMW 7.Use of Personal protective equipment (PPE) 8.Monitoring & controlling of cross infection (Protective devices	8
	Infection prevention and control 1. Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)]. 2. Prevention & control of common healthcare associated infections 3. Components of an effective infection control program, and 4. Guidelines (NABH and JCI) for Hospital Infection Control	12
IV	**Antibiotic Resistance** 1. History of antibiotics 2. How resistance happens and spreads 3. Types of resistance- intrinsic, acquired, passive 4. Trends in drug resistance 5. Actions to fight resistance 6. Bacterial persistence 7. Antibiotic sensitivity 8. Consequences of antibiotic resistance 9. Antimicrobial Stewardship – Barriers and opportunities, tools and	10

	models in hospitals	
V	**Disaster preparedness and management** 1. Fundamentals of emergency management 2. Psychological impact management 3. Resource management 4. Preparedness and risk reduction 5. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.	10

SUGGESTED READINGS:

1. The Essentials of Patient Safety by Charles Vincent
2. Laboratory quality control and patient safety by De Gruyter
3. Essentials of applied microbiology for nurses including infection control and safety by Apurba

PRACTICAL/ CLINICAL

No. OF UNITS	CONTENT	No. OF HOURS
I	**QUALITY AND PATIENT SAFETY** a) Discussion on Concepts of Quality of Care b) Approaches to Quality Improvement c) Quality Improvement Tools Discussion on NABH guidelines and its exercises	10
II	**BASICS OF EMERGENCY CARE AND LIFE SUPPORT SKILLS** 1. Vital signs and primary assessment 2. Basic emergency care – first aid and triage 3. Ventilations including use of bag-valve-masks (BVMs) 4. Choking, rescue breathing methods 5. One- and Two-rescuer CPR 6. Using an AED (Automated external defibrillator). Managing an emergency including moving a patient Students should perform the maneuvers in simulation lab and to test their skills with focus on airways management and chest compressions.	10
III	**BIO MEDICAL WASTE MANAGEMENT AND ENVIRONMENT SAFETY** 1. Visit to Central Sterile Supply Department (CSSD) 2. Visit to incinerator complex 3. Visit to Immunization section 4. Discussion on Biomedical Waste, 5. Demonstration of Types of waste generated from Health Care Facility 6. Discussion on waste minimization 7. Poster presentation of BMW – Segregation, collection, transportation,treatment and disposal (including color coding) 8. Discussion on Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste 9. Visit to Central Sterile Supply Department for demonstration of BMW Management & methods of disinfection	8

	10. Modern Technology for handling BMW e.g. Incinerator, Shredder etc. 11. Demonstration of proper use of Personal protective equipment (PPE) 12. Demonstration of monitoring & controlling of cross infection (Protective devices)	
	INFECTION PREVENTION AND CONTROL 1. Demonstration of evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)], 2. Discussion on prevention & control of common healthcare associated infections, 3. Preparing Charts & Posters of Components of an effective infection control program, and 4. Guidelines (NABH and JCI) for Hospital Infection Control	12
IV	**ANTIBIOTIC RESISTANCE** 1. Discussion on various types of Antibiotics 2. Demonstration of how Resistance Happens and Spreads 3. Discussion on types of resistance- Intrinsic, Acquired, Passive 4. Antibiotic sensitivity testing 5. Display of Consequences of antibiotic resistance 6. Demonstration of Antimicrobial Barriers and opportunities, Tools and models in hospitals	10
V	**DISASTER PREPAREDNESS AND MANAGEMENT** 1. Discussion on fundamentals of emergency management, 2. Management psychological impact 3.Discussion on; 3.1 Resource management, 3.2 Preparedness and risk reduction	10

BASIC COMPUTERS AND INFORMATION SCIENCE

INTRODUCTION:

Computer science spans theoretical disciplines (such as algorithms, theory of computation, and information theory) to practical disciplines (including the design and implementation of hardware and software). It deals with concepts regarding the architecture of a computer, common application software and uses of computers in everyday life.

COURSE OBJECTIVES:

To build necessary concepts regarding the architecture of a computer

To develop an understanding of the common application software.

To understand the uses of computers in everyday life.

SYLLABUS

Theory 15 hrs. & Credit 1
Practical 30hrs.

NO OF UNITS	CONTENT	NO. OF HOURS	NO. OF PRACTICAL
I	1. Describe and identify the principal components of a computer 2. Define the various terms used in computer – hardware/software / operating system 3. Describe the functions and uses of computers including in health care	2	4
II	1. Mention the common types of files including Word documents, Spreadsheets (Excel) and Presentations (PowerPoint) and their uses 2. Basic Network connecting 3. Explain the uses of the internet and email 4. Collaborative work using Google suite of applications / Microsoft Office 365	2	6
III	1. Demonstrate use of a computer for common purposes 2. Demonstrate methods for Data storage & retrieval and making folders; 3. Perform functions like date/time setting or changing, change display settings, Installing /removing programs etc. 4. Understand and Use MS Word / Word Document program 5. Prepare a properly formatted, spell-checked document in Word Document including insertion of images and tables and take a print-out/mail as an attachment, and convert to pdf (portable document format) 6. Understand and Use MS Excel / Data spreadsheet 7. Prepare a proper Excel document (spreadsheet) with given data and sort out data, insert / delete cells, etc., use formula bar for common functions like calculate mean etc, convert to pictorial format like bar / pie diagram, etc. 8. Prepare and use computer-based presentations like PowerPoint	5	10

	with appropriate fonts and colors including insertion of images, videos etc.		
IV	1. Prepare an appropriate file like excel to enter patient data and retrieve it 2. Use the facility of Mail Merge between Excel to a Word document 3. Sending customized email to selected members. 4. Prepare a patient report and take a print out	3	6
V	1. Prepare a database of patient info and lab results for storage and later retrieval 2. Communicate by e-mail including opening email account 3. Demonstrate use of search engines / Google search etc. for academic information 4. Elements of Health Information - Definition, Key Features, Comparison with traditional methods, Benefits, Emerging Trends, and Challenges	3	4

LEARNING OUTCOMES:

- At the end of the training program, the student would be able to
- Classify various components of the computer.
- Experiment with the various application software of Microsoft Office suite.
- Make use of collaborative applications over the internet

COURSE OUTCOMES:

At the end of the course student is expected to

1. Know about the concept and architecture of a computer

2. To understand the common application software.

3. To understand and apply the uses of computers in everyday life.

REFERENCES

1. Introduction to Computers by Peter Norton (McGraw Hill Education)
2. Mastering Excel: A Problem-Solving Approach by James Gips (John Wiley and Sons)
3. SAMs Teach Yourself Computer Basics in 24 hours

ENGLISH, COMMUNICATION & SOFT SKILLS

INTRODUCTION:

The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

COURSE OBJECTIVES

- This course trains the students in oral presentations, expository writing, logical organization and structural support.
- By acquiring skills in the use of communication techniques the students will be able to express better, grow personally and professionally, develop poise and confidence and achieve success.

SYLLABUS
Hours:30 Credits: 02

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**BASICS OF ENGLISH GRAMMAR** Vocabulary:- Synonyms , Antonyms, Prefix and suffix , Homonyms , Tenses , subject verb agreement , common errors in English.	8
II	**LISTENING AND SPEAKING SKILLS** Importance of listening and speaking. Barriers in listening and speaking. Good and persuasive listening and speaking Note Taking, Watching Video Clips and Listening to Audio Clips, Listening to and Watching News and Panel Discussions JAM (Just-A-Minute),Oral Presentation , Group Discussion	8
III	**READING AND WRITING SKILLS** Efficient and fast reading, Importance of Skimming and Scanning	4
IV	Letter Writing, Email, Essay, Paragraph writing, Articles, Memos, note making and Comprehension.	4
V	Common Medical Terminology and writing a medical report	6

COURSE OUTCOMES

- By the end of the course, the learners will be able to:
- Think critically, analytically, creatively and communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy.
- Write grammatically correct sentences employing appropriate vocabulary suitable to different contexts
- Comprehend and analyze different academic texts.
- Make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing.
- Effectively handle formal correspondence like e-mail drafting and letter writing.

