Faculty of Biomedical Science

JSS ACADEMY OF HIGHER EDUCATION & RESEARCH
(DEEMED TO BE UNIVERSITY) MYSURU

JSS Academy of Higher Education & Research
(Deemed to be University)
Accredited "A" Grade by NAAC
Sri Shivarathreeshwara Nagar, Mysuru – 570 015

Regulation & Syllabus

BSc MEDICAL LABORATORY TECHNOLOGY
2016

BSc AHS

REGULATIONS

B.Sc. Medical Laboratory Technology

1. Courses offered in Allied Health Sciences:

a) Bachelor of Science in Medical Laboratory Technology [B.Sc. (MLT)]
b) Bachelor of Science in Anesthesia & Operation Theatre Technology [B.Sc. (AOTT)]
c) Bachelor of Science in Renal Dialysis Technology [B.Sc. (RDT)]
d) Bachelor of Science in Respiratory Care Technology [B.Sc. (RCT)]
e) Bachelor of Science in Medical Imaging Technology [B.Sc. (MIT)]
f) Bachelor of Science in Cardiac Care Technology [B.Sc. (CCT)]
g) Bachelor of Science in Perfusion Technology [B.Sc. (PT)]
h) Bachelor of Science in Emergency Medicine Technology [B.Sc. (EMT)].
i) Bachelor of Science in Physician Assistant [B.Sc. (P A)]
j) Bachelor of Science in Optometry [B.Sc. (optometry)]

1. Eligibility for admission

A candidate seeking admission to the Bachelor of Science Degree in Allied Health Sciences [a) to j) above], shall have studied English as one of the principal subjects and shall have passed (except for B.Sc. Imaging Technology):

a) Two year Pre-University examination or equivalent as recognized by JSS University, Mysore (JSSU) with Physics, Chemistry and Biology as principal subjects of study.

OR

b) Pre-degree course from a recognized University considered as equivalent by JSSU, (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

c) Any equivalent examination recognized by the JSSU for the above purpose, with Physics, Chemistry and Biology as principal subjects of study.

OR

d) Vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted, considered equivalent to 'plus - two' [10+2] examinations of Government of Karnataka Pre University Course.

OR

e) Two years diploma from a recognized Government Board in a subject for which the candidate desires to enroll in the respective Allied Health Sciences course and shall have passed 'plus two' [10+2] with Physics, Chemistry and Biology, as principle subjects.

OR

f) Three years diploma from a recognized Government Board in a subject for which the candidate desires to enroll in the respective Allied Health Sciences course, with Physics, Chemistry and Biology as principal subjects during the tenure of the course.

OR

g) Senior secondary course with Physics, Chemistry and Biology as principal subject of study equivalent to class XII, of open school education system of the central government and state government approved institutions.

h) In case of B.Sc. Imaging Technology the candidate shall have passed Pre-University or equivalent examination with Physics, Chemistry, Biology and Mathematics, as principal subjects of study.

1. Duration of the course

Duration shall be for a period of six semesters (three years) followed by 12 months (one year) of internship.

2. Medium of instruction

The medium of instruction and examination shall be English.

3. Attendance

Candidates should have attended at least 75% of the total number of classes conducted in an academic year, from the date of commencement of the term to the last working day, as notified by the University, in each of the subjects prescribed for that year (theory, practicals, and clinical jointly) to be eligible to appear for the University examinations. Candidates lacking prescribed percentage of attendance in any subject shall not be eligible to appear for the University examination in that subject.

4. Internal assessment (IA)

There shall be a minimum of two Internal assessment examinations in theory and practical of each core subject spread over evenly in each semester. The average marks of the two IA examinations shall be submitted to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of IA examinations. Candidates have to secure 35% marks in the IA theory and practical jointly in each subject to become eligible to appear for the University examination. The marks of the IA examinations must be displayed on the notice board of the respective departments within a fortnight from the date of IA examination. If a candidate is absent for any of the IA examinations due to genuine and satisfactory reasons, such a candidate may be given a re-examination, within a fortnight.

5. Subject and hours of teaching for theory and practicals

The number of hours of teaching theory and practical, course wise in each semester are shown in table I, II, III, IV, V and VI.

There are three compulsory core subjects in each semester. Language, Allied and Skill enhancement subjects are mandatory for all courses. Candidates shall select one elective subject each in fifth and sixth semester from the list mentioned in the table VII.

Table I: Distribution of teaching hours in First Semester subjects

Category	Subjects	Theory hours	Credits	Practical hours	Credits	Total hours	Total credits
Core - 1	Anatomy	60	4	20	2	80	6
Core - 2	Physiology	60	4	20	2	80	6
Core - 3	Basic Biochemistry	60	4	20	2	80	6
Language -1	English	30	2	-	-	30	2
Language - 2	Kannada	30	2	-	-	30	2
Total Credits 18 + 2 + 2							

Table II: Distribution of teaching hours in Second Semester subjects

Category	Subjects	Theory hours	Credits	Practical hours	Credits	Total hours	Total credits
Core - 4	Pathology	60	4	20	2	80	6
Core - 5	Microbiology	60	4	20	2	80	6
Core - 6	Pharmacology	60	4	20	2	80	6
Allied - 1	Health care	30	2	-	-	30	2
Allied - 2	Psychology	30	2	-	-	30	2
Total Credits	18 + 2 + 2						

Table III: Distribution of teaching hours in Third Semester subjects

Category	Subjects	Theory hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 10	Biochemistry I	60	4	200	2	260	6
Core - 11	Pathology I	60	4	200	2	260	6
Core - 12	Microbiology I	60	4	200	2	260	6
Skill Enhancement-2	Computer application	30	2	-	-	30	2
Allied-3	Environment science and Health	30	2	-	-	30	2
Total Credits	18 + 2 + 2						

Table IV: Distribution of teaching hours in Fourth Semester subjects

Category	Subjects	Theory hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 10	Biochemistry II	60	4	200	2	260	6
Core - 11	Pathology II	60	4	200	2	260	6
Core - 12	Microbiology II	60	4	200	2	260	6
Skill Enhancement-2	Biostatistics and Research methodology	30	2	-	-	30	2
Allied-4	Constitution of India	30	2	-	-	30	2
Total Credits	18 + 2 + 2						

Table V: Distribution of teaching hours in Fifth Semester subjects

Category	Subjects	Theory hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 13	Biochemistry III	60	4	200	2	260	6
Core - 14	Pathology III	60	4	200	2	260	6
Core - 15	Microbiology III	60	4	200	2	260	6
Elective 1		30	2	-	-	30	2
Allied-5	Medical Ethics	30	2	-	-	30	2
Total Credits	18 + 2 + 2						

Table VI: Distribution of teaching hours in Sixth Semester subjects

Category	Subjects	Theory hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 16	Biochemistry IV	60	4	200	2	260	6
Core - 17	Pathology IV	60	4	200	2	260	6
Core - 18	Microbiology IV	60	4	200	2	260	6
Elective 2		30	2	-	-	30	2
Allied-6	Medical Ethics	30	2	-	-	30	2
Total Credits	18 + 2 + 2						

Table VII: Elective Subjects

Elective Subjects	Offering Departments
Fifth Semester	
Immunotechniques in diagnosis of diseases	Pathology and Microbiology
Dental Radiography	Radio diagnosis
Pulmonary Function Testing	Pulmonary Medicine
Telemedicine	Dermatology (Dr Kantharaj)
Hands on training in Continuous ambulatory peritoneal dialysis	Nephrology
Echocardiography (Cardiology)	Cardiology
Echocardiography (CTVS)	Cardio Thoracic Vascular Surgery
Difficult airway intubation	Anesthesiology
Sixth Semester	
Molecular Techniques	Biochemistry
Digital Subtraction Angiography	Radio diagnosis
Polysomnography	Pulmonary Medicine
Practice Management	Health system management studies
Renal Transplant	Nephrology
Coronary angiography	Cardiology
Intra Aortic Balloon pump	Cardio Thoracic Vascular Surgery
Ventilator management	Anesthesiology

Extension Activity

The following extension activities shall be provided for the ability enhancement of the candidates, to provide better health care services. The certificate shall be provided by the offering departments. The Basic Life Support (BLS) and Advanced Cardiac Life Support (ACLS) shall be as per the American Heart Association guidelines and certification.

Extension Activity	Courses	Semester	Offering departments
Phlebotomy	All courses	III	Anaesthesiology
Basic life support *(Optional on payment basis)	All courses	IV	Emergency medicine
Small Project/data Analysis/Industrial visit	All courses	V	Concerned departments of the Course
Advanced cardiac life support *(Optional on payment basis)	Respiratory Care Technology, Emergence Medicine Technology, Anaesthesia and OT Technology, Cardiac Care	VI	Emergency medicine

7. End Semester Examination

a) University examinations (UE): The University shall conduct examination for the core subjects at the end of each semester. The candidates, who satisfy the requirement of attendance and internal assessment, shall be eligible to appear for the University examination. The head of the institution shall verify the same before forwarding the applications to the University within stipulated time along with the prescribed fee.

b) Non-University Examinations (NUE): Examination for Languages, Allied subjects, Skill enhancement and Elective subjects shall be conducted by the college and the marks obtained shall be submitted to the University along with the IA marks of the core subjects at least 15 days before the commencement of the University examination. The marks of non-core subjects shall be incorporated in the marks card issued by the University.

c) The candidate must have passed all the previous subjects (Core/Language/Skill enhancement/Allied/elective), to appear for the sixth semester University examination.

8. Scheme ofExamination:

Distribution of subjects and marks for each semester theory and practical examinations are shown in the Table - VIII, IX, X, XI, XII and XIII.

Table VIII: Distribution of Subjects and marks for First Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 1	Anatomy	30	70	-	100	10	40	-	50
Core - 2	Physiology	30	70	-	100	10	40	-	50
Core - 3	Basic Biochemistry	30	70	-	100	10	40	-	50
Language-1	English		-	50	50	-	-	-	-
Language-2	Kannada	-	-	50	50	-	-	-	-

Table IX: Distribution of Subjects and marks for Second Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 4	Pathology	30	70	-	100	10	40	-	50
Core - 5	Microbiology	30	70	-	100	10	40	-	50
Core - 6	Pharmacology	30	70	-	100	10	40	-	50
Allied -1	Health care	-	-	50	50	-	-	-	-
Allied -2	Psychology	-	-	50	50	-	-	-	-

Table X: Distribution of Subjects and marks for Third Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 7	Biochemistry I	30	70	-	100	10	40	-	50
Core - 8	Pathology I	30	70	-	100	10	40	-	50
Core - 9	Microbiology I	30	70	-	100	10	40	-	50
Skill Enhancemen-1	Computer application	-	-	50	50	-	-	-	-
Allied-3	Environment science and Health	-	-	50	50	-	-	-	-

Table XI: Distribution of Subjects and marks for Fourth Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 10	Microbiology I	30	70	-	100	10	40	-	50
Core - 11	Pathology I	30	70	-	100	10	40	-	50
Core - 12	Biochemistry I	30	70	-	100	10	40	-	50
Skill Enhancemen-2	Biostatistics & Research methodology	-	-	50	50	-	-	-	-
Allied-4	Computer application	-	-	50	50	-	-	-	-

Table XII: Distribution of Subjects and marks for Fifth Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 13	Biochemistry III	30	70	-	100	10	40	-	50
Core - 14	Pathology III	30	70	-	100	10	40	-	50
Core - 15	Microbiology III	30	70	-	100	10	40	-	50
Elective 1		-	-	50	50	-	-	-	-
Allied-5	Medical Ethics	-	-	50	50	-	-	-	-

Table XIII: Distribution of Subjects and marks for Sixth Semester theory and practical examination

Category	Subjects	Theory				Practical			
		IA	UE	NUE	Total	IA	UE	NUE	Total
Core - 16	Biochemistry IV	30	70	-	100	10	40	-	50
Core - 17	Pathology IV	30	70	-	100	10	40	-	50
Core - 18	Microbiology IV	30	70	-	100	10	40	-	50
Elective 2		-	-	50	50	-	-	-	-
Allied-6	Hospital Management	-	-	50	50	-	-	-	-

Question paper pattern for end semester University theory examinations (70 marks)

I	Long Answers	(Answer 2 out of 3)	2 x 10 = 20
II	Short Essay	(Answer 7 out of 9)	7 x 5 = 35
III	Answer	(Answer all 5)	5 x 3 = 15
		Total =	70 marks

Question paper pattern for end semester Non-University theory examinations (50 marks)

I	Long Answers	(Answer 1 out of 3)	1 x 10 = 10
II	Short Essay	(Answer 5 out of 7)	5 x 5 = 25
III	Answer	(Answer all 5)	5 x 3 = 15
		Total =	50 marks

Examiners

a) Appointment of Examiners
Examiners shall be appointed by the University to conduct the end semester University examinations, from the panel of examiners approved by the Board of Studies. For Practical examinations, there shall be one external examiner and one internal examiner. Theory paper shall be valued by both the examiners.

b) Qualification and Experience of Examiners
For question paper setting and external examiner: Post graduation in the respective field with five years of teaching experience.
For Internal examiners: Post graduation in the respective field with three years of teaching experience.

10. Criteria for pass

Core Subjects: Candidates are declared to have passed in a subject, if they secure 40% of marks in University examination and internal assessment added together. Theory & practical shall be considered as separate subjects. If a candidate passes in practical examination but fails in theory paper, such candidate is exempted from

reappearing for practical but shall have to appear in the subsequent examination for the theory paper in which the candidate has failed OR vice versa.

Language papers, allied papers, skill enhancement and elective papers:
The minimum prescribed marks for a pass shall be 35% of the maximum marks prescribed for a subject.

11. Grading of performances

a) Letter grades and grade points allocations
Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table - XIV.

Table - XIV: Letter grades and grade points equivalent to percentage of marks and performances

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
90.00 - 100	O	10	Outstanding
80.00 - 89.99	A	9	Excellent
70.00 - 79.99	B	8	Good
60.00 - 69.99	C	7	Fair
50.00 - 59.99	D	6	Satisfactory
40.00 - 49.99	E	5	Average
Less than 40	F	0	Fail
Absent	AB	0	Fail

A candidate who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

b) The Semester Grade Point Average (SGPA)
The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C_1, C_2, C_3, C_4 and C_5 and the student's grade points in these courses are G_1, G_2, G_3, G_4 and G_5, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * ZERO + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

c) Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

where C_1, C_2, C_3,…. is the total number of credits for semester I,II,III,…. and S_1, S_2, S_3,….is the SGPA of semester I,II,III,…. .

12. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction	= CGPA of 7.50 and above
First Class	= CGPA of 6.00 to 7.49
Second Class	= CGPA of 5.00 to 5.99
Pass Class	= CGPA of 4.00 to 4.99

13. Carry over

A candidate should pass all the subjects (core/language/skill enhancement/ allied/elective) of first semester, to enter into the third semester. Similarly, second semester subjects should be cleared before entering fourth semester and third semester subjects should be cleared before entering fifth semester. However, the candidate must have passed all the previous subjects (core/language/skill enhancement/ allied/elective) to appear for the sixth semester University examination.

14. Internship

Twelve months (one year) internship shall be mandatory after successful completion of sixth semester examination. The 'Internship Completion Certificate' shall be issued by the college and copy of same is submitted to the University.

15. Award of Ranks/Medals

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more subject during the course shall not be eligible for award of ranks.

16. Award of degree

A candidate who has passed in all the subjects (core/language/allied/skill enhancement/elective papers) of all the semesters and has successfully completed the internship shall be eligible for award of degree.

17. Revaluation and Re-totaling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for re-totaling by paying prescribed fee.

18. Maximum duration for completion of course

A candidate shall complete the course within six years from date of admission, failing, which candidate shall re-register for the course.

I Semester
Core-1 Anatomy

Objectives:

At the end of the course the student Should be able to:

- Describe the structure, composition and functions of the organ systems of human body.
- Describe how the organ systems function and interrelate.
- Learn basic technical terminology and language associated with anatomy.

Learning Objectives: Skills

- Use the process of prosection to investigate anatomical structure.
- Use the microscope to learn anatomical or histological structure.
- Learn how to study, interpret and care for anatomical specimens.

Contents
Theory:

Unit I:

Organization of the Human Body **12hrs**

Introduction to the human body

Definition and subdivisions of anatomy

Anatomical position and terminology

Cell - Definition of a cell, shapes and sizes of cells

- Parts of a cell - cell membranes, cytoplasm, sub cellular organelles.

  Cell Division - Definition and main events in different stages of mitosis and meiosis.

Tissues - Tissues of the body

- Definition and types of tissues
- Characteristics, functions and locations of different types of tissues
- Epithelial tissue - definition, classification with examples
- Glands- classification with examples

Unit II :

Locomotion and Support **12hrs**

1. **Cartilage - Types with examples**
2. **Skeletal system**

Skeleton - Definition, axial and appendicular skeleton with names and number of bones, Types of bones. Marking of bones. Functions of bones.Development (types and ossification) and growth of bone.Name, location and general features of the bones of the body.