REFERENCE BOOKS:

- Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M. A Student's Guide to Academic and Professional Writing in Education, UK, Teachers College Press, 2019
- Raymond Murphy, English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English: Cambridge University Press;2019
- Peter Watkins, Teaching and Developing Reading Skills: UK, CUP, 2018
- Deeptha Achar et al. Basic of Academic Writing. (1and 2) parts New Delhi: Orient Black Swan. (2012& 2013).
- Kumar S and Lata P, Communication Skills: New Delhi Oxford University Press, 2015

PROFESSIONALISM & VALUES
SYLLABUS
Hours : 15 Credits: 01

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**Professional values** Integrity, Objectivity, Professional competence and due care, Confidentiality	3
II	**Personal values** Ethical or moral values	3
III	**Attitude and behavior** Professional behavior, treating people equally	2
IV	**Code of conduct** Professional accountability and responsibility, misconduct	2
V	Differences between professions and importance of team efforts	2
	Cultural issues in the healthcare environment	3

PRINCIPLES OF MANAGEMENT WITH SPECIAL REFERENCE TO MEDICAL LABORATORY SCIENCE (MLS) MANAGEMENT

SYLLABUS
Theory Hours : 15, Credits: 01 ,
Practical/ Clinical Hours: 195, Credits: 6.5

The course is intended to provide knowledge about the basic principles of Management listed below, in addition to MLS management:

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

MEDICAL LABORATORY SCIENCE MANAGEMENT

Rationale: The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab. In addition they will understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

NO. OF UNITS	CONTENT	NO. OF HOURS	
		Theory	Practical/ Clinical
I	1. Ethical Principles and standards for a clinical laboratory professional 1.1 Duty to the patient 1.2 Duty to colleagues and other professionals 1.3 Duty to the society	1	15
	2. Good Laboratory Practice (GLP) Regulations and Accreditation 2.1 Introduction to Basics of GLP and Accreditation 2.2 Aims of GLP and Accreditation 2.3 Advantages of Accreditation 2.4 Brief knowledge about National and International Agencies for clinical laboratory accreditation	1	15
	3. Awareness / Safety in a clinical laboratory 3.1 General safety precautions 3.2 HIV: pre- and post-exposure guidelines 3.3 Hepatitis B & C: pre- and post-exposure guidelines 3.4 Drug Resistant Tuberculosis	2	30
	4. Patient management for clinical samples collection, transportation and preservation	1	15
II	5. Sample accountability 5.1 Purpose of accountability	1	15

	5.2 Methods of accountability		
	6. Sample analysis 6.1 Introduction 6.2 Factors affecting sample analysis	1	15
	7. Reporting results 7.1 Basic format of a test report 7.2 Reported reference range 7.3 Clinical Alerts 7.4 Abnormal results 7.5 Turnaround time 7.6 Results from referral laboratories 7.7 Release of examination results 7.8 Alteration in reports	1	15
III	8. Quality Management system 8.1 Introduction 8.2 Quality assurance 8.3 Quality control system 8.4 Internal and External quality control	1	15
IV	9. Biomedical waste management in a clinical laboratory	1	15
V	10. Introduction and importance of calibration and Validation of Clinical Laboratory instruments	1	15
	11. Laboratory Information system (LIS), Hospital Information system (HIS) and financial Management 11.1 Introduction 11.2 Functions of a laboratory management system 11.3 Standards for laboratory management system 11.4 Introduction and awareness of financial management in a clinical laboratory	1	15
	12. Ethics in Medical laboratory Practice 12.1 Understanding the term Ethics 12.2 12.3 12.4 Ethics in relation to the following: 12.2.1 Pre-Examination procedures 12.2.2 Examination procedures 12.2.3 Reporting of results Preserving medical records Access to Medical laboratory Record	2	30
	13. Procurement of equipment and Inventory Control 13.1 Audit in a Medical Laboratory 13.2 Introduction and Importance 13.3 Responsibility 13.4 Planning 13.5 Horizontal, Vertical and Test audit 13.6 Frequency of audit 13.7 Documentation	1	15

SUGGESTED READINGS:

1. Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur
2. ICMR guidelines for Good clinical Laboratory (GcLP) 2021

SEMESTER – II

ANATOMY – II

INTRODUCTION:

Anatomy deals with the structural organization of human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to provide quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides and VARIOUS models provide the ideal environment to learn anatomy during the 1st year of their course.

COURSE OBJECTIVES:

The objective of this subject is to provide an outline of anatomy to improve the students understanding the technical and diagnostic procedures used, with special emphasis on limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology.

SYLLABUS

Hours: Theory 30 & Practical 15

Credits: Theory 02 & Practical 0.5

No. OF UNITS	CONTENT	No. OF HOURS
I	**The Nervous system** Review Structure of neurons; CNS, ANS and PNS (Central, autonomic and peripheral) – Peripheral nerves , Brachial, Lumbar, Sacral plexus, Covering of brain, Surfaces and lobes of cerebrum white fibers of cerebrum, cranial nerves, brain stem, spinal cord - spinal nerves, functional areas of cerebral cortex, Ventricular system – formation, circulation, and drainage	9
II	**Gastro Intestinal Tract** Stomach morphology, blood supply, applied aspects Liver morphology, ligaments blood supply applied aspects, porta hepatitis Small and large intestine, appendix and appendicitis	5
III	**The Excretory system & Reproductive system** Morphology , relations and internal Structure of kidney, urethra Components of female reproductive system, Morphology of uterus and its supports Parts of Fallopian Tube, Layers of scrotum, Anatomy of Testis and its coverings Spermatic cord, Male urethra & its parts	7
IV	**The Endocrine system** Endocrine glands, Structure of Hypothalamus, Pineal Gland, Pituitary gland- Dwarfism Thyroid- Goiter, Parathyroid, Pancreas – Diabetes Mellitus, Adrenal glands,	5

	Gonads	
V	**The Sensory organs** Receptors, Structure of skin, Eye - Anatomy of orbit and eyeball, Anatomy of Nose, Anatomy of ear, Anatomy of tongue	4
Practical:		
No. OF UNITS	**CONTENT**	**No. OF HOURS**
I	Histology of Liver, Thyroid, Kidney	3
II	Liver, Stomach, Intestines	3
III	Spleen, Kidney	3
IV	Brain, Spinal card	3
V	Bony Pelvis, Skull, Normal X- Rays, Surface markings	3

COURSE OUTCOMES:

- This course is aimed to make the student to gain knowledge in basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology which provides foundation in completion of the course.
- Enable to understand about the Gastro Intestinal Tract, location, surfaces, lobes, relations, and blood supply of Liver.
- Enables to understand about the Endocrine glands and explain the morphology and blood supply of Thyroid gland.

REFERENCES:

1. Anatomy and physiology –Vijaya D Joshi, Ashalatha N Nandedkar, Sadhana S Mendhurwar
2. Anatomy and physiology- Indu Khurana and Arushi Khurana
3. Human anatomy &physiology for nursing -Mahindra Kumar Anand & Meena Verma
4. Understanding human anatomy & physiology- William Davis(McGraw-Hill)

PHYSIOLOGY – II

INTRODUCTION

Physiology is the study of functions and mechanisms in a living system. Physiology focuses on individual organs, cells, and biomolecules carry out the chemical and physical functions in a living system. Physiological state is the condition of normal function and this course helps in understanding the functions of endocrine system, renal physiology and reproductive physiology.

COURSE OBJECTIVES:

- To know about functions and physiological anatomy of endocrine system – Thyroid, Adrenal, Parathyroid, Pituitary glands and Pancreas.
- To impart knowledge related to physiological structure of kidney and the nephron and its functions.
- To understand about reproductive system, process and methods of determination of ovulation.
- To know about types of joints, the structure and formation of cartilage and the structure and formation of bone.

SYLLABUS

Credits: Theory 03 & Practical 0.5

Hours: Theory 45 & Practical 15

No. OF UNITS	CONTENT	No. OF HOURS
I	**Cardiovascular System** 1. Describe the gross structure of heart and the normal circulation of blood 2. Describe the cardiac cycle 3. Describe the normal arterial pulse wave and the normal heart rate, and factors increasing and decreasing it. 4. Describe normal Blood pressure and its regulation, 5. Describe the normal Heart sounds 6. Describe the normal ECG and its importance	**12**
II	**Endocrine Physiology** 1. Describe the physiological anatomy of Thyroid gland, functions and its applied physiology 2. Describe the physiological anatomy of Adrenal gland, functions and its applied physiology 3. Describe the physiological anatomy of Parathyroid gland, functions and its applied physiology 4. Describe the physiological anatomy of Pancreas, its functions and its applied physiology 5. Describe the physiological anatomy of hypothalamus and the Pituitary gland, their functions and its applied physiology	10
III	**Excretory Physiology** 1. Describe the physiological structure of kidney and the nephron and its functions 2. Describe the GFR and factors affecting GFR 3. Describe the Substances absorbed and secreted from renal tubules	10

	4. Describe the various Renal function tests **5.** Describe briefly the Urinary bladder and its functions and the physiology of micturition **6.** Functions of skin **7.** Acid base balance	
IV	Reproductive Physiology 1. Describe the physiology of puberty 2. Describe the process of menstruation, normal menstrual cycle, menarche and menopause. 3. Describe briefly the process of ovulation and methods of determination of ovulation 4. Describe briefly the normal physiology of pregnancy and mention the diagnostic tests for pregnancy and their physiological basis 5. Describe briefly the functions of placenta and pregnancy diagnostic tests 6. List out the Contraceptive methods in male and female 7. Describe the Spermatogenesis	06
V	**Central Nervous System** 1. Describe the physiological anatomy of the brain and functions of different lobes 2. Describe briefly the structure and functions of spinal cord 3. Describe briefly the subdivisions of brain stem and their functions 4. Describe briefly the special senses and their pathways – vision, audition (& olfaction & taste) 5. Describe the normal EEG 6. Describe briefly the CSF formation, circulation, properties, composition and functions	07
PRACTICAL		
No. OF UNITS	**CONTENT**	**No. OF HOURS**
I	General examination – Brief history, General appearance, Vital data	02
II	Pulse and BP	03
III	Demonstrate examination of heart – inspect JVP, localize apex beat, look for any abnormal pulsations, percuss cardiac dullness, auscultate heart for normal sounds	02
IV	Demonstrate examination of respiratory system – inspect the chest for symmetry, movements, localize apical impulse and trachea, measure chest expansion, percuss the chest for lung resonance, liver dullness, auscultate lungs for breath sounds	02
V	Demonstrate examination of the cranial nerves	**02**
VI	Demonstrate the various sensory and motor reflexes - abdominal, plantar, biceps, triceps, supinator, knee, and ankle	**02**
VII	Clinical charts	**02**

REFERENCE BOOKS

- Human Anatomy & Physiology for Nursing – Mahindra Kumar Anand & Meena Verma Understanding Human Anatomy & Physiology – William Davis (McGraw Hill) Anatomy & Physiology – Kaarna Muni Shekhar
- Textbook of Physiology for BDS students - Dr Jain
- Textbook of Physiology for BDS students – Dr Sambulingam
- Handbook of Human Physiology – Vidya Ratan
- Concise Medical Physiology – Sujith K Choudhari

BASIC CLINICAL BIOCHEMISTRY

SYLLABUS

Credits: Theory 02 &Practical/ Clinical 4

Hours: Theory 30 &Practical/ Clinical 120

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Medical Lab Technology, Role of Medical lab Technologist, Ethics and responsibility, Safety measures, First aid 2. Cleaning and care of general laboratory glass ware and equipment Steps involved in cleaning soda lime glass, Steps involved in cleaning borosil glass, Preparation of chromic acid solution, Storage	6
II	3. Distilled water Method of preparation of distilled water, Type of water distillation plants, Storage of distilled water 4. Units of Measurement. S.I unit and CGS units, Conversion, Strength, molecular weight, equivalent weight, Normality, Molarity, Molality, Numerical	6
III	5. Calibration of volumetric apparatus Flask, Pipettes, Burettes, Cylinders 6. Analytical balance Principle, Working, Maintenance	6
IV	7.ConceptofpH , Definition Henderson Hassel batch equation, Pka value, pH indicator Methods of measurement of Ph, pH paper, pH meter Principle, working, maintenance and calibration of pH meter 8.Volumetricanalysis Normal and molar solutions, Standard solutions, Preparation of reagents, Storage of chemicals	6
V	9. Osmosis Definition, Types of osmosis, Factors affecting osmotic pressure, VantHoff's equation, Applications of osmosis, Dialysis	6

PRACTICALS	
CONTENT	**NO. OF HOURS**
Cleaning of the laboratory glassware(Volumetric and non-volumetric)	120
Preparation of distilled water	
Principle, working and maintenance of pH meter.	
Preparation of Solutions (Normal, molar, percentage and saturated)	
Demonstration of osmosis and dialysis	

MEDICAL LAW AND ETHICS

SYLLABUS

Hours: Theory 15

Credits: Theory 01

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, 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.[28]

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice".[28] Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are as follows:

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics – Confidentiality	3
II	4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia	3
III	7. Organ transplantation 8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.	3
IV	9. Professional Indemnity insurance policy 10. Development of standardized protocol to avoid near miss or sentinel events	3
V	11. Obtaining an informed consent.	3

GENERAL MEDICAL MICROBIOLOGY
SYLLABUS

Hours: Theory 30 Practical/Clinical 105

Credits: Theory 02 Practical/Clinical 3.5

Rationale: This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e. microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

No. OF UNITS	CONTENT	No. OF HOURS
I	Introduction to Medical Microbiology: • Definition • History • Host - Microbe relationship	2
	Microscopy: • Introduction and history • Types, principle and operation mechanism of following microscopes • Light microscope • DGI • Fluorescent • Phase contrast • Electron microscope: Transmission/ Scanning	2
	General characteristics & classification of Microbes: (Bacteria &fungi) • Classification of microbes with special reference to prokaryotes & eukaryotes • Morphological classification of bacteria • Bacterial anatomy (Bacterial cell structures)	5
	Growth and Nutrition of Microbes: • General nutritional & other requirements of the bacteria • Classification of bacteria on the basis of their nutritional requirements • Physical conditions required for growth. • Normal growth cycle of bacteria (growth curve) • Types of microbial cultures: Synchronous, Static, continuous culture.	2
	Culture media: • Introduction • Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selective differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media • Quality control in culture media • Automation in culture media preparation	3
	Aerobic & anaerobic culture methods: • Concepts • Methods Used for aerobic cultures	2

	□ Methods used for anaerobic cultures	
II	Safety measures in Clinical Microbiology	2
	Glassware used in Clinical Microbiology Laboratory: □ Introduction □ Care and handling of glassware □ Cleaning of glassware Equipment used in clinical Microbiology Laboratory: □ Introduction □ Care and maintenance including calibration	2
III	Sterilization: □ Definition □ Types and principles of sterilization methods □ Heat (dry heat, moist heat with special Reference to autoclave) □ Radiation □ Filtration □ Efficiency testing to various sterilizers	2
	Antiseptics and disinfectants: □ Definition. □ Types and properties □ Mode of action - Uses of various disinfectants □ Precautions while using the disinfectants - Qualities of a good disinfectant □ Testing efficiency of various disinfectants	2
IV	Biomedical waste management in a Medical Microbiology laboratory: □ Types of the waste generated – Segregation – Treatment – Disposal	2
V	Introductions to Immunology □ Immunity □ Antigens and Antibodies	4

SUGGESTED READINGS

1. Practical Medical Microbiology by Mackie and McCartney
2. Text book of Microbiology by Ananthanarayan
3. Medical Microbiology by Panikar& Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. District Laboratory Practice in tropical countries Vol II Microbiology by Monica Cheesbrough
6. Text book of Microbiology by Baveja
7. Essentials of medical microbiology by Apurba

Practicals:

No. OF UNITS	CONTENT	No. OF HOURS
I	To demonstrate safe code of practice for a Microbiology laboratory	5
II	To demonstrate the working & handling of Compound microscope.	5
III	To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.	5
	To demonstrate the method of sterilization by autoclave including its efficacy testing.	10
	To demonstrate the method of sterilization by hot air oven including its efficacy testing.	5
	To demonstrate the method of sterilization of media/solution by filtration.	5
IV	Demonstration of Antiseptics, Spirit, Cetrimide & Povidone Iodine	5
	To demonstrate the use of disinfectants.	5
	Demonstrate the precaution while using disinfectants.	5
	To prepare working dilution of commonly used disinfectants.	10
	In-use test	5
	Rideal-walker phenol co-efficient test.	5
	Kelsey-Sykes test	5
V	To demonstrate the different morphological types of bacteria	10
	Preparation of one culture media from each type	10
	To demonstrate aerobic culture	5
	To demonstrate anaerobic culture	5

BASIC HEMATOLOGY

SYLLABUS

Credits: Theory 02 & Practical 3.5

Hours: Theory 30 & Practical 105

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Haematology 1.1 Definition 1.2 Importance 1.3 Important equipment used	2
	2. Laboratory organization and safety measures in Haematology Laboratory	2
	3. Introduction to blood, its composition, function and normal cellular components	2
	4. Anticoagulants: types, mode of action and preference of anticoagulants for different hematological studies	2
	5. Collection and preservation of blood sample for various hematological investigations	3
II	6. Formation of cellular components of blood (Haemopoiesis) 6.1 Erythropoiesis 6.2 Leucopoiesis 6.3 Thrombopoiesis	6
III	7. Hemoglobin: definition, types, structure, synthesis and degradation	1
	8. Morphology of normal blood cells	5
	9. Normal Hemostasis & physiological properties of coagulation factors	2
IV	10. Urine analysis	2
V	11. Quality assurance in Haematology 11.1 Internal and external quality control including reference preparation 11.2 Routine quality assurance protocol 11.3 Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision	3

SUGGESTED READINGS

1. Text book of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's Clinical Haematology in Medical Practice

PRACTICALS	
CONTENT	**No. of Hours.**
1. Preparation of various anticoagulants : 1.1 EDTA 1.2 Sodium Citrate, 1.3 Oxalate with Fluoride	105
2. Collection of blood sample for various Lab Investigations	
3. Familiarization and working of routine Haematology Lab. Instruments 3.1 Microscopes 3.2 Haemocytometers 3.3 Colorimeter 3.4 Spectrophotometer 3.5 Glass pipettes & Auto pipettes 3.6 Glassware 3.7 Sahli‘s Apparatus	
4. Identification of Normal blood cells	
5. Urine Analysis: 5.1 Routine biochemistry of Urine for: 5.1.1 pH 5.1.2 Specific Gravity 5.1.3 Glucose 5.1.4 Ketones 5.1.5 Bilirubin 5.1.6 Albumin 5.2 Microscopic Examination of Urine	

SEMESTER – III

BASICS OF PATIENT CARE

INTRODUCTION:

This course develops knowledge and skills basic to patient care undergoing radiographic procedures. Topics include patient communication, patient assessment, and safety of patient and healthcare provider in the health care facility. Focus extends to include proper body mechanics and patient positioning to promote comforting for patient. Basics of infection control and methods of medical asepsis were focused on especially when dealing with patients undergoing certain invasive procedures. Finally describe and perform basic procedures like injections, Ryle's tube, Foley's catheterization, taking blood samples, wound dressing etc.

COURSE OBJECTIVES:

1. Students will gain understanding of the fundamental concepts of patients care while in the hospital or undergoing a special procedure.
2. Students will become familiar with some procedures relevant to patient condition
3. Students will Be able to provide certain basic procedures and identify symptoms of altered cognition.
4. Students will be able to relate them to patient overall health and well being.
5. Relationship between certain procedures, radiographic procedure, and patient overall health will be emphasized.

SYLLABUS
THEORY: 30Hr and 2 Credits

LEARNING OUTCOMES:

The main Intended Learning Outcome (ILO) that is measured throughout this course is "Critical Thinking." This ILO is conceptually defined as "a cognitive process that aims at using the rational and logical examination of ideas for the purposes of understanding, problem solving, and decision-making." Critical thinking will facilitate the process of teaching/ learning, which is originally a change in thinking or behaviour.