Joints - Definition and types of joints with examples. Axes and kind of movements possible. Name, location, type, bones forming, ligaments, movements possible and the muscles producing such movements of the joints of the body.

3. Muscular system

Parts of the Skeletal muscle. Definition of origin and insertion. Classification of muscular tissue. Compartment muscles of upper limb, lower limb, sternocleidomastoid

Unit III :

Maintenance of the Human Body **12hrs**

1. Cardio-vascular system

Types and general structure of blood vessels. Structure and types of arteries and veins. Structure of capillaries. Shape, size, location, coverings, external and internal features of heart. Structure of heart wall. Conducting system and blood supply of the heart. The systemic arteries and veins. Name, location, branches and main-distribution of major arteries and veins.

2. Lymphatic system

Lymph, lymphatic vessels, name, location and features of the lymphoid organs.

3. Respiratory system

Names of organs of respiration, Location and features of nose, pharynx, larynx, trachea, bronchi, lungs and pleura.

4. Digestive system

Names of organs of digestion. Location and features of mouth, pharynx, esophagus, stomach, small and large intestines. Location and features of salivary glands, pancreas, liver and gall bladder

UNIT IV.

1. Urinary system and Reproductive system **12hrs**

Names of urinary organs, location and features of kidney, ureter, urinary bladder and urethra.

Names of male and female organs of reproduction. Location and features of scrotum, testis, epididymis, vas deferens, seminal vesicle, ejaculatory duct, prostate gland, penis and spermatic cord.

Location and features of uterus & its supports, uterine tube, ovary & mammary gland.

2. Development

Gametes, period of gestation, gametogenesis, structure of sperm and ovum, growth of ovarian follicles, events of 1^{st}, 2^{nd} and 3^{rd} weeks of development, folding of embryo. Derivatives of germ layers, placenta

Unit V :

Control Systems of the Body **12hrs**

1. Nervous system

Sub-divisions of the nervous system

Brain - Sub-divisions, location external features and internal structure of medulla oblongata, pons, mid-brain, cerebellum and cerebrum.

Spinal cord - Location, extent, spinal segments, external features and internal structure.

Location and features of thalamus and hypothalamus.

Locations and subdivisions of basal ganglia. Meninges and spaces around them.

Name and location of ventricles of brain and circulation of cerebrospinal fluid.

Blood supply of the brain and spinal cord. Cranial nerves

2. Sense organs

Location and features of the nose, tongue, eye, ear and skin

3. Endocrine system

Names of the endocrine glands. Location and features of pituitary, thyroid, parathyroid, suprarenal, pancreas, ovaries and testes. Names of hormones produced by each gland.

Practical :

1. Demonstration of parts of microscope and its uses
2. Demonstration of skeleton and joint
3. Demonstration of deltoid and gluteus maximus , Cubital fossa
4. Demonstration of heart and its blood supply, demonstration of major arteries of upper limb and lower limb, histology of cardiac muscle and histology of vessels
5. Demonstration of location and parts of lungs , histology of trachea and lungs
6. Demonstration of location of stomach, small and large intestines. Location and features of pancreas, liver and gall bladder
7. Demonstration of location and features of kidney, ureter, urinary bladder and urethra. Histology of urinary system except urethra
8. Demonstration of location of male and female reproductive organs
9. Demonstration of brain and spinal cord
10. Histology of cornea and retina

Practical Examination Pattern **40 Marks**

1. Gross Anatomy- Discussion of any one specimen -10 Marks

   Disscusion of specimens of Cardiovascular system, Respiratory System, Gastrointestinal system, Urinary system, Reproductive system
2. Spotters - Cardiovascular system, Respiratory System, Gastrointestinal system, Urinary system, Reproductive system - 10x2=20 Marks
3. Histology discussion of any one demonstrated slide - 10 Marks

Recommended books:

1. Ross and Wilson: Anatomy and Physiology in Health and illness
2. Understanding Human Anatomy and Physiology, William Davis (p) MC Graw Hill
3. Essentials of Human Embryology. Bhatnagar, Orient Blackswan Pvt. Ltd.
4. Anatomy for B.Sc Nursing by Renu Chauhan. Arichal publishing company 2012
5. Hand book of Anatomy BD Chaurasia
6. Basics in Human Anatomy for B.Sc. Paramedical Courses 1st edition 2008 Jaypee Publishers

Reference books:

1. B D Chaurasia: Regional Anatomy. Vol I, II, III 6th edition

I Semester
Core- 2 Physiology

Objectives

At the end of the semester students should be able to describe

1. Blood cell counts
2. Nerve and muscle functions
3. Cardiac functions
4. Pulmonary functions
5. Renal functions
6. The actions of various hormones
7. Functions of Central nervous system and special senses

Contents:

Theory

UNIT -I

General physiology and Blood 12 Hrs

General Physiology (2 Hrs)

- Organization of the cell and its function, homeostasis
- Transport across cell membrane
- Membrane Potentials - Resting Membrane Potential & Action Potential
- Body Fluid Compartments - Normal Values

Blood (10 Hrs)

- Introduction: composition and function of blood.
- Red blood cells: erythropoiesis, stages of differentiation, function, count, physiological variation.
- Structure, function, concentration, physiological variation, methods of estimation of haemoglobin.
- White blood cells: production, function, count.
- Platelets: origin, normal count, morphology & functions.
- Plasma proteins: types, functions
- Haemostasis: definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting - Blood groups: ABO system, Rh system. Blood grouping & typing, cross matching.

  Rh system: Rh factor, Rh incompatibility. -Blood transfusion: indication.transfusion reactions.
- Anticoagulants: classification, examples and uses.

  Anaemias: morphological and etiological classification, -Blood indices: CI, MCH, MCV, MCHC.
- Erythrocyte sedimentation rate (ESR) and packed cell volume, normal values.

UNIT -II

Digestive system & Respiratory system 12hrs

Digestive System (4Hrs)

- Physiological anatomy of gastro intestinal tract, functions of digestive system.
- Salivary glands: structure and functions, deglutition: stages and regulation.
- Stomach: structure and functions. Gastric secretion: composition function regulation of gastric juice secretion.
- Pancreas : structure, function, composition of pancreatic juice
- Functions of liver. Bile secretion, composition, function. jaundice: types.
- Functions of gall bladder.
- Small intestine: functions, digestion, absorption, movements.
- Large intestine: functions, movements defecation

Respiratory system (8 Hrs)

- Functions of respiratory system, physiological anatomy of respiratory system, respiratory tract, respiratory muscles.
- Mechanism of normal and rigorous respiration, forces opposing and favoring expansion of the lungs. Intra pulmonary & intrapleural pressure.
- Surface tension, recoil tendency of the thoracic cage and lungs .
- Transport of respiratory gases: transport of oxygen & carbon dioxide, oxy haemoglobin dissociation curve, factors affecting it.
- Lung volumes and capacities - normal values
- Regulation of respiration: mechanisms of regulation, nervous and chemical regulation, respiratory centre.
- Applied physiology : hypoxia, cyanosis, dyspnoea, apnoea.

UNIT -III

Cardiovascular and Endocrine system 12hrs

Cardiovascular system (7Hrs)

- Heart: Physiological Anatomy, Nerve supply.
- Properties of cardiac muscle, cardiac cycle:
- Conducting System of Heart, Origin and Spread of Cardiac Impulse
- Electrocardiogram (ECG) waves and normal duration. Recording
- Cardiac Cycle: Phases and Volume Changes
- Normal heart sounds, areas of auscultation. Pulse: jugular, radial pulse,
- Cardiac output : definitions of stroke volume, cardiac index, factors Affecting It. measurement of Cardiac output.
- General principles of circulation
- Blood pressure: definition, normal value, clinical measurement of blood pressure, hypotension, hypertension. Factors affecting it and regulation

- Physiological variations & regulation of heart rate.
- Coronary circulation.
- Shock

Endocrine System (5 Hrs)

- Classification of endocrine glands & Definition of hormone.
- Pituitary hormones: anterior and posterior pituitary hormones, secretion, functions
- Thyroid gland: physiological anatomy, hormone secreted, physiological function, regulation, secretion, disorders (hypo and hyper secretion of hormone).
- Adrenal cortex: physiological anatomy. cortical hormones, functions and regulation.
- Adrenal medulla: hormones, regulation and secretion. Functions of adrenaline and nor adrenaline.
- Hormones of pancreas. Insulin: secretion, regulation, function and action.

  Diabetes mellitus: regulation of blood glucose level.
- Parathyroid gland: function, action, regulation of secretion of parathyroid hormone.

  Calcitonin:

UNIT -IV

Excretory system and Reproductive system 12 hrs

Excretory System (8Hrs)

- Functional anatomy of kidney
- Juxta glomerular apparatus: structure and function.
- Glomerular filtration
- Tubular function(reabsorption and secretion)
- Micturition, innervation of bladder, cystometrogram.
- Artificial kidney, renal function tests skin and body temperature

Reproductive system (4Hrs)

- Male reproductive system: functions of testes, spermatogenesis: Endocrine functions of testes -Female reproductive system: oestrogen, progesteron, menstrual cycle: ovulation, physiological changes during pregnancy, pregnancy tests.
- Lactation: composition of milk, factors controlling lactation.

UNIT -V

Muscle nerve physiology, Nervous system and Special senses 12hrs

Muscle nerve physiology (3Hrs)

- Classification and properties of neuron and neuroglia. Classification of nerve fibers
- Classification of muscle, structure of skeletal muscle,
- Neuromuscular junction. Transmission across nmj
- Excitation contraction coupling. muscle tone, fatigue, rigor mortis

Nervous system (5Hrs)

- Organisation of nervous system
- Synapse: structure, types, properties.
- Receptors: definition, classification, properties. Sensations-pain
- Organization Spinal cord. Ascending tracts, descending tracts.
- Reflex : definition reflex arc, clinical classification of reflexes : Babinski's sign.
- Hypothalamus- functions
- Cerebral cortex lobes - functions,
- Cerebellum- functions
- Basal ganglia functions.
- Cerebro Spinal Fluid (CSF) : formation, circulation & reabsorption . composition and functions. Lumbar puncture.
- Autonomic Nervous System: Sympathetic and parasympathetic distribution

Special senses (4Hrs)

- Vision: structure of eye, function of different parts. Structure of retina. visual pathway, errors of refraction
- Hearing: structure and functions of ear.
- Taste : taste buds and taste pathway.
- Olfaction : receptors, pathway.

Practicals (20 Hrs)

1. Haemoglobinometry.
2. Haemocytometry
3. Total leucocyte count.
4. Total Red blood cell count.
5. Determination of blood groups.
6. Differential WBC count.
7. Determination of clotting time, bleeding time.
8. Erythrocyte sedimentation rate (ESR). Determination of packed cell Volume, Calculation of Blood indices: CI, MCH, MCV, MCHC.
9. Blood pressure recording.
10. Spirometery, Artificial Respiration

Practical Examination : 40 Marks

1. Estimation of Hemoglobin. - 10 marks
2. Determination of Blood Groups. - 10 marks
3. Determination of Bleeding and Clotting time. - 10 marks
4. Spotters - Haemocytometer, (Identification of cells) Differential Count, Sphygmomanometer, Spirometer . - 10 marks

Recommend Books

1. A.K.Jain, Human Physiology and Biochemistry for physical therapy and occupational Therapy, 1st edition Arya publication.
2. Dr. Venkatesh .D and Dr. Sudhakar H.S.Basic of medical physiology, 2nd edition, Wolter-Kluwer publication.
3. Chaudhari (Sujith K) Concise Medical Physiology 6th Ed. New Central Book.

Reference Books

1. A.K.Jain, Text book of Physiology for medical students, 4th edition Arya publiction.
2. Guyton (Arthur) Text Book of Physiology.11th Ed. Prism publishers.
3. Ganong (William F) Review of Medical Physiology. 23rd Ed . Appleton.

I Semester

Core- 3- Basic Biochemistry

Unit I **12hrs**

Chemistry of Cell & Chemistry of Carbohydrates, Proteins, Lipids &Nucleotides-

Cell- Structure & Function of Cell Membrane, Subcellular Organelles and their Functions.

Carbohydrates- Definition, Classification & Biological importance of carbohydrates, Derivatives of Monosaccharides.

Proteins- Definition & Classification of amino acids & Proteins, Biologically important peptides Plasma proteins, Immunoglobulins.

Lipids- Definition, Classification & Biological importance and Functions of Lipids. Structure and functions of Cholesterol, types and functions of Lipoproteins.

Nucleotides- Structure and Functions of DNA & RNA. Biologically important nucleotides.

Unit II **12hrs**

Enzymes & Acid base balance

Enzymes- Definition and Classification. Factors affecting enzyme activity. Coenzymes and Cofactors. Enzyme inhibition & Regulation of enzyme activity

Acid Base balance- Acids, Bases & Body Buffers, Regulation of pH, Acid base disorders.

Unit III **12hrs**

Vitamins & Minerals

Vitamins-Classification, Sources, RDA, Functions(in brief), deficiency manifestations and hypervitaminosis.

Minerals- Classification, Sources, RDA, Functions (in Brief), deficiency manifestations of the following: calcium, phosphorous, iron, copper, iodine, zinc, fluoride, magnesium, selenium, sodium, potassium and chloride.

Unit IV **12hrs**

Nutrition, Blood chemistry & Urine Chemistry

Nutrition- Nutrients, Calorific value of food, BMR, SDA, respiratory quotient and its applications, Balanced diet based on age, sex and activity, biological value of proteins, nitrogen balance, Protein energy malnutrition, Total parenteral nutrition, dietary fibers.

Blood chemistry- Biochemical components & their reference ranges in normal & diseased states.

Urine chemistry- Biochemical components & their reference ranges in normal & diseased states

Unit V **12hrs**

Clinical Biochemistry- 10 hrs

Specimen Collection - Blood, Urine and Body fluids.

Preanalytical, analytical and postanalytical errors

Clinical Biochemistry- Parameters to diagnose Diabetes & Cardiovascular diseases.

Diagnostic enzymology, Assessment of arterial Blood gas status and electrolyte balance, Point of Care Testing. Renal Function tests(in brief), Liver function tests(in brief), Biomedical Waste Management.

Practicals

1. General Reactions of Carbohydrates.
2. Color reactions of Proteins.
3. Reactions of Non Protein nitrogenous substances.
4. Demonstration of pH meter, Colorimeter and spectrophotometer.
5. Demonstration of Chromatography and Electrophoresis.

Practical Examination

1. Identification of Substance of physiological importance - 10 Marks
2. Color reactions of Proteins - 10 Marks
3. Spotters - 10 Marks
4. Charts on Clinical biochemistry - 10 Marks

Recommended books Recent edition

1. Textbook of Biochemistry - D.M.Vasudevan
2. Biochemistry - Pankaja Naik
3. Clinical Biochemistry - Principles and Practice - Praful. B. Godkar
4. Textbook of Biochemistry - Chatterjea and Shinde
5. Textbook of Clinical Chemistry - Norbert W Teitz

Reference Books Recent Edition

1. Harpers Biochemistry
2. Clinical Biochemistry-Michael L. Bishop
3. Textbook of Biochemistry-Rafi M.D
4. Lippincott's Illustrated review of Biochemistry
5. Practical Clinical Biochemistry-Harold Varley

I Semester

Language-1English

UNIT I

Introduction

a) Study Techniques - Reading Comprehension

Exercises on reading passages and answering questions based on the passage.

b) Organization of Effective Note Taking

Why good note-taking is important

Effective note-taking is an important practice to master at university. You have a lot of new knowledge and you need to develop reliable mechanisms for recording and retrieving it when necessary. But note-taking is also a learning process in itself, helping you to process and understand the information you receive.

c) Use of the Dictionary

Tips on how to use the dictionary

1. Choose the right dictionary.
2. Read the introduction.
3. Learn the abbreviations.
4. Learn the guide to pronunciation.
5. Looking Up a Word
   a) Find the section of the dictionary with first letter of your word.
   b) Read the guide words.
   c) Scan down the page for your word.
   d) Read the definition.
6. Online dictionaries
7. Research various facts.
8. Thesaurus

It is a dictionary of synonyms and antonyms, such as the online Thesaurus.com.

Enlargement of Vocabulary

Roots : A to G

Effective Diction

Foreign Expressions - meaning and pronunciation

UNIT II

Applied Grammar

a) Correct Usage

The Eight Parts of Speech

1. Noun
2. Pronoun
3. Adjective
4. Verb
5. Adverb
6. Preposition
7. Conjunction
8. Interjection

b) The Structure of Sentences

What is a sentence?

What are clauses?

What are phrases?

Types of sentences:

1. Simple sentences
2. Compound sentences
3. Complex sentences

c) The Structure of Paragraphs

1. What is a Paragraph?

Paragraphs are comprised of sentences, but not random sentences. A paragraph is a group of sentences organized around a central topic.

2. The Secrets to Good Paragraph Writing:

Four Essential Elements

The four elements essential to good paragraph writing are: unity, order, coherence, and completeness.