I- Caring

II- Communication

III- Critical thinking

IV- Therapeutic intervention

V - Leadership

VI- Employer's satisfaction

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Describe the principles of care of bedridden patient** - Care of a bedridden patient - Patient assessment - Assessing personal concerns of patient - Assessing physiological needs Assessing current physical status **Describe the basic principles of communication** Communication with patients and attendants - Communication skills - Communication with patients - Special circumstances in communication - Patient education - Communication with patient's families Dealing with death and loss	3
II	**Describe and demonstrate techniques to maintain patient hygiene** Patient hygiene - Cycle of infection - Body's defense against infection - Infectious diseases - Maintaining hygiene **Describe and practice infection control measures in the ward and ICU** Infection control measures in the ward and ICU - Microorganisms - Cycle of infection - Hand Washing Preventing disease transmission	3
III	**Describe and record vital data and basic clinical parameters** Vital data and basic clinical parameters -Assessment of body temperature: sites, equipments and techniques, special considerations - Assessment of pulse: Sites, location , equipments and technique, special consideration - Assessment of respirations: technique, special consideration Recording of vital signs **Describe and demonstrate how to monitor patients** Patients monitoring Assessing personal concerns of patient - Assessing physiological needs - History taking - Physical assessment	3

IV	**Describe the principles of patient safety** **-** Patient transfer - Restraints and immobilization - Accidents and incident reports - Fire hazards Other common hazards **Describe and demonstrate the principles of cleaning, disinfection and sterilization in the hospital wards/ ICU** - Hand washing: simple, hand antisepsis and surgical antisepsis (scrub) - Isolation: source and protective -Sterile packs - Surgical scrubbing - Gowning and gloving -Sterilization - Fumigation Autoclaving **Describe the common routes for drug administration** -Assess the patient's condition - Recognize different definitions associated with pharmacology - Recognize various classifications of drugs - Identify the ten rights of drug administration - List out common routes and methods of drug administration - Perform venipuncture using appropriate universal Precautions	3
V	**Describe and perform basic procedures** -Injections, -Ryle's tube, -Foley's catheterization, -Taking blood samples, -Wound dressing **Describe and demonstrate documentation of patient related data in the case sheet records** -History taking data sheet - Documentation: Purpose of Recording and reporting, Communication within the Health Care Team, - Types of records; ward records, medical/nursing records, Common Record- keeping forms, Computerized documentation **Describe and demonstrate use of basic hospital equipment** Use of basic hospital equipment	3

COURSE OUTCOMES:

1. Perform basic infection control practices in the Healthcare setting.
2. Use effective skills to draw blood and accurately label tubes
3. Perform basic procedures using advanced technique and interpretation.

4. Perform basic patient care skills.
5. Communicate with a diverse patient population using written and oral communication and listening skills in interactions.

REFERENCES:

1. Ehrlich, R., A., McCloskey, E. D., & Daly, J., A. (2004). *Patient Care in Radiography with an Introduction to Medical Imaging.* Mosby: An Affiliate of Elsevier. Sixth edition.
2. Adler, A., M., & Carlton, R., R. (2007). *Introduction to Radiologic Sciences and Patient Care*. Saunders: Elsevier. Fourth edition
3. Torres, L.,S. (1989). *Basic Medical Techniques and Patient Care for Radiologic Technologists*. J. B.Lippincott Company: Philadelphia. Third Edition.

SYSTEMATIC BACTERIOLOGY
SYLLABUS
THEORY: 30hrs, Practical/Clinical:105
Credits: Theory- 2, Practical/Clinical- 3.5

RATIONALE: This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

NO. OF UNITS	CONTENT	NO. OF HOURS
I	Bacterial culture Instruments used to seed culture media Culture procedures – seeding a plate	2
II	Staining techniques in bacteriology Significance of staining in bacteriology Principle, Reagent preparation, procedures and interpretation of the following Simple staining Negative staining Gram stain Albert‘s stain Neisser‘s stain Ziehl –Neelsen staining Capsule staining Flagella staining Spore staining Fontana stain for spirochetes	2
III	Principle, procedures and interpretation of the following biochemical tests for identification of different bacteria: Catalase Coagulase Indole Methyl Red Voges Proskauer Urease Citrate Oxidase TSIA Nitrate reduction Carbohydrate fermentation Huge and Leifson Bile solubility H2S production Demonstration of motility Decarboxylases CAMP Hippurate hydrolysis Nagler‘s reaction Cholera-red reaction	2

IV	Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria • Gram positive cocci- Staphylococcus, Streptococcus, Pneumococcus • Gram negative cocci- Neisseria gonorrhea and Neisseria meningitis	6
V	Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria • Gram positive bacilli- Corynebacterium, Clostridia of wound infection, Actinomyces • Gram negative bacilli- Enterobacteriaceae (Escherichia coli, Klebsiella, Citrobacter, Enterobacter, Proteus, Salmonella, Shigella, Yersinia enterocolitica and Yersinia pestis), Vibrio, Aeromonas and Plesiomonas, Haemophilus, Pseudomonas & Burkholderia, Bordetella and Brucella • Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae • Other groups- Spirochetes (Treponema, Borrelia and Leptospira), Mycoplasma and Ureaplasma, Rickettsia, Chlamydia • Brief introduction about non sporing anaerobic cocci and bacilli	18

SUGGESTED READINGS:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2

2.Text book of Microbiology by Ananthanarayanan

3. Medical Microbiology by Paniker& Satish Gupte

4. Text book of Microbiology by Baveja

5. Essentials of medical microbiology by Apurba

UNIT	PRACTICAL/CLINICAL	HOURS
I	• To demonstrate the instruments used to seed culture media • To learn techniques for Inoculation of bacteria on culture media • To isolate specific bacteria from a mixture of organisms	10
II	• To demonstrate simple staining (Methylene blue) • To prepare India ink preparation to demonstrate negative staining	5
III	Bacterial identification: To demonstrate reagent preparation, procedure and interpretation for- • Gram stain • Albert stain • Neisser‘s staining • Z-N staining • Capsule staining • Demonstration of flagella by staining methods • Spore staining • To demonstrate spirochetes by Fontana staining procedure	30
IV	To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria: • Catalase • Coagulase • Indole • Methyl Red (MR) • Voges Proskauer (VP) • Urease	30

	Citrate Oxidase TSI Nitrate reduction Carbohydrate fermentation Huge and Leifson Bile solubility H2S production Demonstration and motility Decarboxylases CAMP Hippurate hydrolysis Nagler‘s reaction	
V	To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples: Staphylococcus Streptococcus Corynebacterium Escherichia coli Klebsiella Citrobacter Enterobacter Proteus Salmonella Shigella Vibrio cholera Mycobacterium tuberculosis Pseudomonas	30

BASICS OF HEMATOLOGICAL DISEASES

SYLLABUS

Hours: Theory - 30; Practical- 90

Credits: Theory –2; Practical - 3

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Anemia 1.1 Introduction 1.2 Classification 1.2.1 Microcytic hypo chromic anemia 1.2.2 Macrocytic anemia 1.2.3 Normocytic normochromic anemia	5
II	2. Quantitative disorders of Leukocytes Cause and significance 2.1 Granulocytic and Monocytic Disorders 2.2 Lymphocytic Disorders	5
III	3. Morphologic Alterations in Neutrophils 3.1 Toxic granulation 3.2 Cytoplasmic vacuoles 3.3 Döhle bodies 3.4 May–Hegglin anomaly 3.5 Alder–Reilly anomaly 3.6 Pelger–Huët anomaly 3.7 Chédiak–Higashi syndrome	5
IV	4. Bleeding disorders 4.1 Introduction Causes of bleeding disorders 4.2 Vascular defect 4.2.1 Platelet defect 4.2.2 Factor deficiency 4.2.3 Inhibitors 4.2.4 Hyper fibrinolysis 4.3 Types of bleeding disorders 4.3.1 Inherited bleeding disorders 4.3.2 Acquired bleeding disorders	5
V	5. Thrombosis 5.1 Introduction 5.2 Causes of thrombosis	5
	6. Monitoring of Anticoagulants 6.1 Oral anticoagulants by INR 6.2 Heparin	5

SUGGESTED READINGS

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical Laboratory Technology by K L Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20thedition) by John Bernard Henry
5. Atlas of Haematology by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice

7. Wintrobe's Clinical Haematology– 2013 by John P. Greer, Daniel A. Arber, Bertil E. Glader, Alan F. List

Practical Topics	No. of Hours
Parts of microscope; its functioning and care	90
Parts of centrifuge; its functioning and care	
Cleaning and drying of glassware	
Collection of venous and capillary blood	
Cleaning of glass-syringes and its sterilization	
Preparation of the stains and other reagents	
Preparation of peripheral blood film (PBF)	
Staining of PBF	
Haemoglobin estimation methods (Sahli‘s, Oxyhaemoglobin, and cyanmethaemoglobin)	
Differential leukocyte count (DLC)	
Recognition and staining of various types of blood cells (normal and abnormal)	
Preparation of thick and thin blood smear for malarial parasite (Leishman/Giemsa/JSB)	
RBC counting	
WBC counting	
Platelet counting	
Routine Examination of urine	

BIOCHEMICAL METABOLISM
SYLLABUS
Hours: Theory - 30; Practical- 90
Credits: Theory –2; Practical/Clinical –3

NO. OF UNITS	CONTENT	NO. OF HOURS
I	Carbohydrate Metabolism Introduction, Importance and Classification, Digestion and Absorption, Metabolism:- Glycolysis,Citricacidcycle,Gluconeogenesis,Glycogenolysis, Glycogenesis Disorders of carbohydrate metabolism	6
II	Protein Metabolism Introduction, Importance and classification Important properties of proteins, Digestion & absorption of Proteins, Protein synthesis, Metabolism of proteins, Disorders of protein metabolism and Urea Cycle	6
III	Lipids Introduction & Classification, Digestion & absorption of fats Lipoproteins, Fatty acid biosynthesis & fatty acid oxidation	6
IV	Nucleic Acid Introduction, Functions of Nucleic acid, Functions of energy carriers	6
V	Enzymes Introductions, Importance & Classifications, Properties of enzymes Mechanism of enzyme action, Factors affecting enzyme action, Enzyme kinetics & enzyme inhibitors	6

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. To determine the presence of carbohydrates by Molisch test. 2. To determine the presence of reducing sugar by Fehling solutions	90
1. To determine the presence of reducing sugar by Benedicts method. 2. To determine starch by Iodine test.	
1. Determination of Glucose in serum & plasma 2. Estimates of blood Glucose by Folin &Wumethod	
1. Determination of Urea in serum, plasma & urine. 2. Determination of Creatinine in serum or plasma	
1. Determination of serum Albumin 2. Determination of Cholesterol in serum or plasma	

FUNDAMENTALS OF HISTOLOGY
SYLLABUS
Hours: Theory - 30; Practical/Clinical- 90
Credits: Theory –2; Practical/Clinical -3

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Alimentary System: Diseases of mouth, Diseases of Esophagus- Esophageal varices.	3
	2. Digestive System: Gastritis, Peptic ulceration, Appendicitis, microbial diseases, Intestinal obstructions & mal absorption.	3
II	3.1 Liver – hepatitis, liver failure, cirrhosis. 3.2 Pancreas- pancreatitis. 3.3 Gall Bladder- Gall stones, jaundice and cardiovascular diseases.	3
	4. Circulatory System: Diseases of Blood vessels- Atheroma, Arteriosclerosis,	3
III	5. Respiratory System:, Tuberculosis, COPD.	3
	6. Urinary System: Nephrotic syndrome, renal calculi, Urinary tract infection.	3
IV	7. Reproductive system: Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cervix (CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility	3
	8. Nervous System: Meningitis	3
V	9. Endocrine System: 9.1 Thyroid: Goiter 9.2 Pancreas: Diabetes	6

SUGGESTED READINGS

1. Anatomy &Physiology – Ross and Wilson
2. Human Anatomy and Physiology by Pearce
3. Di Fiore‘s Atlas of Histology
4. Medical Laboratory Technology by KL Mukherjee-Volume III
5. Text book of Pathology by Robbins

PRACTICAL TOPICS	NO. OF HOURS
1. To study squamous cell from cheek cells (Buccal mucosa)	90
2. To study stained slide preparation from organs of digestive system	
3. Study of stained slides of liver, pancreas, gall bladder	
4. Study of various types of microscope and draw diagram in practical notebook	
5. To study stained slide preparation from organs of circulatory system	
6. To study stained slide preparation from organs of Respiratory system	

7. To study stained slide preparation from organs of Nervous system	
8. To study stained slide preparation from organs of Urinary system	
9. To study stained slide preparation from organs of Endocrine system	

SEMESTER – IV

APPLIED BACTERIOLOGY

SYLLABUS

Theory: 30, Practical/Clinical:105

Credits- Theory: 2, Practical/Clinical: 3.5

RATIONALE: This part will cover the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Laboratory strategy in the diagnosis of various infective syndromes: Samples of choice, collection, transportation and processing of samples for laboratory diagnosis of the following complications: 1.1 Septicemia and bacteremia 1.2 Upper Respiratory tract infections 1.3 Lower respiratory tract infections 1.4 Wound, skin, and deep sepsis 1.5 Urinary tract infections 1.6 Genital Tract infections 1.7 Meningitis 1.8 Gastro intestinal infections 1.9 Enteric fever 1.10 Tuberculosis (Pulmonary and Extra-pulmonary) 1.11 Pyrexia of unknown origin	12
II	2. Antibiotic susceptibility testing in bacteriology 2.1 Definition of antibiotics 2.2 Culture medium used for Antibiotic susceptibility testing 2.3 Preparation and standardization of inoculum 2.4 Control bacterial strains 2.5 Choice of antibiotics 2.6 MIC and MBC: Concepts and methods for determination 2.7 Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method	3
	3. Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR)	2
	4. Automation in bacterial culture detection and antimicrobial susceptibility testing: Principles and importance.	2
III	5. Bacteriological examination of water, milk, food and air 5.1 Examination of water 5.1.1 Collection and transportation of water sample 5.1.2 Presumptive coliform count 5.1.3 Eijkman test 5.1.4 Introduction and importance of other bacteria considered as indicators of fecal contamination 5.1.5 Membrane filtration tests 5.1.6 Interpretation of results 5.2 Examination of Milk and milk products 5.2.1 Basic Concepts regarding gradation of milk 5.2.2 Various tests for Bacteriological examination of milk	2

	5.3 Examination of food articles 5.3.1 Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc. 5.3.2 Various tests for Bacteriological examination with special reference to food poisoning bacteria 5.4 Examination of Air 5.4.1 Significance of air bacteriology in healthcare facilities 5.4.2 Settle plate method 5.4.3 Types of air sampling instruments 5.4.4 Collection processing and reporting of an air sample	
IV	6. Sterility testing of I/v fluids 6.1 Collection, transportation and processing of I/v fluids for bacterial contamination 6.2 Recording the result and interpretation	2
	7. Nosocomial Infection: 7.1 Introduction, sources and types of nosocomial infections. 7.2 Surveillance of hospital environment for microbial load. 7.3 Role of microbiology laboratory in control of nosocomial infections	3
V	8. Epidemiological markers: 8.1 Introduction 8.2 Types 8.3 Serotyping 8.4 Phage typing and 8.5 Bacteriocin typing	2
	9. Preservation methods for microbes 9.1 Basic concepts of preservation of microbes 9.2 Why do we need to preserve bacteria? 9.3 Principle and procedures of various short term and long term preservation methods with special reference to Lyophilization	2

SUGGESTED READINGS:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker& Satish Gupte
4. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough
5. Text book of Microbiology by Baveja
6. Essentials of medical microbiology by Apurba
7. Control of Hospital infection- by Apurba

NO. OF UNIT	PRACTICAL/CLINICAL	NO. OF HOURS
I	1. Inoculation of different culture media 2. Isolation of pure cultures 3. Processing of following clinical samples for culture and identification of bacterial pathogens: 3.1 Blood 3.2 Throat swab 3.3 Sputum 3.4 Pus 3.5 Urine 3.6 Stool for Salmonella, Shigella and Vibrio cholerae 3.7 C.S.F. and other body fluids	30
II	4. Demonstration of PCR 5. Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing	20
III	6. Antimicrobial susceptibility testing 6.1 Introduction and terms used 6.2 Preparation and standardization of inoculum 6.3 To demonstrate reference bacterial strains 6.4 To determine MIC and MBC of known bacteria against a known antibiotic 6.5 To perform antibiotic susceptibility testing of clinical isolates by using 6.5.1 Stokes method 6.5.2 Kirby-Bauer method	30
IV	7. Collection, transportation and processing of following articles for bacteriological examination: 7.1 Water 7.2 Milk 7.3 Food and 7.4 Air To demonstrate sterility testing of intravenous fluid with positive and negative controls	20
V	8. Demonstration of serotyping and bacteriocin typing 9. Demonstration of lyophilization and other available preservation methods	5

APPLIED HAEMATOLOGY - I
SYLLABUS
Theory 30 practical/clinical 105
Credit hours Theory: 2 ; Practical/clinical: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits	6
	2. Haemocytometry: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors. 2.1 RBC Count, 2.2 Total leucocyte count(TLC) 2.3 Platelet Count. 2.4 Absolute Eosinophil count 3. Principle mechanism and different methods with merit and demerits for the measuring Erythrocyte Sedimentation Rate(ESR) and its significance	
II	4. Different methods with merit and demerits for packed cell volume/Haematocrit value	6
	5. Preparation of blood films 5.1 Types, Methods of preparation (Thick and thin smear/film) & utility	
III	6. Staining techniques in Haematology (Romanowsky's stains):Principle, composition,preparationofstainingreagentsandprocedureofthefollowing 6.1 Giemsa's stain 6.2 Leishman's stain	6
	7. Differential leucocytes count(DLC	
IV	8. Normal and absolute values in Haematology	6
	9. Physiological variations in Hb, PCV,TLC and Platelets	
	10. Macroscopic and microscopic examination of seminal fluid	
V	11. Examination of CSF and other body fluids for cytology i.e. pleural, peritoneal and synovial fluid etc.	6
	12. Preparation of Reagents for coagulation studies: 12.1 M/40 Calcium chloride 12.2 Brain Thromboplastin 12.3 Cephalin 12.4 Adsorbed Plasma	
	13. Screening Tests for coagulation Studies and their significance	

SUGGESTED READINGS:

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L.Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20thedition)by John Bernard Henry
5. Atlas o fHaematology by G.A.Mc Donald
6. De Gruchy's Clinical Haematology in medical practice