4. Paragraph Structure

A paragraph consists of 3 main structures :

1. Claim
2. Evidence
3. Analysis

d) Enlargements of Vocabulary

Roots: H to M

UNIT III

Written Composition

a) Precise writing and Summarizing

1. Definition of precise:

   A precise or summary is an encapsulation of someone's writing or ideas.

   Technically it should be one - third the length of the actual passage given.

2. Definition of summary:

   Summaries may not always follow a direct line through what they're summarizing - if you want to summarize someone else's ideas in a few sentences, it might make more sense if you begin with their conclusion, and work back to the arguments they use to develop that conclusion.

Guidelines to follow while writing a summary are:

1) Divide…and conquer.
2) Read.
3) Reread.
4) One sentence at a time.
5) Write a thesis statement.
6) Check for accuracy.
7) Revise.

b) Writing of a Bibliography

I. What is a bibliography?

A bibliography is an alphabetical list of all materials consulted in the preparation of your assignment.

II. What is an annotated bibliography?

An annotated bibliography is an alphabetical list of books or articles for which you have added explanatory or critical notes.

III. Why you must do a bibliography?

a) To acknowledge and give credit to sources of words, ideas, diagrams, illustrations and quotations borrowed, or any materials summarized or paraphrased.

b) To show that you are respectfully borrowing other people's ideas, not stealing them, i.e. to prove that you are not plagiarizing.

IV. What must be included in a bibliography?

[redacted]hor

[redacted]

[redacted]e of publication

[redacted]lisher

[redacted] date of publication

[redacted]e number(s) (for articles from magazines, journals, periodicals, newspapers, encyclopedias, or in anthologies).

V. Writing a bibliography in MLA style

1. Standard Format for a Book:

Author. Title: Subtitle. City or Town: Publisher, Year of Publication.

If a book has no author or editor stated, begin with the title. If the city or town is not commonly known, add the abbreviation for the State or Province.

2. Standard Format for a Magazine, Periodical, Journal, or Newspaper Article:

Author. "Title: Subtitle of Article." Title of Magazine, Journal, or

Newspaper Day, Month, Year of Publication: Page Number(s).

c) Enlargement of Vocabulary

Roots - N to S

UNIT IV:

Reading and Comprehension

a) Review of selected materials and express oneself in one's words

Seminar for students on powerpoint presentation and book review.

b) Enlargement of Vocabulary

Roots - T to Z

UNIT V:

The study of Varioius forms of Composition

a) Paragraph

Exercises for students on short paragraph topics.

b) Essay

How to Write an Essay

The writing of an essay has three stages :

1. Essay writing
2. Close reading
3. Research

c) Letter

Mechanics of writing formal and business letters.

Exercises on writing letters for students.

d) Summary

Writing reports: project report, magazine article and reporting in newspapers on sporting events.

e) Practice In Writing

Exercises and assignments on report writing for students.

UNIT VI:

Verbal Communication

a) Discussions And Summarization

Tips on taking minutes of a meeting

Why Meeting Minutes Matter

Meeting minutes are important. They capture the essential information of a meeting - decisions and assigned actions. The following instructions will help you take useful and concise meeting minutes.

Before the Meeting

If you are recording the minutes, make sure you aren't a major participant in the meeting. You can't perform both tasks well.

Create a template for recording your meeting minutes and make sure you leave some blank space to record your notes.

Decide how you want to record your notes. If you aren't comfortable relying on your pen and notepad, try using a tape recorder or, if you're a fast typist, take a laptop to the meeting.

During the Meeting

As people enter the room, check off their names on your attendee list. Ask the meeting lead to introduce you to meeting attendees you aren't familiar with. This will be helpful later when you are recording assigned tasks or decisions.

After the Meeting

Review the notes and add additional comments, or clarify what you didn't understand right after the meeting.

a) Debates

Group Discussions:

1. Do's in a group discussion:

- Be confident. Introduce yourself with warm smile and get into topic soon.
- Have eye contact with all group members
- Learn to listen.
- Be polite.
- Be a good team player. Move with all group members and help them when needed.

2. Don'ts in a group discussion:

- Don't be harsh when you are interrupted.
- Don't interrupt the other person
- Don't try to push your ideas on others.
- Don't argue. Everyone is free to express their ideas.

c) Oral Reports

An oral report is a presentation, usually done for a student's teacher and classmates, though it can also be done for a larger segment of the school community, for parents, or for a more open group, depending on the circumstances. For example, at a science fair, a student might present a report on his or her project periodically for the class, for other visitors who pass by, and for judges.

d) Use in Teaching

Writing of dialogues

Originating from dialogos, the Greek word for conversation, the term dialogue refers to a verbal conversation between two or more people.

When writing dialogues, it is important to adhere to specific grammar rules. The following points need to be remembered while writing dialogues for role play.

1. Quotation Marks
2. Periods
3. Question Marks
4. Commas
5. Capitalization and Paragraphs
6. How Dialogue Enhances Writing

Dialogue reveals information about the speaker(s) within a written work. Dialogue also enhances the story line and plot.

a) Exposes Character Traits

Through indirect characterization, dialogue reveals details about a character by what they say, how they say it, and perhaps what they choose not to say.

b) Unveils Mood/Emotions

A character's word choice, description of tone, and choice of language reveal the inner state of the character without directly "telling" the audience. Showing instead of telling creates a deeper understanding of the character through the eyes of the reader or audience.

c) Reveals Motivation/Influences

Dialogue can illuminate a character's internal motivation or desires.

d) Establishes Relationships

Seeing how a character addresses and responds to other characters shows the type of relationships that they form and where their relationships currently stand. Dialogue can demonstrate how relationships change throughout the course of the story. It can show how a character changes or responds to various situations.

Exercises for students on preparing a dialogue exchange between two people

1. On the street (with a vegetable vendor)
2. At college with a lecturer (regarding admissions)
3. In a bank with the manager (for opening a bank account)
4. Telephone conversation with a hotel receptionist (make room reservations)
5. Telephone conversation (taking an appointment with the dentist/doctor)

I Semester

Language 2- Kannada

PÀ£ÀßqÀ : MAzÀÄ

¥ÀoÀåPÀæªÀÄzÀ ±ÀÃ¥ÀðPÉ

¸ÀAiÉÄ : ©.J¸ï.¹. (C¯ÉÊqï ºÉ¯ïÛ ¸ÉÊ£ïì¸ï) ªÉÆzÀ®ªÀµÀð

¸ÀªÀÄAiÀÄ : 30 WÀAmÉUÀ¼ÀÄ (ªÀÄÆªÀvÀÄ WÀAmÉUÀ¼ÀÄ)

¥ÀoÀåPÀæªÀÄzÀ «ªÀgÀuÉ : «zÁåyðUÀ½UÉ ¸ÀA¥ÀQð¸ÀÄ§ºÀÄzÁzÀ ¸ÀÄ®¨sÀªÁzÀ PÀ£ÀßqÀzÀ ¸ÀA¸ÀÌøwAiÀÄ ¸ÁªÀiÁfPÀ ªÀÄvÀÄÛ ¸ÁA¸ÀÌøwPÀ ºÉÆ¼ÀºÀÄUÀ¼À£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀ ¥ÀoÀåPÀæªÀÄzÀ ªÀÄÆ®PÀ ¨sÁµÁ ¸ÁªÀÄxÀåðªÀ£ÀÄß ªÀÈ¢Þ¸ÀÄªÀÅzÀÄ.

GzÉÝÃ±À : ¢£À§¼ÀPÉAiÀÄ ªÀåªÀºÁgÀzÀ°è ¸ÀéAvÀªÁV ¸ÀA§A¢ü¹zÀAvÉ PÀ£ÀßqÀ ¨sÁµÉAiÀÄ §¼ÀPÉAiÀÄ£ÀÄß ¥ÀjZÀ¬Ä¸ÀÄªÀÅzÀÄ. PÀ£ÀßqÀ ¨sÁµÉAiÀÄ ¥ÀjZÀAiÀÄ ªÀiÁrPÉÆqÀÄªÀÅzÀÄ.

¥ÀoÀåPÀæªÀÄzÀ «ªÀgÀuÉ

WÀlPÀ MAzÀÄ (JgÀqÀÄ WÀAmÉUÀ¼ÀÄ) : CPÀëgÀªÀiÁ¯É, ¸ÀégÀUÀ¼ÀÄ, ªÀåAd£ÀUÀ¼ÀÄ, PÁUÀÄtÂvÀ, §gÀªÀtÂUÉ, C©ü¸À.

ZÀlÄªÀnPÉ : 1. PÀ£ÀßqÀ ªÀtðªÀiÁ¯ÉAiÀÄ CPÀëgÀUÀ¼À£ÀÄß §gÉ¬Äj.

WÀlPÀ JgÀqÀÄ (JgÀqÀÄ WÀAmÉUÀ¼ÀÄ) : ¥ÀzÀ¥ÀjZÀAiÀÄ, ¥ÀzÀ¥ÀÄAd, ¢£À§¼ÀPÉAiÀÄ ¥ÀzÀUÀ¼ÀÄ, ¸ÀA§AzsÀUÀ¼ÀÄ, £ÁªÀÄ¥ÀzÀ, ¸ÀªÀð£ÁªÀÄ, CAQUÀ¼À ¥ÀjZÀAiÀÄ, ¥Àæ±ÁßxÀðPÀ ¥ÀzÀUÀ¼ÀÄ.

ZÀlÄªÀnPÉ : 1. ¤ªÀÄUÉ w½¢gÀÄªÀ «±ÉõÀt ºÁUÀÆ ¸ÀªÀðAiÀÄ ¥ÀzÀUÀ¼À£ÀÄß ¥ÀnªÀiÁr.
2. ¤ªÀÄUÉ w½¢gÀÄªÀ wAr – w¤¸ÀÄUÀ¼À ºÉ¸ÀgÀÄUÀ¼À£ÀÄß ¥ÀnªÀiÁr.

WÀlPÀ ªÀÄÆgÀÄ (JgÀqÀÄ WÀAmÉUÀ¼ÀÄ) : ºÀtÄ, vÀgÀPÁj, CªÀAiÀÄ, wAr – w¤¸ÀÄUÀ¼À ¥ÀjZÀAiÀÄ, zÉÃºÀzÀ CAUÀUÀ¼À ¥ÀjZÀAiÀÄ, «±ÉõÀ §tÚUÀ¼À ºÉ¸ÀgÀÄUÀ¼À ¥ÀjZÀAiÀÄ.

ZÀlÄªÀnPÉ : ºÉÃ¼ÀÄªÀ «ªÀgÀ w½AiÀÄ®Ä D¸ÀàvÉæAiÀÄ°è §¼À¸ÀÄªÀ £ÁªÀÄ¥ÀzÀUÀ¼À ¥ÀnÖ ªÀiÁr.

WÀlPÀ £Á®Ì (JgÀqÀÄ WÀAmÉUÀ¼ÀÄ) : ¸ÀAªÀºÀ£À ¥ÀzÀUÀ¼ÀÄ, D¸ÀàvÉæAiÀÄ°è §¼À¸ÀÄªÀ «±ÉõÀ £ÁªÀÄ¥ÀzÀUÀ¼À ¥ÀjZÀAiÀÄ, £ÁªÀÄ¥ÀzÀUÀ¼À ¥ÀnÖ.

ZÀlÄªÀnPÉ : ¸ÀAªÀºÀ£ÀzÀ ªÀiÁvÀÄ ºÉÃ¼ÀÄªÀ £ÀqÀªÀ½PÉ ¸ÀA¨sÁµÀuÉAiÀÄ ªÀiÁzÀj ¥ÀjZÀ¬Ä¹.

WÀlPÀ LzÀÄ (JgÀqÀÄ WÀAmÉUÀ¼ÀÄ) : ¸ÀAªÀºÀ£À ºÁUÀÆ ºÉÃ¼ÀÄªÀ £ÀqÀªÀ½ ¸ÀA¨sÁµÀuÉ CxÀð ªÀiÁqÀÄªÀ ¥ÀjZÀAiÀÄ.

CzsÀåAiÀÄ£ÀPÉÌ ¥ÀÄ¸ÀÛPÀUÀ¼À ¥ÀnÖ

1.	PÀ£ÀßqÀ ªÀåPÀgÀt (8,9 ªÀÄvÀÄÛ 10£Éà vÀgÀUÀwUÀ½UÉ PÀ£ÁðlPÀ ¸ÀPÁðgÀ, ¥ÀoÀå¥ÀÄ¸ÀÛPÀ E¯ÁSÉ)		
2.	ªÀiÁºÀjPÀ£ÀßqÀ	:	JZï.¸É.
3.	¥ÀvÀæ¯ÉÃR£À	:	PÀ£ÀßqÀ¸Á»vÀå¥ÀjµÀvÀÄ
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5.	DqÀÄ¨sÁµÉ ªÀÄvÀÄÛ EvÀgÀ ¥À§AzsÀUÀ¼ÀÄ	:	qÁ|| ¦.J¸ï.ºÁ¥Àðgï
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PÀ£ÀßqÀ: JgÀqÀÄ

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¸ÀAiÉÄ : ©.J¸ï¹(C¯ÉÊqï ºÉ¯ïÛ ¸ÉÊ£ïì¸ï) ªÉÆzÀ® ªÀµÀð

¸ÀªÀÄAiÀÄ : 30 WÀAmÉUÀ¼ÀÄ (ªÀÄÆªÀvÀÄ WÀAmÉUÀ¼ÀÄ)

GzÉÝÃ±À : dUÀwÛ DzÀåvÉAiÀÄ §UÉÎ ¸ÀªÀÄzÁAiÀÄPÉÌ w½¹PÉÆqÀÄªÀÅzÀÄ.

II Semester
Core 4-General Pathology

Unit I-

Introduction- & scope of pathology **12hrs**

Cell injury and Cellular adaptations- Normal cell, Cell injury- types, etiology, morphology, Cell death-autolysis, necrosis, apoptosis, Cellular adaptations- atrophy, hypertrophy, hyperplasia, metaplasia.

Inflammation-Introduction, acute inflammation-vascular events, cellular events, chemical mediators, chronic inflammation- general features, granulomatous inflammation, tuberculosis.

Healing and repair- Definition, different phases of healing, factors influencing wound healing, fracture healing.

Haemodynamic disorders- Oedema, hypermia, congestion, haemorrhage, embolism, thrombosis, infarction.

Neoplasia- defintion, nomenclature, features of benign and malignant tumors, spread of tumors, dysplasia, carcinoma in situ, precancerous lesions.

Environmental and nutritional pathology-smoking, radiation injury, malnutrition, obesity, vitamin deficiencies.

Unit II-

Haematological Disorders **12hrs.**

Introduction and Haematopoiesis

Anaemia-introduction and classification (morphological and etiological), iron deficiency anemia: distribution of body iron, iron absorption, causes of iron deficiency, lab findings, megaloblastic anamia: causes, labfindings, haemolytic anemias: definition. Causes, classification and labfindings.

WBC disorders- quantitative disorders, leukemia-introduction and classification, acute leukemias, chronic leukemias.

Bleeding disorders- introduction, physiology of hemostasis. Classification, causes of inherited and acquired bleeding disorders, thrombocytopenia, DIC, laboratory findings. Pancytopenia.

Unit- III

Basic Hematological Techniques **12 hrs**

Characteristics of good technician, Blood collection- methods (capillary blood, venipuncture, arterial puncture) complications, patient after care, anticoagulants, transport of the specimen, preservation, effects of storage, separation of serum and plasma, universal precautions, complete hemogram- CBC, peripheral smear, BT, CT, PT, APTT, ESR, disposal of the waste in the laboratory.

UNIT IV-

Transfusion Medicine **12 hrs**

Selection of donor , blood grouping, Rh typing, cross matching, storage, transfusion transmitted diseases, transfusion reactions, components- types, indications.

UNITV-

Clinical Pathology **12 hrs**

- Introduction to clinical pathology- collection, transport, preservation, and processing of various clinical specimens.

Urinalysis- collection. Preservatives, physical, chemical examination and microscopy, physical examination; volume, color, odor, appearance, specific gravity and ph, chemical examination; strip method- protein- heat and acetic acid test, sulfosalicylic acid method, reducing sugar- benedicts test, ketone bodies- rotheras test, bile pigments- fouchet method, bile salt- hays method, blood- benzidine test, urobilinogen and porphobilinogen- ehrlich aldehyde and schwartz test, bence jones protein., microscopy.

Examination of cerebrospinal fluid-physical examination, chemical examination, microscopic examination, examination of body fluids (pleural, pericardial and peritoneal), physical examination, chemical examination, microscopic examination, sputum examination.

Practicals:

Laboratory organization-

Reception of specimen, dispatch of reports, records keeping, coding of cases.

Laboratory safety guidelines.

SI units and conventional units in hospital laboratory.

Haematology techniques

Basic requirements for hematology laboratory

Glasswares forhematology

Equipments for haematology.

Anticoagulant vials

Complete blood counts.

Determinations of haemoglobin.

RBC count and TLC by hemocytometer.

Differential leukocyte count.

Determination of platelet count

Determination of ESR and PCV.

Erythrocyte Indices- MCV, MCH, MCHC.

Reticulocyte count

Absolute eosinophilic count

Morphology of blood cells

Urinanalysis

Examination of cerebrospinal fluid

Examination of body fluids (pleural, pericardial, peritoneal)

Sputum examination.

Practical Examination- 40 marks.

Spotters- 10 marks.

Estimation of Haemoglobin or blood grouping- 10 marks.

Urine analysis- 10 marks.

Determination of ESR and PCV- 10 marks.

1.Recommended Books Recent Editions.

1. Basic Pathology Robbins Saunders, an imprint of Elsevier Inc., Philadelphia, USA.
2. Text book of Pathology Harsha Mmohan Jaypee Brothers, New Delhi.
3. Practical Pathology P. Chakraborthy, Gargi Chakarborty New Central book agency, Kolkata.
4. Text book of Haematology Dr Tejinder Singh Arya Publications, Sirmour (H P)
5. Text book of Medical Laboratory Technology Praful Godkar Bhalani Publications house, Mumbai.
6. Textbook of Medical Laboratory Technology Ramanik sood
7. Practical Haematology Sir John Dacie Churchill Livingstone, London.
8. Todd and Sanford, Clinical Diagnosis and Management by Laboratory
9. Methodsjohn Bernard Henry, All India Traveller Bookseller.
10. Histopathology Techniques, Culling.
11. Histopathology Techniques Bancroft
12. Diagnostic Cytopathology Koss
13. Diagnostic Cytopathology Winfred Grey
14. Hand book of Medical Laboratory Technology, CMC Vellore
15. Basic Haematological Techniques Manipal.

II Semester
Core 5- Microbiology
Theory

Unit - I

General Microbiology **12 hrs**

1. Morphology and classification of microorganisms.
2. Growth, nutrition and multiplication of bacteria
3. Sterilization and Disinfection-Principles and use of equipments of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization, antiseptics and disinfectants
4. Immunology - antigen, Antibodies, Immunity, vaccines, types of vaccine and immunization schedule.
5. Hospital acquired infection - Causative agents, transmission methods, investigation, prevention and control of hospital Acquired infections.

Unit - II

Bacteriology **12 hrs**

Classification of bacteria, morphology, infections, lab diagnosis, treatment and prevention of common bacterial infections. Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium diphtheriae, Clostridia, Enterobacteriaceae - Shigella, Salmonella, Klebsiella, E.coli, Proteus, Vibrio cholerae, Pseudomonas and Spirochetes

Unit III -

Mycobacteriology & Parasitology **12 hrs**

Mycobacteria- classification, pathogenesis, lab diagnosis and prevention
Classification, infections and lab diagnosis of following parasites. Entamoeba, Giardia, Malaria, Hookworm, Roundworm and Filarial worms.

Unit IV -

Mycology **12 hrs**

Morphology, disease caused and lab diagnosis of following fungi. Candida, Cryptococcus, Dermatophytes, opportunistic fungi (Aspergillus, Zygomycetes and Penicillium)

UnitV -

Virology **12 hrs**

General properties of viruses, diseases caused lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Dengue, Influenza, Chikungunya, Rabies and Poliomyelitis.

Practicals: 20 hours

1. Compound microscope and its application in microbiology
2. Demonstration of sterilization equipments: hot air oven, autoclave, bacterial filters. Demonstration of commonly used culture media, nutrient broth, nutrient agar, blood agar, chocolate agar, Mac conkey medium, L J media, Robertson cooked meat media, MacConkey agar with LF & NLF, Nutrient agar with staph colonies.Anaerobic culture, Methods and Antibiotic susceptibility test.
3. Demonstration of common serological tests: Widal, VDRL, ASLO, CRP, RF, Rapid tests for HIV, Hbsag and HCV.
4. Grams staining.
5. Acid fast staining.
6. Principles and practice of Biomedical waste management
7. Stool Microscopy

Practical examination pattern

Spotters (10 spotters carrying 2 marks each) 20 marks

Culture media - 6

Equipments - 2

Slides - 2

Discussion:

1.Gram stain 10 marks

2.Ziehl- Neelsen stain 10 marks

Reference Books

1. Anathanarayana&Panikar: Medical Microbiology - Revised 8th Edition University Press.
2. Parasitology by Chatterjee - Interpretation to Clinical medicine.
3. Textbook of microbiology- Baveja, 5th edition, Arya publications
4. Textbook for laboratory technicians by RamnikSood. Jaypee publishers
5. Textbook of parasitology by Paniker. 7th edition

II Semester
Core- 6- Pharmacology

UNIT I-

General Pharmacology, ANS, PNS. - 12 Hrs

Sources of Drugs

Route of drug administration

Pharmacokinetics (Absorption, Metabolism, Distribution, Excretion)

Pharmacodynamics (Mechanisms of action)

Adverse drug reactions

ANS : ADRENERGIC drugs -Adrenaline, Noradrenaline, Ephidrine, Dopamine, Dobutamine

Anti adrenergic-Phentolamine, Phenoxybenzamine, Prazocin, Tamsulosin, Propranolol, Atenolol, Carvidelol

Cholinergic drugs-Acetyl choline, Pilocarpine, Neostigmine, Organophosphorous compounds

Anti cholinergic agents-Atropine, Glycopyrrolate, Ipratropium Bromide, Dicyclomine

Unit II-

PNS, CVS, Renal system - 12 hrs

Skeletal muscle relaxants-D Tubocurarine, Succinyl choline, Diazepam, Dantroline

Local anaesthetics-lignocaine, la+vasoconstrictor

CVS-ionotropic agents -Digoxin,

Antianginal drugs-GTN,

Antihypertensives- Betablockers (Propranolol, Atenolol, carvidelol) ,CCBs (Nifedeine), Diuretics(Thiazide, Furesemide, ace inhibitors, ARBs, Clonidine

Drugs used in treatment of different types of shock, Plasma expanders

Renal system-Diuretics Furosemide, Thiazide, Spiranolactone

Antidiuretics-Vasopressin

Unit III-

CNS, Blood - 12 hrs

CNS-general Anaesthetics-nitrous oxide, Halothane, iv anaesthetics

Sedative hypnotics-diazepam,barbiturates,zolpidem

Antiepileptics - Phenytoin, carbamezapine, phenobarbitone, valproate

Opioid analgesics-morphine,pethidine, codiene

NSAIDS-Aspirin, Diclofenacibuprofen, Selective COX2 inhibitors

Respiratory system-treatment of cough And Bronchial asthma

Blood-Hematinics, Anticoagulants -Warfarin, Heparin

Thrombolytics & Antiplatelet drugs-streptokinase,/ aspirin, clopidogrel

Unit IV-

GIT, Chemotherapy - 12 hrs

GIT-drugs used in peptic ulcer-ppi, H2 blockers, Antacids
Antiemetics -Metaclopromide, Domperidone, Ondensetron
Purgatives & Laxatives-bran, ispaghula, Lactulose, Bisacodyl &senna
Drugs used in Diarrhoea- ORS, Super ORS, Antimotility drugs (loperamide, diphenoxylate)
Chemotherapy-general considerations MOA, Resistance, Prophylaxis
Sulfonamides, cotrimoxazoles, Quinolones
Tetracyclines, chloramphenicol
Betalactam antibiotics

Unit V-

Chemotherapy , Hormones.- 12 hrs

Aminoglycosides
Macrolides, other antibiotics(vancomycin,linezolid) & treatment of UTI
Antifungal(clotrimazole,flucanozole)
Antiviral (Acyclovir, Few drugs used inHAART,)
Cancer chemotherapy
(names, common Adverse effects, general principles in the treatment of cancer)
Hormones-Corticosteroids its uses and adverse effects,
Treatment of Diabetes mellitus(insulin, Metformin, Glibenclamide)

Practicals Syllabus : -20 hrs

Dosage forms
Solid Dosage forms
Liquid Dosage forms
Gaseous Dosage forms
Oral route
Parentral routes
Novel routes
Fixed dose combination-Amoxycillin+clavulinic acid-cotrimoxazole, Lignocaine+ Adrenaline
Drug stations-Adrenaline, dopamine, Dobutamine)
Drug stations-Corticosteroids(hydrocortisone, prednisalone, inhaltional steroids)
Drug stations-common antibiotics (Amoxycillin, Ciprofloxacin, Azithromycin, Metronidazole, Cephalosporins)
Drug stations-Insulin preparations
Instrument & devices(Nasogastric tube, laryngoscope, Different Cathetors, Nebulizers, Inhalers, Rotahalers)

Practical examination : 40 marks

1. Dosage Forms : 15 Marks (5 X 3)

Capsules, Tablets, Syrup, Iv, Im, Sc, Ia , Intra Articular -

Advantages (1 Mark), Disadvantages (1 Mark) Examples (1 Mark)

2. Mention the name of the Device/Instruments and uses : 15 marks (5X3)

   Inhalares, Rotahalers, Spacehalers, Dripsets, Vasofix, Ryles tube, Urinary catheter, Endotracheal tube, Hand gloves

3. 10 Spotters : 10 marks (10X 1) 2 uses of preparation

Recommended Books

1. K.d. Tripathi, Essentials of Medical Pharmacology, V. Edition, M/s. Jaypee Brothers, Post Box, 7193, G-16, Emca House, 23/23, Bansari Road, Daryaganj, New Delhi.
2. Padmaja Udaykumar -Pharmacology for Allied Sciences
3. R. S. Satoskar, S.D. Bhandarkar, S. S. Ainapure, Pharmacology and Pharmacotherapeutics, 18th Edition, Single Volume, M/s Popular Prakashan, 350, Madan Mohan Marg, Tardeo, Bombay - 400 034.

II Semester
Allied - 1 Health Care

Learning Objectives

1. To define Health and understand various concepts of Health
2. To know the Health care delivery system in India
3. To know various National Health Programmes of India
4. To have overview of First Aid Principles and guidelines

1. Concepts of Health

Definition of health; evolution in concepts of public health; public health events-sanitary awakening, germ theory of disease, rise of public health in various countries, changing concepts of health- biomedical concept, ecological concept, psycho-social concept and holistic concept.

2. Dimensions of Health

Physical dimension, mental dimension, Social dimension etc; Common health problems in India - Communicable diseases, Non communicable diseases, MCH problems, Nutritional problems, Environmental sanitation, Glance over National Health profile.

3. Evolution of health care delivery systems

History of health care delivery services; Genesis of primary health care; National health policy; MDGs.

4. Levels of health care

Primary health care, secondary health care, tertiary health care.

Primary health care-principles of primary health care, elements of primary health care.

5. Primary health care: Delivery of services

Introduction; Structure of health care delivery system; Delivery of primary health care services at village level; Village health guide, ASHA, ICDS: Subcentre: Primary health centre.

6. Secondary and tertiary health care: Delivery of services

Community Health centre; First referral unit; District hospital.

7. Primary health care - Current status in India

Status of health care infrastructure; Health team concept; Health insurance; Social security and social assistance in health; AYUSH.

8. National Health Programmes

Introduction; National Vector Borne Disease Control Programme; National Leprosy Eradication Programme; Revised National Tuberculosis Control Programme; National AIDS Control Programme; Universal Immunization Programme; National Rural Heath Mission.

9. National Health Programmes

Reproductive and Child Health Programme; Integrated Management of Neonatal and

Childhood Illnesses; National Nutritional Anemia Prophylaxis Programme; National Programme for Control of Blindness; National Cancer Control Programme; National Mental Health Programme.

10. First aid

Basic terminologies; general guidelines; first aid in specific situations; Wound, bleeding, fracture, choking, burns, epistaxis, strains and sprain, animal bites (classification, causes and first aid).

Cardio-pulmonary resuscitation

Recommended Books

1. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur: Banarsidas Bhanot Publishers, 2015. p.135-141
2. Suryakantha. Textbook of Community medicine with recent advances. 3rd edition
3. Bhalwar R editor. Textbook of Public Health and Community Medicine. 2nd Pune, Department of community medicine AFMC; 2012
4. Essentials of Community Medicine for Allied Health Sciences, JSS University Publications, 2015

II Semester
Allied -2- Psychology

Objective
After studying this applied paper, at the end of the semester students shall be able to demonstrate and develop the skills to understand patients better in the respective field.

Unit -I
Introduction to Psychology; Meaning and Definitions psychology. Evolution of modern psychology. Scope of Psychology. Branches of psychology. Concept of normality and abnormality.

Unit -II
Identifying psychological disorders. Anxiety disorders (panic, phobia, OCD, PTSD signs symptoms and management).

Unit -III
Stress, Hans Selye Model of stress. Lazarus and Folkman model of stress. Sources of stress. Stress, disease and health. Changing health- impairing behavior.

Unit-IV
Learning; Meaning, definition, Theories of learning .Pavlov's classical conditioning .Skinner's operant conditioning.

Unit-V
Therapeutic Techniques. Counselling - meaning and definition.
Psychotherapy- meaning and definition. Relaxation-types. (Brief introduction to psychoanalytical, behavioral and CBT techniques)

Recommended Books.

C.P. Khokhar (2003) Text book of Stress Coping and Management shalab publishing house.

S.M.Kosslyn and R.S.Rosenberg (2006) Psychology in Context. Pearson Education Inc.

C.R. Carson, J.N. Bitcher, S.Mineka and J.M. Hooley (2007), Abnormal Psychology13th, Pearson Education, Inc.

D.A. Barlow and V.M. Durand (2004) Abnormal Psychology Wadsworth, Thompson Learning, 3rd edition USA.

R.J . Gerrig and P.G. Zimbardo (2006) Psychology and life ,Pearson Education, Inc.

Pestonjee, D.M (1999). Stress & coping, The Indian experience 2nd edn. New Delhi, Sage India Publications.

B.Sc. Medical Laboratory Technology
III Semester
Core -7- Biochemistry-I
Theory:

Unit I

Membrane transportand Carbohydrates **12hrs**

Membrane transport - Transport across the cell membrane - Facilitated diffusion, Passive transport, Active transport and Receptor mediated Endocytosis. Exocytosis

Carbohydrates - Derivates of monosaccharides, Reactions of carbohydrates, Isomerism. Structure and importance of Disaccharides. Structure, distribution and functions of Homopolysaccharides and Heteropolysaccharides.

Unit II

Amino acids & Proteins **12hrs**

Properties and color reactions of amino acids. Protein structure. Quantitative estimation of Proteins (Biuret and Lowry's method).Methods of Separation - electrophoresis & chromatography.

Lipids

Composition, distribution and functions of Simple, compound (phospholipids, sphingolipids, glycolipids, lipoproteins) and Derived lipids(Bile salts and eicosanoids)

Unit III

Introduction to Laboratory apparatus **12hrs**

Introduction to Laboratory apparatus

Pipettes - Different types (Graduated, Volumetric, Pasteur and Autopipettes).

Burettes, beakers, Petri dishes, Flasks - different types (Volumetric, round bottomed, Erlenmeyer and conical). Funnels - different types.

Reagent bottles, Wash bottles, Measuring cylinders, Porcelain dish, Test tubes, centrifuge tubes, Tripod stand, Wire gauze, Bunsen burner, Cuvettes, and Desiccators.

Dispensers (reagent and sample)

Maintenance of lab glass ware and apparatus

Reflux condenser: Use, care and maintenance

Care and cleaning of glass & plastic ware, Different cleaning solutions.

Unit IV

Instruments & Techniques **12hrs**

Instruments - Laboratory balances - use care & maintenance, guidelines to be followed while weighing solids, liquids and hygroscopic compounds. Water distillation unit & Water deionizer - use care & maintenance and evaluation of water purity. Refrigerator, cold box and deep freezers.

Techniques - Principle & Uses of paper chromatography, Photometry (Colorimetry) and Spectrophotometery. Beer - Lambert law - Verification and limitation. Principle & applications of Turbidimetry, Flame photometry, Atomic absorption Spectrophotometery, ELISAandRIA.

Unit V

Concepts of Molecular weight, Equivalent weight **12hrs**

Concepts of Molecular weight, Equivalent weight, Normality and Molarity

Preparation of Molar solutions -1M NaCl, 0.15 M NaCl, 1M NaOH, 0.1 M HCl, 0.1M H2SO4

Preperation of Normal solutions, (1N sodium carbonate,1N Oxalic acid, 0.1N HCl, 0.1N H2SO4., 0.66NH2SO4.)

Percent solutions- V/V and W/V(Solids, Liquids & acids.) Conversion of percent solution into molar solution.

Dilutions - Preparing working standards from stock standard, reagent dilution techniques.

Acid base Indicators - Indicators for pH determination, List of commonly used Indicators and their pH range. Universal indicators

Practicals

Part A :

1. Introduction to laboratory glassware - Cleaning, care and Maintenance.
   Use of pipettes and dispensors
2. Balance: Weighing of solids, liquids and hygroscopic chemicals.
3. Preparation of Normal, Molar, Percent and Standard Solutions. (stock standard and working standards) - NaCl, NaOH, H2S04, HCl and Glucose
4. Centrifuge, Vortex mixer, Magnetic stirrer and Dessicators - Use Care and Maintenance.
5. Colorimeter and Spectrophotometer - Use Care and Maintenance.