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. Hb Estimation 1.1 Sahli's method 1.2 Oxyhaemoglobin method	105
2. Total leukocyte count	
3. Platelets count	
4. Absolute Eosinophil count	
5. Preparation of smear and staining with Giemsa and Leishman stain.	
6. ESR(Wintrobe and Westergren method)	
7. Packed cell volume(Macro & Micro)	
8. Cytological examination of CSF and other body fluids	
9. Physical and Microscopic examination of seminal fluid including sperm count	
10. Perform normal DLC	
11. Perform BT, CT, PT and APTT	

ANALYTICAL CLINICAL BIOCHEMISTRY
SYLLABUS
Theory: 30 hrs, Practical/Clinical: 105 hrs
Credits: Theory- 2, Practical/Clinical- 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**SPECTROPHOTOMETRYANDCOLORIMETRY** Introduction, Theory of spectrophotometry and colorimetry Lambert`s law and Beer`s law, Applications of colorimetry and spectrophotometry	6
II	**PHOTOMETRY** Introduction, General principles of flame photometry Limitations of flame photometry, Instrumentation Applications of flame photometry, Atomic absorption spectroscopy–Principle & applications	6
III	**CHROMATOGRAPHY** Introduction, Types of chromatography PaperChromatography:Introduction,principle,types,detailsforqualitativeandquantitativeanalysis,application Thinlayerchromatography:Introduction,experimentaltechniques,applicationofTLC,limitations,Highperformancethinlayerchromatography	6
IV	**CHROMATOGRAPHY** Columnchromatography:Introduction,principlecolumnefficiency,applicationof column chromatography, Gaschromatography:Introductionprinciple,instrumentation,applications.Ionexchangechromatography:Introduction,Definitionandprinciple,cationandanionexchangers,applications. GelChromatography:IntroductionPrincipleandmethod,applicationandadvantages	**6**
V	**ELECTROPHORESIS** Introduction, Principle, Instrumentation, Applications, Types of electrophoresis, Paper electrophoresis, Gel electrophoresis	**6**

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. To demonstrate the principle, working & maintenance of spectrophotometer. 2. To demonstrate the principle, working & maintenance of colorimeter.	105
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	

APPLIED HISTOPATHOLOGY-I
SYLLABUS
Theory 30hrs Practical/Clinical105hrs
Credits: Theory 2 Practical/Clinical 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Histotechnology	6
	2. Compound microscope: 2.1 Optical system, magnification and maintenance 2.2 Microscopy: 2.2.1 Working principle 2.2.2 Applications of various types of microscopes i.e. dark field, polarizing, phase contrast, interference and fluorescent microscope	
	3. Care and maintenance of laboratory equipment used in Histotechnology	
	4. Safety measures in a histopathology laboratory	
II	5. Basic concepts about routine methods of examination of tissues	6
	6. Collection and transportation of specimens for histological examination	
	7. Basic concepts of fixation	
	8. Various types of fixatives used in a routine histopathology laboratory 8.1 Simple fixatives 8.2 Compound fixatives 8.3 Special fixatives for demonstration of various tissue elements	
III	9. Decalcification 9.1 Criteria of a good decalcification agent 9.2 Technique of decalcification followed with selection of tissue, fixation, and decalcification, neutralization of acid and thorough washing 9.3 Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resigns and Electrophoretic decalcification and treatment of hard tissues which are not calcified	6
IV	10. Processing of various tissues for histological examination 10.1 Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing. 10.2 Components & principles of various types of automatic tissue 10.3 Processors 10.4 Embedding: 10.4.1 Definition 10.4.2 Various types of embedding media	6
	11. Section Cutting 11.1 Introduction regarding equipment used for sectioning 11.2 Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, various types of microtome and their applications 11.3 Freezing Microtome and various types of Cryostats. 11.4 Faults in paraffin section cutting with reason and remedy, spreading the sections and attachment or mounting of sections to glass slides.	
V	12. Staining, Impregnation and Mountants 12.1 Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry 12.2 Stains and Dyes and their uses 12.3 Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasia	6

	12.4 Use of Controls in Staining Procedures 12.5 Preparation of Stains, solvents, aniline water and buffers etc. 12.6 Commonly used mountants in Histotechnology lab 12.7 General Staining Procedures for Paraffin Infiltrated and Embedded tissue 12.8 Nuclear Stains and Cytoplasmic stains 12.9 Equipment and Procedure for manual Staining and Automatic Staining Technique 12.10 Mounting of Cover Slips, Labeling and Cataloguing the Slides	
	13. Routine Staining Procedures 13.1 Haematoxylin and Eosin Staining, various types of Haematoxylins	

SUGGESTED READINGS

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. Demonstration of instruments used for dissection	105
2. Reception and labeling of histological specimens	
3. Preparation of various fixatives 3.1 10% Neutral formalin 3.2 Formal saline 3.3 Formal acetic acid	
4. Testing of melting point of paraffin wax and perform embedding of given tissue in paraffin block	
5. To process a bone for decalcification	
6. To prepare ascending and descending grades of alcohol from absolute alcohol	
7. Processing of tissue by manual and automated processor method	
8. To demonstrate various part and types of microtome	
9. To learn sharpening of microtome knife (Honing and stropping technique), and types of disposable blades in use (High and Low Profile).	
10. To perform section cutting (Rough and Fine)	
11. To practice attachment of tissue sections to glass slides	
12. To learn using tissue floatation bath and drying of sections in oven (60-65C)	
13. To perform & practice the Haematoxylin and Eosin staining technique	
14. To learn mounting of stained smears	

SEMESTER – V

IMMUNOLOGY & BACTERIAL SEROLOGY

SYLLABUS

Theory 30hrs Credits 2

Practical/Clinical105hrs Credits 3.5

IMMUNOLOGY AND BACTERIAL SEROLOGY

RATIONALE: This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. History and introduction to immunology	1
	2. Immunity 2.1 Innate 2.2 Acquired immunity 2.3 Basic concepts about their mechanisms	3
	3. Definition, types of antigens and determinants of antigenicity	2
	4. Definition, types, structure and properties of immunoglobulin	2
II	5. Antigen-Antibody reactions 5.1 Definition 5.2 Classification 5.3 General features and mechanisms 5.4 Applications of various antigen antibody reactions	3
	6. Principle, procedure and applications of under mentioned in Medical Microbiology: 6.1 Complement fixation test 6.2 Immuno- fluorescence 6.3 ELISA 6.4 SDS-PAGE 6.5 Western blotting	2
III	7. Principle, procedure and interpretation of various serological tests: 7.1 Widal 7.2 VDRL 7.3 ASO 7.4 CRP 7.5 Brucella tube agglutination 7.6 Rose-Waaler	5
	8. Complement system: 8.1 Definition 8.2 Basic concepts about its components 8.3 Complement activation pathways	2
IV	9. Immune response: 9.1 Introduction 9.2 Basic concepts of Humoral and Cellular immune responses	3
	10. Hypersensitivity: 10.1Definition Types of hypersensitivity reactions 10.2Types of hypersensitivity reactions	2

V	11. Basic concepts of autoimmunity and brief knowledge about autoimmune diseases	2
	12. Automation in diagnostic serology	1
	13. Vaccines: 13.1Definition 13.2Types 13.3Vaccination schedule Brief knowledge about National immunization Schedule in India	2

SUGGESTED READINGS:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Paniker& Satish Gupte
4. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough
5. Immunology by Riot
6. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites
7. Text book of Microbiology by Baveja
8. Essentials of medical microbiology by Apurba

NO. OF UNITS	Practical/Clinical TOPICS	NO. OF HOURS
I	Collection of blood sample by vein puncture, separation and preservation of serum	105
II	Preparation of Phosphate buffers, Buffers of different pH and Molarity, Tris buffer	
III	Performance of Serological tests i.e. □ Widal □ Brucella Tube Agglutination □ VDRL (including Antigen Preparation) □ ASO (Anti-Streptolysin O) □ C-Reactive Protein (Latex agglutination) □ Rheumatoid factor (RF) Latex agglutination	
IV	CLIA and Turbidometry	
V	Demonstration of antigen/antibody determination by ELISA	

APPLIED HAEMATOLOGY – II
SYLLABUS
Theory: 30 hrs; Credits: 2
Practical/Clinical: 105hrs ; Credits: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Safety precautions in Haematology	6
	2. Basic concepts of automation in Haematology with special reference to: 2.1 Blood cell counter 2.2 Coagulometer	
II	3. Bone marrow examination 3.1 Composition and functions 3.2 Aspiration of bone marrow (Adults and children) 3.3 Processing of aspirated bone marrow (Preparation & staining of smear) 3.4 Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios) 3.5 Processing and staining of trephine biopsy specimens	6
III	4. Red cell anomalies 4.1 Morphological changes such as variation in size shape & staining character.	6
	5. Reticulocytes: Definition, different methods to count, Absolute reticulocyte count and IRF (Immature reticulocyte fraction) and significance of reticulocytes.	
IV	6. Lupus Erythematosus (L.E) cell phenomenon. 6.1 Definition of L.E. cell. 6.2 Demonstration of L.E. cell by various methods. 6.3 Clinical significance.	6
V	7. Cyto-chemical staining: Principles, method and significance	6
	8. Biomedical waste management in Haematology laboratory (Other than Radioactive material)	

SUGGESTED READINGS

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Practical Haematology by JB Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. Review the morphology of Normal and abnormal RBCs	105
2. Review the morphology of normal and immature WBCs	
3. WBCs anomalies	
4. Calculating INR	