Part B :

1. Reactions of Carbohydrates
2. Colour reactions of Amino Acids
3. Precipitation Reactions of Proteins
4. Reactions of NPN Substances
5. Analysis of Normal Urine
6. Analysis of abnormal Urine

Practical examination:

1. Preparations of solutions- 10 marks
2. Analysis of normal urine and abnormal urine-20 marks
3. Spotters- 10 marks

Recommended books Recent edition

1. Textbook of Biochemistry - D.M.Vasudevan
2. Biochemistry - Pankaja Naik
3. Clinical Biochemistry - Principles and Practice-Praful.B.Godkar
4. Textbook of Biochemistry - Chatterjea and Shinde
5. Textbook of Clinical Chemistry-Norbert W Teitz

Reference Books Recent Edition

1. Harpers Biochemistry
2. Clinical Biochemistry - Michael L.Bishop
3. Textbook of Biochemistry - Rafi M.D
4. Lippincott's Illustrated review of Biochemistry
5. Practical Clinical Biochemistry-Harold Varley

III Semester

Core - 8 - Pathology - I

Theory

I. Histopathology **12hrs**

Unit I

a. Introduction

i. Receiving of specimens
ii. Grossing Techniques
iii. Various fixatives - Mode of action, Indications, Preparations
iv. Decalcification of calcified tissue before sectioning
v. Processing of tissues for routine paraffin sections and other methods of embedding

b. Techniques:

i. Routine paraffin section cutting
ii. Frozen section and Cryostat section studies

Unit II

a. Staining techniques:

i. Principle, types and methods of preparation
ii. Hematoxylin & Eosin stain (H&E) stain
iii. Special stains for carbohydrates, connective tissue, nervous tissue, bone tissue, collagen and elastic fibers, lipids, organisms, fungi parasites, pigments and deposits in tissues

b. Mounting techniques:

Various mountants and mounting techniques

Unit III

a. Instrumentation:

I. Automated tissue processor
ii. Microtomes, knives, knife sharpners and ultramicrotome
iii. Tissue floating bath
iv. Freezing microtome and cryostat
v. Automatic slide stainer

b. Microscope:

Use and principles of - compound microscope, polariser microscope, electron microscope, scanning electron microscope, dark ground and fluorescent microscope

Unit IV

A. Museum technology:

i. Introduction, preparation of specimen
ii. Fixation of specimen and fixatives: Kaiserling solution-1 & Kaiserling solution 2.
iii. Mounting and storage of specimens.
iv. Filling and scaling.

b. Microphotography and its applications

Unit V

a. Maintenance of records and filing of slides
b. ICDS classification and coding
c. Administration in histopathology, quality control and application of computers.
d. Disposal of the waste in the laboratory

Practicals:

Histopathology

1. Fixation
2. Decalcification
3. Tissue processing
4. Paraffin section cutting
5. Staining by hematoxylin & eosin
6. Special stains for carbohydrates, connective tissue,
   Nervous tissue, bone tissue, reticulin, collagen and elastic fibers, lipids, organisms, fungi, parasites, pigments and deposits in tissues
7. Mounting techniques
8. Frozen section
9. Immunohistochemistry

Practical Examination

Pathology II

Hematoxylin and eosin stain 10
special stain 10
section cutting 10
record 5
Spotters 5
Total 40

Reference Books Recent Edition

1 Basic Pathology, Robbins Saunders, an imprint of Elsevier Inc., Philadelphia, USA
2 Text book of Pathology, Harsh Mohan, Jaypee Brothers, New Delhi
3 Practical Pathology P. Chakraborty, Gargi Chakraborty New Central Book Agency, Kolkata
4 Text Book of Haematology, Dr. Tejinder Singh Arya Publications, Sirmour (H.P)
5 Text Book of Medical Laboratory Technology, Praful Godkar Bhalani Publication House, Mumbai
6 Text Book of Medical Laboratory Technology, Ramanik Sood
7 Todd & Sanford, Clinical Diagnosis &Management by Laboratory Methods John Bernard Henry, All India Travellar Booksellar,
8 Histopathology Techniques, Culling
9 Histopathology Techniques, Bancroft
10 Diagnostic Cytopathology, Koss
11 Hand-Book of Medical Laboratory Technology, CMC, Vellore.
12 Basic Haematological Techniques, Manipal.

III Semester

Core - 9 - Microbiology-1

UNIT I

Immunology I **12 hrs**

1. Infection - Classification, sources, types & methods of transmission, Factors predisposing to microbial pathogenicity, Types of infectious diseases
2. Immunity - Definition, Types of immunity
3. Antigen - Definition, Types & Biological classes of antigens
4. Antibodies - Definition, Properties, Structure, Types and functions of antibodies and monoclonal antibodies
5. Antigen antibody reactions-Agglutination, Precipitation, Opsonization, Activation of compliment, Neutralization
6. Complement system-General properties, pathways, regulation of compliment activation, deficiencies of compliment system

Unit II

Immunology II **12 hrs**

1. Structure and functions of immune system-central & peripheral lymphoid organs, cells of lymphoreticular system, T & B cell maturation, Null cells, MHC
2. Immune response -Humoral immunity and cell mediated immune response
3. Hypersensitivity reactions-Definition & types of hypersensitivity reactions
4. Autoimmune disorders-mechanisms,classification & pathogenesis of autoimmune diseases
5. Transplantation immunology-Types of grafts

UNIT III

Mycology I **12hrs**

1. **General Mycology:** Introduction, classification of fungi and laboratory diagnosis of fungal infections
2. **Superficial mycoses:** Morphology, disease caused and lab diagnosis of following fungi
   - i. Malsezzia furfur.
   - ii. T nigra.
   - iii. T pedis.
   - iv. Dermatophytes.

UNIT IV

Mycology II **12 hrs**

3. **Subcutaneous mycoses:** Morphology, disease caused and lab diagnosis of following fungi.
   - i. Mycetoma.
   - Ii. Rhinosporidiosis.
   - iii. Sporotrichosis.

4. **Systemic mycoses:** Morphology, disease caused and lab diagnosis of following fungi:
    i. Histoplasmosis.
    ii. Blastomycosis.
    iii. Coccidiodosis / coccidiodomycosis.
    iv. Paracoccidiosis.

UNIT IV

Mycology III **12hrs**

5. **Opportunistic fungi:** Morphology, disease caused and lab diagnosis of following fungi
    i. Candida
    ii. Cryptococcus
    iii. Aspergillosis.
    iv. Penicillosis.
    v. Zygomycosis.
6. **Mycotoxins:**

Practicals :

Serology - Demonstration of common serological tests
Widal, Weil-Felix test, Brucella, ASLO, RA, CRP, RPR
ELISA technique

Mycology- Preparation of fungal media and reagents

a) KOH mount
b) Tease mount, LCB, Slide culture technique
c) Identification of fungal cultures by microscopic and macroscopic examination Candida, Cryptococcus, Trichophyton, Microsporum, Aspergillus, Rhizopus, Mucor and Penicillium

Practical examination pattern

Serology-

1. Widal test, Weil felix test, Brucella tube agglutination tests 10 marks
2. Rapid tests- 10 marks
    - ASLO, RA, CRP, RPR
    - ELISA Technique
3. Mycology- 20 marks

1. preparation of fungal media & fungal reagents
2. Tease mount/slide culture technique
3. Identifications of fungal cultures by microscopic and macroscopic examination Candida, Cryptococcus, Trichophyton, Microsporum, Aspergillus, Rhizopus, Mucor and penicillium.

Reference Books Recent Edition

1. Anathanarayana & Panikar. Medical Microbiology, Revised 8th Edition University Press.
2. Parasitology By Chatterjee - Interpretation to Clinical Medicine.
3. Textbook of Microbiology - Baveja.
4. Textbook of Mycology by Arora.
5. Textbook for Laboratory Technicians by Sood
6. Textbook of Parasitology by Paniker.

III Semester
Skill Enhancement-1
Computer Application

1 Overview

- Functionalities of a computer
- Definition
- Advantages
- Disadvantages

2 Applications

- Banking
- Insurance
- Education
- Marketing
- Health Care
- Engineering Design
- Military
- Communication
- Government

3 Generations

- First Generation
- Second Generation
- Third Generation
- Fourth Generation
- Fifth Generation

4 Types of Computer

- PC (Personal Computer)
- Workstation
- Minicomputer
- Mainframe
- Supercomputer

5 Components

- Input Unit
- CPU (Central Processing Unit)
- Output Unit

6 CPU - Central Processing Unit

- Memory or Storage Unit
- Control Unit
- ALU (Arithmetic Logic Unit)
- Arithmetic Section
- Logic Section

7 Input Devices

- Keyboard
- Mouse
- Advantages
- Joystick
- Light Pen
- Track Ball
- Scanner
- Digitizer
- Microphone
- Magnetic Ink Card Reader(MICR)
- Optical Character Reader(OCR)
- Bar Code Readers
- Optical Mark Reader(OMR)

8 Output Devices

- Monitors
- Cathode-Ray Tube (CRT) Monitor
- Flat-Panel Display Monitor
- Printers
- Impact Printers
- Character Printers
- Dot Matrix Printer
- Daisy Wheel
- Line Printers
- Drum Printer
- Chain Printer
- Non-impact Printers
- Laser Printers
- Inkjet Printers

9 Memory

- Cache Memory
- Primary Memory (Main Memory)
- Secondary Memory

10 Random Access Memory

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

11 Read Only Memory

- MROM (Masked ROM)
- PROM (Programmable Read only Memory)
- EPROM(Erasable and Programmable Read Only Memory)
- EEPROM (Electrically Erasable and Programmable Read Only Memory)
- Advantages of ROM

12 Mother board

- Features of Mother board
- Popular Manufacturers
- Description of Mother board

13Memory Units

14Ports

- Serial Port
- Parallel Port
- PS/2 Port
- VGA Port
- Power Connector
- Firewire Port
- Modem Port
- Ethernet Port
- Game Port
- Digital Video Interface, DVI port
- Sockets

15Hardware

- Relationship between Hardware and Software

16Software

- System Software
- Application Software

17Number System

- Decimal Number System
- Binary Number System
- Octal Number
- Hexadecimal Number System

18Data and Information

- Data Processing Cycle

19Networking

- Characteristics of Computer Network
- Cables
- Router
- Network Card
- Internal Network Cards
- External Network Cards

20Operating System

- Objectives of Operating System
- Characteristics of Operating System

21Internet and Intranet

- Similarities in Internet and Intranet
- Differences in Internet and Intranet

22Computer Viruses

- Types of computer virus
- Use of Antivirus software

Practicals:
Suggested Hands on Exercises
Operating System:

1. Starting the Windows Starting a program, running a program Running multiple programs and switching between windows Customizing the Task bar Recycle bin, restoring the deleted files
2. Creating and removing folders Making the taskbar wider, arranging icons on the Desktop Displaying and hiding the taskbar clock Controlling the size of start menu options Creating Shortcuts.
3. Customizing desktop view Adding a program to the start menu Adding a program shortcut in the Desktop Customizing the mouse settings
4. Expanding and collapsing a folder Recognizing File types using icons Running a program from explorer Renaming a file or folder Sorting a folder
5. Displaying the properties for a file or folder Using cut and paste operations to move a file Using copy and paste operations to copy a file Moving and copying files with mouse Searching a file or folder by using search command
6. Finding a file or folder, by name Defragmenting the disk, using disk defragmenter Controlling the speaker volume Recording and saving an audio file Connecting a printer to the PC

Word Processing:

1. Preparing a Govt. Order / Official Letter / Business Letter / Circular Letter Covering formatting commands - font size and styles - bold, underline, upper case, lower case, superscript, subscript, indenting paragraphs, spacing between lines and characters, tab settings etc.
2. Preparing a news letter: To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
3. Creating and using styles and templates To create a style and apply that style in a document To create a template for the styles created and assemble the styles for the template.
4. Creating and editing the table to create a table using table menu To create a monthly calendar using cell editing operations like inserting, joining, deleting, splitting and merging cells To create a simple statement for math calculations viz. Totaling the column.
5. Creating numbered lists and bulleted lists To create numbered list with different formats (with numbers, alphabets, roman letters) To create a bulleted list with different bullet characters.
6. Printing envelopes and mail merge. To print envelopes with from addresses and to

addresses To use mail merge facility for sending a circular letter to many persons To use mail merge facility for printing mailing labels.

7. Using the special features of word To find and replace the text To spell check and correct. To generate table of contents for a document To prepare index for a document.

8 Create an advertisement Prepare a resume. Prepare a Corporate Circular letter inviting the shareholders to attend the Annual Meeting.

Work Sheet:

1. Using formulas and functions: To prepare a Worksheet showing the monthly sales of a company in different branch offices (Showing Total Sales, Average Sales). Prepare a Statement for preparing Result of 10 students in 5 subjects (using formula to get Distinction, I Class, II Class and Fail under Result column against each student).
2. Operating on the sheets: Finding, deleting and adding records, formatting columns, row height, merging, splitting columns etc. Connecting the Worksheets and enter the data.
3. Creating Different type of Charts: To create a chart for comparing the monthly sales of a company in different branch offices.
4. Using the data consolidate command: To use the data consolidate command to calculate the total amount budgeted for all departments (wages, travel and entertainment, office supplies and so on) or to calculate the average amount budgeted for - say, department office expenses.
5. Sorting Data, Filtering Data and creation of Pivot tables.

Presentation::

1. Creating a new Presentation based on a template - using Auto content wizard, design template and Plain blank presentation.
2. Creating a Presentation with Slide Transition - Automatic and Manual with different effects.
3. Creating a Presentation applying Custom Animation effects - Applying multiple effects to the same object and changing to a different effect and removing effects.
4. Inserting Objects Creating and Printing handouts.
5. Publishing Presentation Exporting Presentations.

Internet:

1. Understanding different types of Browser Programs and Internet file types. (.html, pdf etc.)
2. Searching for a web site / application / text documents viewing and downloading.
3. Create an E-mail account, Retrieving messages from inbox, replying, attaching files filtering and forwarding
4. Operating on a Tablet / Smart Phone - browsing and practicing on some important applications (UcBrowser, Skype) - operating on internet - creating and sending messages / mails using the applications like WhatsApp and We Chat etc.- downloading text and media files and video conferencing using Skype.

III Semester

Allied-3- Environment Science and Health

Learning Objectives

1. To know various Environmental factors Health
2. To learn the modes of disease transmission and various control measures

Unit I

1. a. Introduction to Environment and Health and Water

Ecological definition of Health, Population perspective of relations, Health & environment perspective of relations, Environmental factors, Environmental Sanitation, Need to study environmental health, Predominant reasons for ill-health in India

1.b. Water

Safe and wholesome water, requirements, uses, sources; sanitary well; Hand pump; water Pollution; Purification of water; large scale & small scale; slow sand filters; rapid sand filters; Purification of Water on a small scale; Household purification, Disinfection of wells; water quality criteria & standards.

Unit II

Air, Light, Noise, Radiation

2 a. Air

Composition, Indices of Thermal Comfort, Air pollutants, Air Pollution - Health Effects, Environmental Effects, Green-house effect, Social & Economic Effects, Monitoring, Prevention & Control.

2. b. Light, Noise, Radiation

Natural and Artificial light; Properties, sources, noise pollution and its control, types, sources, biological effects and protection.

Unit III

Waste and Excreta Disposal

3 a. Disposal of Wastes

Solid Wastes, Health hazards, Methods of Disposal; Dumping, Controlled tipping/ sanitary landfill, Incineration, Composting.

3 b. Excreta Disposal

Public health importance, Health hazards, sanitation barrier, Methods of excreta disposal, unsewered areas and sewered areas, sewage, Modern Sewage Treatment.

Unit IV

Housing and Health and Medical Entomology

4 a. Housing and Health

Human Settlement, Social goals of housing, Criteria for Healthful Housing by Expert Committee of the WHO, Housing standards- Environmental Hygiene Committee, Rural Housing Standards, Overcrowding, Indicators of Housing.

4 b. Medical Entomology

Classification of Arthropods, Routes of Disease transmission, Control measures.

Unit V

Insecticides and Rodents

5 a. Insecticides

Types, mechanism of action, dosage and application for control of insects.

5 b. Rodents

Rodents and its importance in disease, along with anti-rodent measures.

Reference Books (latest edition)

1. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur: Banarsidas Bhanot Publishers; 2015. p.135-141
2. Suryakantha. Textbook of Community Medicine with recent advances. 4th edition.
3. Bhalwar R. Textbook of Public Health and Community Medicine. 2nd edition. Pune: Department of Community Medicine AFMC, 2012
4. Essentials of Community Medicine for Allied Health Sciences, JSS University Publications, 2015.

IV Semester
Core -10 - Biochemistry - II

Unit I **12hrs**

Digestion and absorption of Carbohydrates and its disorders, Glycolysis, Oxidation of pyruvate, TCA cycle, Gluconeogenesis, Cori's cycle, Metabolism of glycogen (glycogenesis, glycogenolysis, storage disorders), HMP shunt pathway, Metabolism of fructose, galactose and Uronic acid pathway. Inborn errors associated with them.

Unit II **12hrs**

Blood glucose regulation, Diabetes Mellitus - etiology, metabolism in Diabetes Mellitus (Biochemical basis of acute and chronic complications) laboratory Diagnosis and monitoring (Glycated Hb, Fructosamine), Glucose tolerance test and glucose challenge test.

Unit III **12hrs**

Metabolism of lipids- Digestion and absorption of Lipids. Oxidation of fatty acids & associated disorders, Formation and utilization of ketone bodies and ketosis. De novo synthesis of fatty acids, elongation and desaturation. Phospholipids (lecithin and cephalin only) and triglycerides - formation and breakdown, Lipid storage disorders. Synthesis of cholesterol (only crucial intermediates), Fate of cholesterol and compounds derived from cholesterol. Lipoproteins - classification, metabolism, functions and disorders. Atherosclerosis and role of PUFA in preventing atherosclerosis. Metabolism in adipose tissue, fatty liver and lipotrophic factors.

Unit IV **12 hrs**

Radioisotopes and its applications, free radicals and antioxidants

Biomedical techniques - Principles, experimental procedures and applications of chromatography (Paper, Thin layer, affinity, gel filtration, Gas-liquid and HPLC). Principles, Procedures and applications of Electrophoresis, Polyacrylamide gel, agarose gel and cellulose acetate.

Unit V **12 hrs**

Endocrinology - Classification of hormones, mechanism of hormone action.

Mechanism of action of insulin, glucagon, epinephrine and steroid hormones in detail. Tests for thyroid function and its interpretation.

Practicals

Part A:

1. Calibration of Pipettes and Preparation of Protein Free Filtrate
2. Estimation of Blood Glucose by O-Toluidine method and Glucose Oxidase method
3. Estimation of serum Cholesterol by Zaks Method and Cholesterol Oxidase method
4. Estimation of HDLcholesterol by MgCl2 Precipitation Method
5. Estimation of Serum Phosphorus by Fiske and Subbarow method
6. Estimation of Serum total Proteins and Albumin and determination of Albumin globulin ratio by Biuret and Dye binding method.

Part B 1:
Identification of substance of physiological Importance
Analysis of normal and abnormal urine

Part B 2 :
Case Reports

a) Inborn errors of Carbohydrate Metabolism
b) GTT Charts
c) Hyper lipidemias - Charts

Practical Examination

1. Quantitative estimation - 15 marks
2. Qualitative experiment - 15 marks
3. Case reports - 10 marks

Recommended books Recent edition

1. Textbook of Biochemistry - D.M.Vasudevan
2. Biochemistry - Pankaja Naik
3. Clinical Biochemistry - Principles and Practice - Praful.B.Godkar
4. Textbook of Biochemistry - Chatterjea and Shinde
5. Textbook of Clinical Chemistry - Norbert W Teitz

Reference Books Recent Edition

6. Harpers Biochemistry
7. Clinical Biochemistry - Michael L.Bishop
8. Textbook of Biochemistry - Rafi M.D
9. Lippincott's Illustrated review of Biochemistry
10. Practical Clinical Biochemistry-Harold Varley

IV Semester
Core - 11 - Pathology - II
Theory

Hematology

Unit I

Special Hematological tests: 12hrs

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

Unit II

Hemostasis and Coagulation 12hrs

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

Unit III

Bone marrow aspiration and biopsy study

a. Needle aspiration and surgical biopsy technique
b. Preperation of smears and staining
c. Perl's stain for marrow iron stores

Unit IV

Preperation of slides and different stains 12 hrs

a. Romanowsky stains: principle and peripheral blood smear staining
b. Buffy coat preparation
b. Supravital staining for reticulocytes and reticulocyte count
c. Cytochemistry in hematology
d. Demonstration of LE cells

Unit V:

a. Automation in haematology **12hrs**
b. Administration in hematology, quality control and application of computers.
c. Disposal of the waste in the laboratory

Practicals:

1. Blood collection, precautions to prevent hemolysis and storage of blood specimens.

2. Determination of hemoglobin and hematocrit
3. Red blood cell count and calculation of red cell indices
4. Total white blood cell count and differential count of white blood cells
5. Absolute eosinophil count
6. Platelet count
7. Reticulocyte count
8. Determination of ESR
9. Determmination of BT, CT, whole blood clotting time
10. Determination of PT and PTT
11. Blood smear preparation and staining
12. Reticulocyte staining
13. Osmotic fragility test
14. Sickling test
15. LE cell preparation
16. Urinalysis.
17 Bence jones protein test)

Practical Examination (4th semester): 40+10

Pathology II

Peripheral blood smear preparation and staining	10 Marks
Hemoglobin or PCV	5 Marks
Total count and differential count	5 Marks
ESR	5 Marks
Urine analysis	10 Marks
AEC /Reticulocyte count	5 Marks
Record	5 Marks
Spotters	5 Marks
Total	**40 Marks**

Reference Books (latest edition)

1 Basic Pathology, Robbins Saunders, an imprint of Elsevier Inc., Philadelphia, USA
2 Text book of Pathology Harsh Mohan, Jaypee Brothers, New Delhi
3 Practical Pathology P. Chakraborty, Gargi Chakraborty New Central Book Agency, Kolkata
4 Text Book of Haematology, Dr. Tejinder Singh, Arya Publications, Sirmour (H.P)
5 Text Book of Medical Laboratory Technology, Praful Godkar Bhalani Publication House, Mumbai
6 Text Book of Medical Laboratory Technology, Ramanik Sood
7 Practical Haematology, Sir John Dacie, Churchill Livingstone, London.
8 Todd & Sanford, Clinical Diagnosis &Management by Laboratory Methods John Bernard Henry, All India Travellar Booksellar.
9 Histopathology Techniques, Culling
10 Histopathology Techniques, Bancroft
11 Diagnostic Cytopathology Koss
12 Hand-Book of Medical Laboratory Technology, CMC Vellore.
13 Basic Haematological Techniques, Manipal.

IV Semester

Core-12- Microbiology II

Unit-I

Parasitology I **12 hrs**

1. General Parasitology: Introduction, classification of parasites & hosts Mode of Transmission
2. Protozoology: Classification, infections caused and lab diagnosis of following parasites:
    i. Entamoeba histolytica.
    ii. Giardia.
    iii.Trichomonas

Unit- II

Parasitology II **12 hrs**

1. Protozology: Classification, infections caused and lab diagnosis of following parasites:
    i. Balantidium coli.
    ii. Toxoplasma.
    iii.Malaria.
    iv.Leishmania.

Unit-III

Parasitology III **12 hrs**

1. Helminthology : Classification, infections caused and lab diagnosis of following parasites:
    i. Cestodes: Taenia, echinococcus, D. latum, H. Nana.

Unit-IV

Parasitology IV

I. Helminthology: Classification, infections caused and lab diagnosis of following parasites:
ii. Nematodes: Ascaris, hookworm, strongyloides, trichiuris, trichinella, Enterobius.

Unit-V

Parasitology V **12 hrs**

1. Helminthology: Classification, infections caused and lab diagnosis of following parasites:
    i. Nematodes:dracunculus, lymphatic filalrasis
    ii. Trematodes: schistosoma, fasciola.

Practicals (20 Hours)

1. Parasitology: Preparation of reagents

a) Stool examination:
    i. Saline mount.
    ii. Iodine mount

b) Stool concentration techniques
c) Preparation and staining of peripheral blood smear for parasites
d) Identification of parasitology slides

Practical Examination Pattern:

1. Stool examination- saline mount, iodine mount. 10 marks
2. Stool concentration techniques 10 marks
3. Preparation of reagents-Lugol's iodine, modified acid fast stain, Leishman stain 10 marks
4. Identification of Parasitology slides / Specimens with life cycles 10 marks
   Slides- Malaria, Filaria, Enterobius, Hook worm, Echinococcus
   Specimens Hydatid cyst, tapeworm, roundworm

Reference Books Recent Edition

1. Anathanarayana & Panikar: Medical Microbiology - Revised 8th Edition University Press.
1. Parasitology by Chatterjee - Interpretation to Clinical Medicine.
2. Textbook of Microbiology- Baveja
3. Textbook of Mycology by Arora.
4. Textbook for Laboratory Technicians By Sood
5. Textbook of Parasitology by Paniker.

IV Semester

Core - 12 - Basics of Medical Disorders

Objective:

To learn about basic concepts of common medical disorders and its therapeutic options.

Unit I

Cardiac and Respiratory diseases - 12 hours

1. Cardio vascular diseases
    a. Hypertension, Ischemic heart diseases, Myocardial Infarction, arrhythmias
    b. Heart failure, shock - types, causes
2. Respiratory diseases
    a. Pneumonia, tuberculosis,
    b. Chronic obstructive pulmonary disease, asthma
    c. Pleural effusion, pneumothorax
    d. Interstitial lung disease

Unit II

Neurological, Renal, GI and infectious diseases - 12 hours

3.Neurological diseases
    a. Polio myelitis, Gullian Barre Syndrome, Myasthenia Gravis, epilepsy / seizure disorder, cerebro vascular accident / stroke
4. Renal Diseases
    a. Acute kidney injury
    b. Chronic Kidney Disease
5. Gastro intestinal and Liver Diseases
    a. Gastritis / APD, peptic ulcer
    b. Acute gastroenteritis
    c. Hepatitis, Hepatic failure, alcoholic liver disease
6. Infectious diseases: Dengue, malaria, leptospirosis

Unit III

Blood, fluid, electrolyte and acid base abnormalities - 12 hours

7. Blood loss and Anemia, Thrombocytopenia
8. Fluid Electrolyte imbalance and corrective methods
9. Acid Base abnormalities and corrective methods

Unit IV

Pulmonary Oedema, Sepsis and MODS - 10 hours

10. Pulmonary Oedema, Acute Lung Injury and Acute Respiratory Distress Syndrome
11. Sepsis, multi-organ failure, Multi-organ dysfunction syndrome

Unit V

Health problems in Specific conditions and Toxicology - 14 hours

12. Health problems in specific conditions
    a. Pregnancy - antenatal care, disorders in pregnancy
    b. Children and new born
    c. Obesity
    d. Diabetes mellitus
    e. HIV infections and AIDS
    f. Elderly subjects and disability
    g. Brief mention about endocrine disorders
13. Poisoning and drug over dosing
    a. Classification of poisons
    b. Principles of treatment of poisoning and Primary care
    c. Poisons and drug over dosing requiring ventilation
14. Miscellaneous
    a. Drowning
    b. Hanging

Practical:

1. History Taking and clinical examination, monitoring of patient.
2. Therapeutic options for various diseases and conditions

Practical Examination: 40 marks

* Spotters -20 marks

Drugs, Instruments and devices

X rays, Basic Blood investigation reports

* Case Discussion - 10 marks
* Demonstration of Procedures - 10 marks

Reference Books Recent Edition

1. Davidson's, Principles and Practice of Medicine - Elsevier Publications.
2. Harrison's, Principle of Internal Medicine.

IV Semester
Skill Enhancement-2
Biostatistics and Research Methodology

Learning Objectives

1. To have a basic knowledge of biostatistics and its applications in medicine
2. To know various types of data presentation and data summarization in Medical field
3. To have overview of data analysis and sampling techniques
4. To understand various study designs in Medical field
5. To know applications of various study designs in Medical Research

Biostatistics

Unit I

Introduction and Presentation of data

Meaning, Branches of Statistics, Uses of statistics in medicine, Basic concepts, Scales of measurement, Collection of data, Presentation of data; Tabulation, Frequency Distribution, Diagrammatic and Graphical Representation of Data.

Unit II

Measures of central tendency and Measures of Variation

Arithmetic Mean (Mean), Median, Mode, Partition values, Range, Interquartile range , Mean Deviation, Standard Deviation, Coefficient of Variation.

Unit III

Probability and standard distributions

Definition of some terms commonly encountered in probability, Probability distributions; Binomial distribution, Poisson distribution, Normal distribution, Divergence from normality; Skewness and kurtosis

U**nit IV**

Census and Sampling Methods

Census and sample survey, Common terms used in sampling theory, Non-probability (Non random) Sampling Methods; Convenience sampling, Consecutive Sampling, Quota sampling, Snowball sampling, Judgmental sampling or Purposive sampling, Volunteer sampling, Probability (Random) Sampling methods; Simple random sampling, Systematic Sampling, Stratified Sampling, Cluster sampling, Multi-stage sampling, Sampling error, Non-sampling error.

Unit V

Inferential statistics

Parameter and statistic, Estimation of parameters; Point estimation, Interval Estimation, Testing of hypothesis; Null and alternative hypotheses, Type-I and Type-II Errors.

Research Methodology

Unit I

Introduction to research methodology

Types of research; Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Some Other Types of Research

Unit II

Study Designs-Observational Studies

Epidemiological study designs; Observational studies, Descriptive studies; Case reports, Case series, Analytical studies; Case control studies, Cohort studies, Cross sectional

Unit III

Experimental Studies

Experimental studies (Interventional studies); Randomized control Trials (Clinical trials), Field trials, Community trials, Nm-Randomized Trials

Unit IV

Uses of Epidemiology

Unit V

Application of study Designs in Medical Research

Reference Books Recent Edition

1. K.R.Sundaram, S.N.Dwivedi and V Sreenivas (2010), Medical Statistics, Principles and Methods, BI Publications Pvt Ltd, New Delhi.
2. NSN Rao and NS Murthy (2008), Applied Statistics in Health Sciences, Second Edition, Jaypee Brothers Medical Publishers (P) Ltd.
3. J.V.Dixit and L.B. Suryavanshi (1996), Principles and practice of biostatistics, First Edition, M/s Banarsidas Bhanot Publishers.
4. Getu Degu and Fasil Tessema (2005), Biostatistics, Ethiopia Public Health Training Initiative.
5. Essentials of Community Medicine for Allied Health Sciences, JSS University Publications.
6. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur Banarsidas Bhanot Publishers, 2015. p.135-141.
7. Suryakantha. Textbook of Community Medicine with recent advances. 4th edition.
8. Bhalwar R. Textbook of Public Health and Community Medicine. 2nd Edition. Pune, Department of Community Medicine AFMC, 2012.
9. Leon Gordis. Epidemiology Fourth Edition - Elsevier Saunders Publication.

IV Semester
Allied-4
Constitution of India

Unit - I
Meaning of the term 'Constitution'. Making of the Indian Constitution 1946-1950.

Unit - II
The democratic institutions created by the constitution, Bicameral system of Legislature at the Centre and in the States.

Unit - III
Fundamental rights and duties their content and significance.

Unit - IV
Directive principles of States, policies the need to balance fundamental rights with directive principles.

Unit - V:
Special rights created in the Constitution for dalits, backwards, women and children and the religious and linguistic minorities.

Unit - VI
Doctrine of Separation of Powers, legislative, executive and judicial and their functioning in India.

Unit - VII
The Election Commission and State Public Service commissions.

Unit - VIII
Method of amending the Constitution.

Unit - IX
Enforcing rights through writs.

Unit - X
Constitution and sustainable development in India.

Recommended Books Recent Editions.

1. J.C. Johari. The Constitution of India. A Politico-Legal Study. Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey. Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin. The Indian Constitution. Corner Stone of a Nation-Oxford, New Delhi, 2000.

V Semester

Core -13 - Biochemistry-III

Unit I **10hrs**

Metabolism of amino acids and proteins- Digestion and Absorption of Proteins, Formation, transport and disposal of ammonia (urea cycle). Metabolism of amino acids - glycine, serine, aromatic amino acids, sulphur containing amino acids, histidine, arginine, glutamic acid, branched chain amino acids (first three steps) and metabolic disorders associated with them along with laboratory diagnosis.

Specialized products obtained from amino acid metabolism and their importance (Polyamines, creatine, nitric oxide)

Unit II **10hrs**

Heme metabolism- Biosynthesis of heme and regulation. Porphyrias, Degradation of hemoglobin, Biochemical basis of jaundice and distinguishing features of different types of jaundice, Hemoglobin variants and Hb derivatives, Abnormal hemoglobins, hemoglobinopathies and thalassemias.

Water and Electrolyte balance

Unit III **10hrs**

High energy compounds. Electron Transport and Oxidative Phosphorylation- Introduction, Components of electron transport chain, electron transport and formation of ATP and its regulation. Inhibitors and uncouplers.

Xenobiotics

Unit IV **10hrs**

Liver function tests- tests based on excretory, metabolic, synthetic and detoxification functions of the liver. Role of enzymes in liver disease, Jaundice and its types.

Renal function tests -Functions of Kidney, disease of kidney, function tests.

Gastric function test- Functions of stomach, tests for gastric function.

Lipid Profile and Cardiac markers.