APPLIED CLINICAL BIOCHEMISTRY – I
SYLLABUS
Theory: 30 hrs ; Credits: 2
Practical/Clinical: 105hrs; Credits: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	Hazards & safety measures in clinical Biochemistry laboratory	4
II	Quality control and quality assurance in a clinical biochemistry laboratory	3
III	1. Laboratory organization, management and maintenance of records 2.Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference values for : Glucose, Proteins, Urea, Uric acid, Creatinine, Bilirubin, Lipids 3. Principles, procedures for estimation & assessment of the following including errors involved and their corrections Sodium, Potassium and Chloride, Iodine, Calcium, Phosphorous and Phosphates	**9**
IV	1. Instruments for detection of Radioactivity 2. Applications of Radio isotopes in clinical biochemistry.	7
V	1. Enzyme linked immunosorbent assay	7

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. Estimation of Glucose in Urine and in Blood	105
2. Estimation of Protein in Urine and Blood 3. Estimation of serum Bilirubin	
4. Estimation of Urea in blood 5. Estimation of uric acid in blood 6. Estimation of Creatinine in Blood	
7. Estimation of Total Cholesterol in blood. 8. Estimation of HDL Cholesterol. 9. Estimation of LDL Cholesterol. 10. Estimation of TG	
11. Estimation of serum calcium, Inorganic phosphate 12. To measure electrolytes Sodium, Potassium & Chloride	

Applied Histopathology – II
SYLLABUS
Theory 30 hrs Credits 2
Practical/Clinical105 hrs Credits 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Cryostat sectioning, its applications in diagnostic histopathology.	6
II	2. Special Staining Procedures for detection of 2.1 Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulin fibers, collagen fibers etc. 2.2 Metachromatic staining such as Toludine blue on frozen sections 2.3 Principles of metal impregnation techniques. 2.4 Demonstration and identification of minerals and pigments, removal of Pigments/artifacts in tissue sections	6
III	3. Demonstration of Proteins & nucleic acids.	6
	4. Demonstration of Carbohydrates, lipids, fat &fat like substances.	
	5. Demonstration of bacteria and fungi in tissue section.	
IV	6. Tissue requiring special treatment i.e. eye ball, bone marrow, and muscle biopsy, under calcified or unclarified bones, whole brain, and whole lungs including other large organs. 7. Enzyme histochemistry: Diagnostic applications and the demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases.	6
V	8. Vital staining.	6
	9. Museum techniques.	

Suggested Readings

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft‘s Theory and Practice of Histopathological Techniques by John D Bancroft

PRACTICAL TOPICS	NO. OF HOURS
1. To cut frozen section and stain for Haematoxylin and Eosin, Metachromatic stain Toluidine blue-_o‘ and Oil Red “O‘ staining for the demonstration of fat	**105**
2. To prepare Schiff‘s reagent in the lab and do Periodic Acid Schiff‘s (PAS) stain on a paraffin section	
3. To prepare ammonical silver bath in the laboratory and stain paraffin embedded section for the demonstration of reticulin fibers.	
4. To stain a paraffin section for the demonstration of smooth muscle by Van Gieson‘s Stain	
5. To perform Masson‘s trichrome stain on a paraffin section for the demonstration of collagen fiber, muscle fiber and other cell elements.	
6. To stain the paraffin section for the demonstration of the elastic fibers (EVG).	
7. To stain Decalcified paraffin embedded section for the presence of calcium salts (Von Kossa‘s method).	
8. To stain a paraffin section for the following Mucicarmine, Alcian blue.	
9. To stain a paraffin section for the demonstration of iron (Perl‘s stain)	
10. To demonstrate the presence of bacteria and fungi in paraffin embedded sections using	

the following staining procedures: 10.1 Gram‘s staining 10.2 AFB staining (Ziehl Neilson‘s staining) for M. tuberculosis and leprae 10.3 Grocott‘s stain for fungi	

SEMESTER – VI

MEDICAL PARASITOLOGY & ENTOMOLOGY

SYLLABUS

Theory: 30 hrs; Credits: 2

Practical/Clinical: 105hrs; Credits: 3.5

RATIONALE: The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Medical Parasitology with respect to terms used in Parasitology.	1
	2. Protozoology/ Protozoal parasites: 2.1 General characteristics of protozoa. 2.2 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp. 2.3 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Intestinal and vaginal flagellates i.e. Giardia, Trichomonas sp. 2.4 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasma sp.	5
II	3. Helminthology/ Helminthic parasites: 3.1 General characteristics of Cestodes, Trematodes and Nematodes 3.2 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of : 3.2.1 Taenia solium and saginata 3.2.2 Echinococcus granulosus 3.2.3 Hymenolepis nana 3.2.4 Schistosoma haematobium and mansoni 3.2.5 Fasciola hepatica and buski 3.2.6 Trichuris trichura 3.2.7 Trichinella spirales 3.2.8 Strongyloides stercoralis 3.2.9 Ancylostoma duodenale 3.2.10 Enterobius vermicularis 3.2.11 Ascaris lumbricoides 3.2.12 Wuchereria bancrofti 3.2.13 Dracunculus medinensis	10
III	4. Diagnostic procedures: 4.1 Examination of Stool for parasites 4.1.1 For intestinal protozoal infections 4.1.2 General rules for microscopic examination of stool samples 4.1.3 Collection of stool samples 4.1.4 Preparation of material for unstained and stained preparations 4.1.5 Staining methods i.e. Iodine staining and permanent staining 4.1.6 For Helminthic infections 4.1.6.1 Introduction, direct smear preparation and examination 4.1.6.2 Concentration techniques i.e. Flotation and sedimentation techniques 4.1.6.3 Egg counting techniques 4.1.7 Examination of blood for parasites 4.1.7.1 Preparation of thin and thick blood film	5

	4.1.7.2 Leishman staining 4.1.7.3 Examination of thick and thin smear 4.1.7.4 Field's stain 4.1.7.5 JSB stain	
IV	5. Examination of blood film for Malarial parasite and Microfilariae	1
	6. Collection, Transport, processing and preservation of samples for routine parasitological investigations	1
	7. Morphology, life cycle and lab-diagnosis of Giardia and Entamoeba	1
V	8. Morphology, life cycle and lab-diagnosis of Roundworms and Hookworms	1
	9. Morphology, life cycle and lab-diagnosis of T. solium and T. saginata	1
	10. Morphology, life cycle and lab-diagnosis of Malarial parasite with special reference to P.vivax and P. falciparum	1
	11. Laboratory diagnosis of hydatid cyst and cysticercosis	1
	12. Concentration techniques for demonstration of Ova and Cysts (Principles and applications)	2

SUGGESTED READINGS

1. Parasitology in relation to Clinical Medicine by K D Chatterjee
2. Medical Entomology by A.K. Hati, Pub. Allied Book Agency
3. Medical Parasitology by D.R. Arora
4. Clinical Parasitology by Paul Chester Beaver
5. Textbook of medical Parasitology by Paniker
6. Text book of Microbiology by Baveja

NO. OF UNITS	PRACTICAL/ CLINICAL TOPICS	NO. OF HOURS
I	Routine stool examination for detection of intestinal parasites with concentration methods: 1.1 Saline preparation 1.2 Iodine preparation 1.3 Floatation method 1.4 Centrifugation method 1.5 Formal ether method 1.6 Zinc sulphate method	30
II	1.4 Centrifugation method 1.5 Formal ether method 1.6 Zinc sulphate method	10
III	Identification of adult worms from models/slides: 2.1 Tapeworm 2.2 Tapeworm segments	5
IV	2.3 Ascaris (Round worm) 2.4 Hookworms 2.5 Pinworms	30
V	Malarial parasite: 3.1 Preparation of thin and thick smears	30

	3.2 Staining of smears 3.3 Examination of smears for malarial parasites (P. vivax and P. falciparum)	

ADVANCED HAEMATOLOGY
SYLLABUS
Theory: 30 hrs ;Credit:s 2
Practical/Clinical:105hrs; Credits: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Laboratory diagnosis of Iron deficiency anemia	6
	2. Laboratory diagnosis of Megaloblastic anemia & Pernicious anemia	
II	3. Classification and Laboratory diagnosis of Hemolytic anemia	6
	4. Definition, classification and laboratory diagnosis of Leukemia	
III	5. Chromosomal studies in various hematological disorders and their significance.	6
IV	6. Laboratory diagnosis of bleeding disorders with special emphasize to 6.1 Hemophilia A, B & Von-Willebrand disease 6.2 DIC 6.3 Platelet disorder (Qualitative and quantitative)	6
V	7. Laboratory approach for investigating thrombosis.	6

SUGGESTED READINGS

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Practical Haematology by JB Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henary
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's clinical Haematology in medical practice
7. Postgraduate Haematology by Hoffbrand

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
Study and interpretation of Histogram of Automated Blood cell counter	105
To estimate serum iron and total iron binding capacity.	
Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD	
To estimate Hb-F, Hb-A2 in a given blood sample.	
To estimate plasma and urine Hemoglobin in the given specimens.	
To demonstrate the presence of Hb-S by Sickling and Solubility tests.	
Perform Hb electrophoresis (alkaline)	
Perform osmotic red cell fragility.	
Detection of Fibrin degradation products (FDPs)	