Unit V **10hrs**

Automation in clinical laboratory - Chemistry and Immunoassay techniques,

Principle & applications of Autoanalyzers

Quality Control: Role of quality control and its importance, Sensitivity, Specificity, Accuracy, Reliability and Precision

Internal and external quality control measure, preparation of reagents, standardization of methods

Practicals:

Part A :

1. Estimation of Serum Creatinine by Jaffes Method
2. Estimation of Urinary Creatinine by Jaffes Method and calculation of Creatinine Clearance
3. Estimation of Serum Bilirubin by Malloy and Evelyn method.
4. Estimation of Blood Urea and calculation of BUN by Di Acetyl Monoxime method
5. Estimation of Serum Alkaline Phosphatase activity
6. Estimation of Serum Uric acid by Phospho tungstic acid reduction method.
7. Estimation of Serum Calcium by titrimetric method.

Part B:

Charts:

a) Acid base disorders
b) Inborn errors of amino acid disorders
c) Electrophoretogram
d) Paper chromatogram

Practical examination:

1. Quantitative estimation- 2 Exercises - 30 marks
2. Charts- 10 marks

Recommended books Recent edition

1. Textbook of Biochemistry - D.M.Vasudevan
2. Biochemistry - Pankaja Naik
3. Clinical Biochemistry - Principles and Practice - Praful.B.Godkar
4. Textbook of Biochemistry - Chatterjea and Shinde
5. Textbook of Clinical Chemistry - Norbert W Teitz

Reference Books Recent Edition

1. Harpers Biochemistry
2. Clinical Biochemistry - Michael L.Bishop
3. Textbook of Biochemistry - Rafi M.D
4. Lippincott's Illustrated review of Biochemistry
5. Practical Clinical Biochemistry - Harold Varley

V Semester
Core-14- Pathology -III
Theory

Cytology

Unit I

Cytology Introduction: 12hrs

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Types of specimens (FNAC, imprint, scrape and exfolative), methods of collection & preparation of cell block
3. Different fixatives and methods of fixation
4. Staining:
   a) Papanicoloau's stain- principle, preparation and staining techniques
   b) Hematoxylin & Eosin stain (H&E)
   c) May Grunwald Giemsa stain (MGG)
   d) Shorr's stain

Unit II

a. Female Genital tract 12hrs

1. Anatomy, histology, physiology & normal cytology
2. Techniques of collection of different types of specimens for cervical cytology study
3. Hormonal cytology and cytological indices
4. Cervical cytology screening for malignant and nonmalignant conditions, Radiation changes & follow up
5. Cytology in ovarian cancers - (general features) -FNAC, imprint, and scrape.

b. Respiratory tract, Gastrointestinal tract and Urinary tract 12hrs

1. Anatomy, histology and physiology
2. Different types and collection of sample, preparation of smears and staining
3. Cytology of normal, nonmalignant & malignant conditions (general features)

c. Glands - breast, thyroid, salivary glands and lymph nodes 12hrs

1. Anatomy, histology and physiology
2. Different types and collection of samples, preparation of smears and staining
3. Cytology of normal, nonmalignant & malignant conditions (general features)

Unit III 12hrs

a. Automation in Cytology

1. Cytospin
2. Flow cytometry
3. Image analysis
4. Principles, equipments, procedures & evaluation

b. Study of C S F and effusions

1. Cell count and cytology of CSF in inflammatory, nonmalignant & malignant conditions. (general features)
2. Cytology of effusions in nonmalignant and malignant conditions (general features)

Unit IV **12hrs**

a. Tissue culture and immunohistochemistry

1. Equipments for tissue culture studies
   a) Laminar air flow equipment
   b) Carbon dioxide incubator
   c) Inverted microscope
2. Derivation of culture from tissue
   a) Enzymatic digestion of tissue using collagenase, protease
   b) Plating in tissue culture media
   c) Observation of cells in invertoscope
   d) Subculturing & derivation of cell lines
3. Characterization of cell lines
   a) Determination of biochemical markers in cells
   b) Chromosomal & DNA content of cells
   c) Immunological properties of cells
4. Preservation of immortalized cell lines
   a) Storage in glycerol in liquid nitrogen
   b) Storage in dimethyl sulfoxide in liquid Nitrogen

b. Immunocytochemistry

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

Unit V **12hrs**

Cytogenetics

1. Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes
2. Methods of karyotypic analysis
   a) Culture of bone marrow cells, peripheral blood lymphocytes, solid tumors & skin fibroblasts
   b) Direct preparation from tumor materials
3. Characterization of human chromosomes by various banding techniques
4. Sex chromatin identification
5. Chromosomes in neoplasia and oncogenes

Practicals:

1. Examination of cerebrospinal fluid (CSF).

2. Examination of body fluids (pleural, pericardial and peritoneal).
3. Sputum examination.
4. Preparation of various cytology smears and fixation
5. Demonstration of cytology of normal, nonmalignant & malignant conditions (general features) - female genital tract, respiratory tract, gastrointestinal tract, Urinary tract, breast, thyroid, salivary glands and lymph nodes.
6. H & E, Papanicoloau's and may grunwald geimsa staining
7. Hormonal cytology study
8. Cytospin technique

Practical Examination

Pathology III

Pap stain	10 Marks
CSF preparation and cell count	10 Marks
MGG stain	10 Marks
Record	5 Marks
Spotters	5 Marks
Total	**40 Marks**

Reference Books (latest edition)

1 Orell & Sterrett's Fine Needle Aspiration Cytology, S Orell, G Sterrett, Churchill Livingstone Elsevier Limited.
2 Practical Pathology, P. Chakraborty, Gargi Chakraborty, New Central Book Agency, Kolkata.
3 Text Book of Haematology, Dr. Tejinder Singh, Arya Publications, Sirmour (H.P)
4 Text Book of Medical Laboratory Technology Praful Godkar, Bhalani Publication House, Mumbai.
5 Text Book of Medical Laboratory Technology, Ramanik Sood.
6 Practical Haematology Sir John Dacie, Churchill Livingstone, London.
7 Todd &Sanford, Clinical Diagnosis & Management by Laboratory Methods, John Bernard Henry, All India travellar Booksellar.
8 Hand-Book of Medical Laboratory Technology, CMC, Vellore.
9 Basic Haematological Techniques Manipal.
10 Diagnostic Cytopathology, Koss.
11 Diagnostic Cytopathology, Winifred Grey.
12 Cancer Cytogenetics -Methods and Protocols, John Swansbury, Humana Press.

V Semester

Core - 15 - Microbiology -III

UNIT I

Systemic bacteriology I **12 hrs**

Morphology, classification, disease caused, laboratory diagnosis and prevention of following bacterial infections

i. Staphylococcus.
ii. Streptococcus.
iii. Pneumococcus.
iv. Neisseria
v. Corynebacteria.
vi. Clostridia.

UNIT II

Systemic bacteriology II **12 hrs**

Morphology, classification, disease caused, laboratory diagnosis and prevention of following bacterial infections

i. Mycobacteria - M. tuberculosis,
ii. M. leprae
iii. Atypical mycobacteria
iv. Bacillus.
v. Actinomyces.
vi. Nocardia.

UNIT III

Systemic bacteriology III **12 hrs**

Morphology, classification, disease caused, laboratory diagnosis and prevention of following bacterial infections

i. Enterobacteriaceae - Escherichia, Klebsiella, Enterobacter, Proteus, Salmonella, Shigella.
ii. Yersinia
iii. Pseudomonas.
iv. Haemophilus.

UNIT IV

Systemic bacteriology IV **12 hrs**

Morphology, classification, disease caused, laboratory diagnosis and prevention of following bacterial infections

i. Vibrios
ii. Brucella
iii. Bordetella.
iv. Acinetobacter
v. Helicobacter.
vi. Bacteroides.
vii. Fusobacterium.

UNIT V

Systemic bacteriology V **12 hrs**

Morphology, classification, disease caused, laboratory diagnosis and prevention of following bacterial infections

1. Spirochaetes - Treponema, Leptospira.
2. Mycoplasma
3. Chalmydiae
4. Rickettsiaceae

Practical's :

1. Staining
   a. Simple staining
   b. Gram's stain
   c. Ziehl-Neelsen staining
   d. Albert's stain
2. Motility testing by hanging drop preparation
3. Culture media and biochemical tests
4. Culture methods
5. Identification of bacterial culture
6. Antibiotic susceptibility testing
7. Applied bacterial exercises - Identification of Gram positive bacteria

Practical examination pattern

1. Grams stain	10 Marks
2. Ziehll-Neelsen stain	10 marks
3. Spotters - culture media, biochemical test, instruments, slides	10 marks
4. Applied bacteriology exercises	10 marks

Gram positive, Gram negative bacteria - Staphylococci, M. tuberculosis, E.coli, Klebsiella, S. typhi, Pscudomonas, V. cholerae and Shigella

References:

1. Anathanarayana&Panikar: Medical Microbiology - Revised 8th Edition University Press.
2. Parasitology BY Chatterjee - Interpretation to Clinical Medicine.
3. Textbook of Microbiology- Baveja
4. Textbook of Mycology by Arora.
5. Textbook for Laboratory Technicians by Sood
6. Textbook of Parasitology by Paniker.

V Semester
Elective-1

A. Immunohistochemistry:

Immunohistochemistry (IHC), or immunocytochemistry, is a method for localizing specific antigens in tissues or cells based on antigen-antibody recognition.

IHC, history dates back more than 70 years, when Coons first developed an Immunofluorescence technique to detect corresponding antigens in frozen tissue sections. But its use has increased in surgical pathology since 1990.

Methods evolved from a simple, one-step, direct-conjugate method to multistep detection techniques such as the peroxidase-antiperoxidase (PAP), avidin-biotin conjugate (ABC), and biotin-streptavidin (B-SA) methods . This evolution eventually led to amplification methods, such as tyramide, and highly sensitive polymer-based labelling systems.

Use of one or more IHC "stains" is routine in surgical pathology, especially with respect to tumor diagnosis and classification. Furthermore, IHC has been adapted to the identification and demonstration of both prognostic and predictive markers. Since its use has increased enormously among various laboratories, it needs to be standardised and quality control is to be maintained.

Also there is an increase in automated staining instruments, with major implications with respect to choice of reagents, protocols, and controls, to get the best of both processing and staining techniques in view of achieving best result.

Hybridoma facilitated the development of IHC and the manufacture of abundant, highly specific monoclonal antibodies, many of which found early application in staining of tissues. Although great effort has been expended in the search for alternative fixatives (formalin substitutes) to preserve antigenicity without compromising preservation of morphologic features, no ideal fixative has been found to date.

Basic Principles of Immunohistochemistry -

A variety of special stains were developed to facilitate cell recognition and diagnosis, and most of these early stains were based on chemical reactions of cell and tissue components in frozen sections (histochemistry). These stains helped to identify cells and its types completely, but some times they only supported a particular pattern without complete confirmation.

The basic critical principle of IHC, as with any other special staining method, is a sharp visual localization of target components in the cells and tissue based on a satisfactory signal-to-noise ratio. Amplifying the signal while reducing nonspecific background staining (noise) has been a major strategy to achieve a satisfactory result that is useful in daily practice.

If properly controlled in all aspects of its performance, IHC can provide a tissue-based immunoassay with the reproducibility and quantitative characteristics of an enzyme-linked immunosorbent assay (ELISA) test, which not only detects the presence of an analyte, a protein or antigen, in relation to tissue and cell architecture, but also provides an accurate and reliable measure of its relative or real amount.

Antibodies as Specific Staining Reagents-

Antibody molecules are proteins, thus any rigid part of an antibody molecule may itself serve as the antigenic determinant to induce an antibody.

Evaluation of an antibody for use in IHC is based on two main points: the sensitivity and the specificity of the antibody-antigen reaction.

IHC techniques exploit the fact that immunoglobulin molecules can serve both as antibodies, binding specifically to tissue antigens, and as antigens, providing antigenic determinants to which secondary antibodies may be attached.

Hybridoma technique provided an almost limitless source of highly specific antibodies. However, monoclonal antibodies do not guarantee absolute antigen specificity, because different antigens may share similar or cross-reactive epitopes. While in polyclonal antibodies there is much more cross-over among antibodies, and become less sensitive for runningIHC.

Nonspecific background staining is to be blocked to get a better result. It is more often required in polyclonal antibodies. It is attributable either to nonspecific antibody binding or to the presence of endogenous enzymes.

Detection Systems-

Antibody molecules cannot be seen with the light microscope, or even with the electron microscope, unless they are labeled or flagged by some method that permits their visualization. Essentially, detection systems attach labels or flags to primary or secondary antibodies in order to visualize the target antibody-antigen localization in the tissue sections.

Direct-Conjugate-labelled Antibody Method- The method of attaching a label to an antibody by chemical means and then directly applying this labelled conjugate to tissue sections has been used widely in immunohistology. The direct-conjugate procedure has the advantages of rapidity and ease of performance.

Indirect, or sandwich, procedure- The indirect, or sandwich conjugate procedure is a relatively simple modification of the direct conjugate method.

Unlabeled antibody methods- This method is rarely used today but is included for its value in research applications in which chemical conjugation is undesirable.

Biotin-avidin procedure- The biotin-avidin procedure exploits the high-affinity binding between biotin and avidin.

Polymer-based Labeling Methods - The demand for more sensitive, more reliable, and simpler methods for IHC continues to escalate. It is simple when compared to above methods and is used in aotumated system, but with same sensitivity and specificity.

Titration of primary antibody and detection system- The optimal dilution for an antibody in immunohistology is defined as the dilution at which the greatest contrast is achieved between the desired (specific) positive staining and any unwanted (nonspecific) background staining. Selection is subjective and is based not simply on the greatest intensity but rather on the greatest useful contrast. Titration is relatively straightforward in the direct method, with only a single antibody.

Representative dilution titration to determine optimal titer of antibody for use in direct conjugate method

Intensity of staining*	Serial Dilutions of Primary Antibody						
	1/5	1/20	1/80	1/320	1/1280	1/2560	
Unwanted background	++	+	+	+	+	+	
Specific antigens	+++		++++		++++	++++	++

Home Brewing" vs. Ready-to-use approaches

Home Brew	Ready-to-Use
Select primary antibodies and purchase Purchase suitable labeling antibodies Purchase chromogens, etc.	Purchase kit that includes all reagents , matched and tested for performance
Titrate primary antibodies Identify appropriate labeling method Select chromogen Establish time and concentration	Prediluted primary antibodies included Includes labeling method, pretested Includes chromogen Includes protocol
Obtain serial dilutions of labeling reagent Establish incubation times	Prediluted reagents included Recommended times provided
Establish protocol Select controls	Protocol included Recommended controls

Major factors that affect outcome for tissues

Preanalytic Variables	Process	Effects unknown for individual specific analytes (proteins)
Warm ischemia	Vessels clamped at surgery	Beginnings of anoxic damage are apparent.
Cold ischemia	Time before fixation; transport; saline or other transport media	Anoxic damage occurs; proteins, RNA, and DNA are degraded.
Grossing (in pathology lab)	Time to grossing of specimen; block size/ thickness, 2 to 3 mm maximum .	Variable fixation is found within large specimen or block
Fixation	Total time in fixative- type of fixative, freshness, pH; penetration varies with block size and tissue type	Cross-linking of proteins leads to loss of antigenicity
Processing; dehydration, clearing, impregnation in paraffin wax	Varying times in alcohols, xylol, and paraffin; temperature of wax .	Parts of tissue block poorly fixed in formalin will be alcohol fixed
Storage as formalin-fixed paraffin-embedded block	Time and conditions of block storage	Effects are unknown
Cutting	Thickness of section; avoidance of tears; time from cutting to staining	Thick sections show apparent increase in intensity; tears may give artifacts, and loss of antigenicity occurs for some proteins
Antigen (epitope) retrieval	Great variation in solution, time, and Temperature.	Recovery of detectable protein is variable.

B. Immunoflorescence in Diagnosis of Tuberculosis:

Fluorescence microscopy

Fluorescence microscopy was developed by August Köhler. It is based on a fluorescent dye (fluorophore) with which the sample or individual structures are labelled.

Fluorescence microscopy has become one of the most powerful techniques in biomedical research and clinical microbiology. Currently, used for diagnosis of tuberculosis, fungal infections and malaria in our laboratory.

Immunofluorescence

Albert H. Coons and N. H. Kaplan were the first to attach a fluorescent dye to an antibody, and this antibody is subsequently used to localize its respective antigen in a tissue section. This technique has been widely used in microbiology laboratory for diagnosis of many infectious diseases, autoimmune diseases and connective tissue disorders.

Advantages of fluorescent microscopy are its sensitivity, specificity, rapid testing and its easy use.