APPLIED CLINICAL BIOCHEMISTRY – II
SYLLABUS
Theory: 30 hrs ; Credits: 2
Practical/Clinical:105hrs; Credits: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Automation in clinical biochemistry 2. Method of estimation and assessment for: Glucose tolerance test, Insulin tolerance test, Xylose excretion test.	6
II	1. Gastric analysis. 2. Clearance test for renal function	6
III	1. Qualitative test for: Urobilinogens, Barbiturates, T3,T4 and TSH, Ketosteroids	6
IV	1. Enzymes: Principles, Clinical significance and Procedures for estimation of Acid phosphatase, Alkaline phosphatase, Lactate dehydrogenase, Aspartate transaminase, Alanine transaminase, Creatine phosphokinase	6
V	1. Qualitative analysis of Renal calculi. 2. Chemical examination of Cerebrospinal fluid. 3. Brief knowledge about rapid techniques in clinical biochemistry	6

PRACTICAL/CLINICAL TOPICS	NO. OF HOURS
1. Estimation of Glucose tolerance test (GTT). 2. Estimation of Insulin tolerance test(ITT).	105
1. Determination of Creatinine clearance. 2. Determination of Urea clearance. 3. Determination of Uric acid in Urine	
1. Determination of Serum acid phosphatase. 2. Determination of Serum Alkaline phosphatase	
1. Determination of Serum Lactate dehydrogenase	
1. DeterminationofT3,T4andTSH	

CYTOPATHOLOGY
SYLLABUS
Theory:30 hrs ; Credits: 2
Practical/Clinical:105hrs; Credits: 3.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Vital staining for Sex Chromatin	6
II	2. Aspiration cytology: 2.1 Principle 2.2 Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics	6
III	3. Exfoliative cytology (Papanicolaou technique for the staining of cervical smears) 3.1 Cervical cytology 3.2 Fluid Cytology 3.2.1 Urine 3.2.2 CSF 3.2.3 Body Fluids (Pleural, Pericardial, Ascitic)	6
IV	4. Automation in cytology	6
V	5. Liquid based cytology: Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune-cytochemistry	6

SUGGESTED READINGS

1. Handbook of Histopathological Techniques by C F A Culling
2. Medical Lab technology by Lynch
3. An Introduction to Medical Lab Technology by F J Baker and Silverton
4. Bancroft‘s Theory and Practice of Histopathological Techniques by John D Bancroft
5. Diagnostic Cytology by Koss Volume -II

PRACTICAL/ CLINICAL TOPICS	NO. OF HOURS
To perform Papnicolaou‘s stain on cervical smear	105
To cut frozen sections of Gynaec tissue	
To perform CSF sample and body fluids by cytospin	
.. Should know the various stains used in Cytology lab:‖ May Grunwald Giemsa, H&E, PAS, Grocott‘s.	

SEMESTER – VII

MEDICAL MYCOLOGY AND VIROLOGY

SYLLABUS

Theory: 30 hrs; Credits: 2

Practical/Clinical: 120hrs; Credits:4

RATIONALE -The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important Fungi and Viruses.

NO. OF UNITS	CONTENT	NO. OF HOURS.
VIROLOGY		
I	1. Introduction to medical virology 2. Introduction to medically important viruses 3. Structure and Classification of viruses. 4. Multiplication of viruses 5. Collection, transportation and storage of sample for viral diagnosis 6. Staining techniques used in Virology 7. Processing of samples for viral culture (Egg inoculation and tissue culture)	15
II	8. Rapid diagnosis of viral infections with special reference to HIV, HBV and HCV 8.1 EIA 8.2 Immuno fluorescence 8.3 PCR	5
MYCOLOGY		
III	1. Introduction to Medical Mycology 2. Basic concepts about superficial and deep Mycoses 3. Taxonomy and classification and general characteristics of various medically important fungi 4. Normal fungal flora 5. Morphological, cultural characteristics of common fungal laboratory contaminants	5
IV	6. Culture media used in mycology 7. Direct microscopy in Medical mycology laboratory 8. Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids	3
V	9. Techniques used for isolation and identification of medically important fungi 10. Methods for identification of yeasts and moulds 11. Dimorphism in fungi 12. Antifungal susceptibility tests 13. Preservation of fungal cultures 14. Routine myco-serological tests and skin tests	2

SUGGESTED READINGS

1. Practical Medical Microbiology by Mackie &MacCartney Volume 1 and 2
2. Text book of Microbiology by Ananthanarayanan
3. Medical Microbiology by Panikar and Satish Gupte
4. Medical Laboratory manual for tropical countries Vol. II Microbiology by Monica Cheesbrough

5. Medical Mycology by Dr. JagdishChander
6. Text book of Microbiology by Baveja
7. Essentials of medical microbiology by Apurba

NO. OF UNITS	PRACTICAL/ CLINICAL TOPICS	NO. OF HOURS
I	1. To prepare culture media used routinely in mycology	30
	2. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.	
II	3. To identify given yeast culture by performing various identification techniques studied in theory.	25
	4. To identify given mould culture by performing various identification techniques studied in theory.	
	5. To demonstrate dimorphism in fungi	
III	6. To collect and process clinical samples for laboratory diagnosis of fungal infections i.e. 6.1 Skin 6.2 Nail 6.3 Hair 6.4 Body fluids and secretions	30
IV	7. To demonstrate structure of viruses and their multiplication from charts etc.	25
	8. To perform Giemsa stain, Seller‘s stain, immune fluorescent staining procedures for diagnosis of viral infections	
V	9. Demonstration of fertilized hen egg	10
	10. Demonstration of various inoculation routes in fertilized hen egg	

BLOOD BANKING
SYLLABUS
Theory: 30 hrs; Credits: 2
Practical: 90 hrs; Credits: 3

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Blood Banking	6
	2. History and discovery of various blood group systems	
	3. ABO blood group system	
	4. Rh and other major blood group system	
	5. Sources of error in blood grouping and their elimination.	
	6. ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping	
	7. Rh grouping	
II	8. Compatibility test in blood transfusion 8.1 Collection of blood for cross matching from a blood bag 8.2 Major cross matching 8.3 Minor cross matching 8.4 Use of enzymes in blood bank specially Papain	6
	9. Complications and hazards of blood transfusion	
	10. Laboratory investigations of transfusion reactions and mismatched blood transfusion.	
III	11. Precautions while procurement and storage of grouping antisera	6
	12. Various anticoagulants used to collect blood for transfusion purposes	
	13. Selection of donor and procedure for collection of blood from a healthy donor	
IV	14. Preparation of various fractions of blood for transfusion and therapeutic purposes such as: 14.1 Packed red cells, washed red cells and FROZEN Red cells 14.2 Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets. 14.3 Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate	6
V	15. Brief introduction of blood substitute/artificial blood	6
	16. Haemopheresis: pertaining to Leucocytes, platelets and plasma	
	17. Quality control in blood bank	

SUGGESTED READINGS

1. Practical Haematology by J.B. Dacie
2. Transfusion Science by Overfield, Hamer
3. Medical Laboratory Technology by K.L. Mukherjee Volume-I
4. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein

PRACTICAL TOPICS	NO. OF HOURS
1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions	90
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	

5.1 Direct or preliminary grouping 5.2 Indirect or proof grouping 5.3 Rh grouping and determination of Du in case of Rh negative	
6. To perform Direct and Indirect Coomb‘s test	
7. To perform cross matching 7.1 Major cross matching 7.2 Minor cross matching	
8. Preparation of various fractions of blood.	

IMMUNOPATHOLOGY & MOLECULAR BIOLOGY
SYLLABUS
Theory: 60hrs; Credits: 4
Practical/Clinical:210hrs; Credits: 7

NO. OF UNITS	CONTENT	NO. OF HOURS
I	1. Introduction to Immunology	12
	2. Cells of the immune system	
	3. Types and Mechanisms of immune response	
II	4. Lymphoid organs of the Immune system	12
	5. MHC I & II	
	6. HLA Typing & Cross matching	
III	7. Transplant Immunology	12
	8. Hypersensitivity: Definition, Types, Mechanisms	
	9. Autoimmunity	
	10. Immune tolerance: Basic concepts	
	11. Introduction to Molecular Biology	
	12. Relationship of Mol. Biology with other Science	
IV	13. Molecular Biology Techniques : Principle, Reagents used, procedure and applications in Medical diagnostics 13.1 Polymerase Chain Reaction and its advanced versions 13.2 Gel electrophoresis 13.3 Western blotting	12
V	14. Chemical composition of DNA 14.1 DNA replication 14.2 DNA damage and repair 14.3 Regulation of prokaryotic and eukaryotic gene expression 14.4 Cell Cycle	12

SUGGESTED READINGS

1. Immunology by Ivan Roitt, Jonathaan Brost off and David Male
2. Immunology by Kuby
3. Medical Immunology by Daniel P Stites
4. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites
5. Elements of Biotechnology by PK Gupta
6. Watson Molecular Biology of Gene
7. Advanced Molecular Biology by R Twyman
8. Principal of Biochemistry by Lehninger

PRACTICAL/ CLINICAL TOPICS	NO. OF HOURS
1. Immuno fluorescence 1.1 Anti- Nuclear Antibody (ANA) 1.2 Anti- Neutrophil Cytoplasmic Antibody (ANCA)	210
2. AIDS Immunology and Pathogenesis (AIP)	
3. Electrophoresis	
4. Gel diffusion	
5. Nephlometery	

6. HLA 6.1 Typing Serology & Cross match 6.2 Molecular Typing	
7. ELISA for lab. diagnosis of AIDS	
8. Polymerase Chain Reaction and its advanced versions	
9. Gel electrophoresis	
10. Western blotting	
11. Isolation of DNA and RNA	
12. Estimation of DNA and RNA	
13. Determination of molecular weight and quantification of DNA using agarose gel electrophoresis	

SEMESTER VIII

MLS INTERNSHIP 540 hrs.