V Semester
Allied-5-Medical Ethics

General considerations of Medical Ethics

1. Medical Ethics - Introduction
2. Three cor contents in Medical Ethics - Best interest, autonomy unrights
3. Doctors, patient & Profession

Special considerations of Medical Ethics

1. Consent
2. Confidentiality
3. Genetics
4. Reproductive Medicine
5. Mental Health
6. End of life and organ transporentation
7. Research & clinical Trials

Reference Book

Medical Ethics & law, The cor curriculum
Author- Tony hope atla
Reference book no:- 16715 Center library

VI Semester

Core -16-Biochemistry-IV

Unit I **12hrs**

Nucleotide Metabolism- Synthesis and degradation of purines and pyramidines, nucleosides and nucleotides.

Structure of DNA,different forms of DNA& functions.

RNA- Structure and functions.

Unit II **12hrs**

Genetics and Molecular biology- DNA replication, Transcription and post transcriptional modifications, Reverse transcriptase, Genetic code, translation and post translational modifications, Regulation of gene expression and mutation

Unit III **12hrs**

Techniques in Molecular Biology

PCR(Basics), recombinant DNA technology, gene therapy, blotting techniques, RFLP, DNAfingerprinting

Unit IV **12hrs**

Biochemistry of cancer, Carcinogens, Oncogenesis, Oncogenes and Tumor suppressor genes.

Growth factors and Tumor markers

Unit V **12hrs**

Common Lab accidents and ways for its prevention , First aid in the clinical laboratory, Storage and handling of dangerous chemicals, Medical Laboratory Ethics ,Bio medical waste management.

Laboratory Information System and Hospital Information System.

Practicals

Part A 1. :

1. Estimation of Serum AST activity
2. Estimation of Serum ALT activity
3. Estimation of Serum LDH activity
4. Estimation of Serum CKMB activity
5. CSF analysis-Demonstration

Part A 2. :

1. Renal stone analysis
2. Gall stone analysis
3. Plotting of Quality Control charts and calculation of standard deviation

Part B :

Case reports

a) Liver function tests
b) Renal function tests
c) Minerals
d) Electrolytes
e) Cardiac function

Practical Examination

1. Quantitative estimation- 15 marks
2. Stone analysis- 10 marks
3. Plotting of Quality control charts and calculation of standard deviation-5 marks
4. Case reports- 5 marks

Recommended books Recent edition

1. Textbook of Biochemistry -D.M.Vasudevan
2. Biochemistry -Pankaja Naik
3. Clinical Biochemistry-Principles and Practice-Praful.B.Godkar
4. Textbook of Biochemistry-Chatterjea and Shinde
5. Textbook of Clinical Chemistry-Norbert W Teitz

Reference Books Recent Edition

6. Harpers Biochemistry
7. Clinical Biochemistry-Michael L.Bishop
8. Textbook of Biochemistry-Rafi M.D
9. Lippincott's Illustrated review of Biochemistry
10. Practical Clinical Biochemistry-Harold Varley

VI Semester
Core -17-Pathology-IV

Immunohematology and Blood transfusion

Unit I **12hrs**

Blood Grouping and blood grouping techniques

- Introduction to human blood group system
- ABO Blood group (antigen and natural antibodies) and Rh system (Ag&Ab)
- Subgroups of A and B, other blood groups and Bombay group
- Hemolytic disease of newborn & prevention
- HLA antigens and their significance
- Principle of blood grouping,
- Blood grouping techniques and methods for ABO & Rh grouping: Slide & tube method, cell grouping & serum grouping,
- Difficulties in ABO grouping.
- Rouleaux formation, how it interferes with blood grouping,
- Auto agglutinins.
- Antiserum used in ABO test procedures, Anti -A, Anti-B.
- Control, A&B cells preparation, auto control.
- Medical applications of blood groups.

Unit II **12hrs**

Donor screening, blood collection and screening test on blood

- Criteria for selection & rejection of donors -medical history & personal details
- Self-exclusion
- Health checks before donating blood
- Voluntary donors and replacement donors
- Blood collection bags.
- Anticoagulants
- Techniques of collecting blood from a donor
- Instructions given to the donor after blood donation.
- Adverse donor reactions.
- Labeling
- Donor blood testing,
- Screening donor's blood for infectious agents - HIV, HCV, HBV, syphilis, malaria.
- Bacterially contaminated blood
- Techniques for screening of donor blood

Unit III **12hrs**

Blood component preparation and storage

Packed RBCs, fresh frozen plasma, platelet concentrates, cryoprecipitate

Principles of preparation,

- Techniques for preparation of various components and its indications.
- Apheresis
- Appropriate storage of components

Storage of blood.

- Changes in blood after storage.
- Lay out of a blood bank refrigerator
- Transportation

Unit IV **12hrs**

Compatibility testing and coombs test, antibody screening (12hours)

- Purpose
- Single tube compatibility techniques using AHG reagent.
- Emergency compatibility testing.
- Difficulties in cross matching.
- Coombs test and its significance
- Labeling & issuing cross- matched blood
- Antibody screening

Unit V **12 hrs**

Blood transfusion, taintenance of blood bank records, blood bank organization, standards, procedures, techniques and quality control, automation in blood banking (12 hrs)

- Principle & practice of blood transfusion.
- Guide lines for the use of blood
- Hemovigilance

Blood transfusion reactions and work up

- Blood donation record book.
- Blood donor card.
- Blood bank temperature sheet.
- Blood bank stock sheet.
- Blood transfusion request form.

Practicals:

1. Blood grouping and Rh typing
2. Cross matching techniques
3. Coombs test
4. Screening of donor's blood for infective agents
5. Transfusion reaction work up
6. Preparation of blood components

7. Apheresis
8. Charts
9. Organizing blood donation camps
10. Soft skills

Practical Examination (6th semester): 40marks

Pathology III

Blood grouping and typing	10 Marks
Cross matching	10 Marks
Record	5 Marks
Spotters	5 Marks
Total	**40** Marks

Reference Books (latest edition)

1 Practical Pathology, P. Chakraborty, Gargi Chakraborty New Central Book Agency, Kolkata.
2 Text Book of Haematology, Dr. Tejinder Singh, Arya Publications, Sirmour (H.P).
3 Text Book of Medical Laboratory Technology, Praful Godkar, Bhalani, Publication House, Mumbai.
4 Text Book of Medical Laboratory Technology, Ramanik Sood.
5 Practical Haematology, Sir John Dacie Churchill Livingstone, London.
6 Todd &Sanford, Clinical Diagnosis & Management, by Laboratory Methods John Bernard Henry All India Travellar Booksellar.
7 Hand-Book of Medical Laboratory Technology, CMC, Vellore.
8 Basic Haematological Techniques, Manipal.

VI Semester
Core - 18 - Microbiology - IV

Unit 1

Virology I **12 hrs**

1. General Properties of Viruses and Cultivation of Viruses and Laboratory Diagnosis of Viral Infections
2. Properties, Diseases caused lab diagnosis and Prevention of following viruses:
   - Pox viruses
   - Herpes viruses

Unit II

VirologyII **12 hrs**

Properties, Diseases caused lab diagnosis and Prevention of following viruses:

- Adenoviruses
- Papova viruses
- Parvovirus

UNIT III

Virology III **12 hrs**

Properties, Diseases caused lab diagnosis and Prevention of following viruses:

- Picornaviruses
- Orthomyxoviruses
- Paramyxoviruses

UNIT IV

Virology IV **12 hrs**

Properties, Diseases caused lab diagnosis and Prevention of following viruses:

- Arboviruses-JE, Dengue, KFD, Chikungunya and Yellow fever
- Rhabdoviruses
- Hepatitis Viruses

UNIT V

Virology V **12 hrs**

Properties, Diseases caused lab diagnosis and Prevention of following viruses:

- Oncogenic Viruses
- Hiv Virus
- Miscellaneous - Prions, Sars, Rotavirus and Ebola Virus
- Viruses causing diarrhoea

Practicals :

1. Embryonated egg inoculation techniques for viruses and tts applications
2. Virology exercise - spot tests - HIV, HBV, HCV, Dengue
   ELISA - HIV, HBV, HCV
3. Virology applied exercises

Practical Examination Pattern

1. Virology exercise I: Embryonated egg inoculation 10 marks
2. Virology exercise II: 10 marks
   Spot tests-HIV, Hepatitis B Virus, Hepatitis C virus, Dengue virus
   ELISA - HIV, Hepatitis B Virus, Hepatitis C virus 10 marks
3. Virology applied exercise 10 Marks

References

1. Anathanarayana & Panikar, Medical Microbiology - Revised 8th edition University Press.
2. Parasitology by Chatterjee - Interpretation to Clinical Medicine.
3. Textbook of Microbiology- Baveja
4. Textbook of Mycology by Arora.
5. Textbook for Laboratory Technicians By Sood
6. Textbook of Parasitology by Paniker.

VI Semester
Elective-2
Molecular Techniques

1. Protocol for DNA Isolation

Aim: To learn the technique of isolation of DNAfrom cells

Introduction: DNA isolation is one of the most basic and essential techniques in the study of DNA. Extraction and purification of DNA are the first steps in the analysis and manipulation of DNA that allow scientists to detect genetic disorders, produce DNA fingerprints of individuals, and even create genetically engineered organisms that can produce beneficial products such as insulin, antibiotics, and hormones. This technique is of primary importance in the field of biotechnology and forensics.

Many different methods and technologies are available for the isolation of genomic DNA. In general all the methods involve three basic steps. The cell must be lysed (broken open) to release the nucleus. The nucleus (if present) must also be opened to release the DNA. Cell membrane can be lysed by using physical (ultrasonic vibrations or using motor and pestle) or chemical means (using detergent and salt solutions). At this point the DNA must be protected from enzymes that will degrade it, causing shearing. Removal of enzymes/proteins is typically achieved by digestion with proteinase K, followed by salting-out, organic extraction, or binding of the DNA to a solid-phase support (either anion-exchange or silica technology) as in spin column. Once the DNAis released, it must then be precipitated in alcohol. In water, DNA is soluble. When it is in ethanol, it uncoils and precipitates leaving behind the other cell components that are not soluble in ethanol.

The choice of a method depends on many factors: the required quantity and molecular weight of the DNA, the purity required for downstream applications, and the time and expense.

The DNA purification procedure using the spin column comprises of three steps viz. adsorption of DNA to the membrane, removal of residual contaminants and elution of pure genomic DNA. The DNA thus obtained is compatible with downstream applications such as restriction enzyme digestion, PCR and Southern blotting.

Principal: This new method of extraction of DNA from blood is simple, reliable and fast method for isolation of high-quality DNA. This method is based on the selective adsorption of nucleic acids to a silica-gel membrane in the presence of high concentrations of chaotropic salts. The system efficiently couples the reversible nucleic acid-binding properties of the advanced gel membrane and the speed plus versatility of spin column technology to yield high quantity of DNA. The use of spin column facilitates the binding, washing and elution steps thus enabling multiple samples to be processed simultaneously. This column eliminates the need for alcohol precipitation, expensive resins and harmful organic compounds such as phenol and chloroform, otherwise employed in traditional DNA isolation techniques. DNA binds specifically to the advanced silica-gel membrane while contaminants pass through. PCR inhibitors such as divalent cations and proteins are completely removed in two efficient wash steps, leaving pure nucleic acid to be eluted in the buffer. The purified DNAis upto 20-30 kb in length and can be used for further downstream applications.

Reagents

* Resuspension Solution (1X PBS)
* Lysis Solution (C1)
* Prewash Solution Concentrate (PW)
* Wash Solution Concentrate (WS)
* Elution Buffer (ET) [10 mM Tris-Cl, pH 8.5]
* Proteinase K
* RNase A Solution (20 mg/ml)
* HiEluteTM Miniprep Spin Column (in PW1139 Collection Tube)
* Collection Tubes, Polypropylene (2.0 ml)

Other materials needed

* 55°C water bath or heating block
* Tabletop Microcentrifuge (with rotor for 2.0 ml tubes)
* Ethanol (96 - 100%)
* Molecular Biology Grade Water

Storage

The reagents can be stored at room temperature (15-25°C) for up to 1 year without showing any reduction in performance. The Proteinase K solution can be stored for several days at 2-8°C. For long-term storage, the unused portion of the solution may be stored in aliquots at -20°C until needed.

General Preparation Instructions

1. Preheat a water bath or heating block to 55°C
2. Thoroughly mix reagents

   Examine the reagents for precipitation. If any kit reagent forms a precipitate (other than enzymes), warm at 55-65°C until the precipitate dissolves. The reagent should be at room temperature (15-25°C) before use.
3. Ensure that clean & dry tubes and tips are used for the procedure.
4. Dilute Prewash Solution Concentrate (PW) as follows:

Number of Preps	Prewash Solution Concentrate (PW)	Ethanol (96-100%)
20	6 ml	9 ml
50	12 ml	18 ml
250	60 ml	90 ml

5. Dilute Wash Solution Concentrate (WS) as follows:

Number of Preps	Wash Solution Concentrate (WS)	Ethanol (96-100%)
20	4 ml	12 ml
50	8 ml	24 ml
250	40 ml	120 ml

6. Reconstitute Proteinase K

Intensive research has shown that it is the optimal enzyme for use with the Lysis Solution. It is completely free of DNase and RNase activity. The specific activity of Proteinase K is 33.5 units/mg dry weight.

Resuspend the Proteinase K powder in Molecular Biology Grade Water to obtain a 20 mg/ml stock solution.

Number of Preps	Proteinase K	Molecular Biology Grade Water
20	10 mg	0.5 ml
50	24 mg	1.20 ml
250	120 ml	6 ml

The product as supplied is stable at room temperature; upon reconstitution store at -20°C.

Note:

The Proteinase K solution must be added directly to each sample preparation every time. Do not combine the Proteinase K and Lysis solutions for storage.

Procedure

1. **Collect Blood**

   Collect whole blood in an anticoagulant tube (an EDTA tube is preferred) under sterile conditions (if to be used for future). Ensure that the blood sample is at room temperature before beginning the protocol.

   For Frozen blood: To 200 ?l of frozen blood pellet (kept on ice) add 200 ?l of Lysis Solution and thaw the pellet with continuous pipetting. Then proceed with step 2 for Proteinase K and RNase A treatment (optional). Incubate at 55°C for 10 minutes and then proceed to step 4 of the protocol

2. Add 20 ?l of the reconstituted Proteinase K solution (20 mg/ml) into 2.0 ml collection tube containing 200 ?l of the whole blood. Vortex for 10-15 seconds to ensure thorough mixing.

3. Add 20 ?l of RNase Asolution (20 mg/ml). Vortex for 10-15 seconds and incubate for 2 minutes at room temperature (15-25°C). (Optional only if RNA-free genomic DNA is required)

4. Lysis reaction

   Add 200 ?l of the Lysis Solution (C1) to the sample, vortex thoroughly for a few seconds to obtain a homogenous mixture. Incubate at 55°C for 10 minutes.

Note:

If cell clumps are visible, the sample can be mixed gently by pipetting to obtain a homogenous mixture.

5. Prepare forBinding

   Add 200 ?l of ethanol (96-100%) to the lysate obtained from the above step for preparation of lysate for binding to the spin column. Mix thoroughly by gentle pipetting.

Note:

Ahomogenous solution is essential.

6. Load lysate in HiElute Miniprep Spin Column

   Transfer the lysate obtained from step 5 into the spin column provided. Centrifuge at ?6,500 x g (?10,000 rpm) for 1 minute. Discard the flow-through liquid and place the column in a new 2.0 ml collection tube.

Note:

Use a wide bore pipette tip to reduce shearing of the DNAwhen transferring contents into the column.

7. Prewash

   (Prepare Prewash Solution as indicated in General Preparation Instructions)

   Add 500?l of diluted Prewash Solution to the column and centrifuge at ?6,500 x g (?10,000 rpm) for 1 minute. Discard the flow-through liquid and re-use the same collection tube with the column.

8. Wash

   (Prepare Wash Solution as indicated in General Preparation Instructions)

   Add 500 ?l of diluted Wash Solution to the column and centrifuge at 12,000 - 16,000 x g (?13,000-16,000 rpm) for 3 minutes to dry the column. Discard the flow-through liquid and spin the empty column for another minute at the same speed if residual ethanol is observed. Discard the collection tube containing the flow through liquid and place the column in a new 2.0 ml collection tube.

Note:

The column must be free of ethanol before eluting the DNA. The tube can be emptied and re- used for this additional centrifugation step.

9. DNAElution

   Pipette 100 ?l of the Elution Buffer (ET) directly onto the column without spilling to the sides. Incubate for 1 minute at room temperature (15-250C). Centrifuge at ?6,500 x g (?10,000 rpm) for 1 minute to elute the DNA. Repeat the step again with another 100 ?l of Elution Buffer (ET) for high yield of DNA.

Note:

To increase the elution efficiency, incubate for 5 minutes at room temperature (15-250C) after adding the Elution Buffer (ET), then centrifuge.

Elution

The yield of genomic DNAdepends on the sample type and the number of cells in the sample. An elution with 200 ?l of Elution Buffer (ET) will provide sufficient DNA to carry out multiple amplification reactions. Elution with volume less than 200 ?l will increase the final DNAconcentration, but will reduce the overall DNAyield.

Concentration, yield and purity of DNA

Spectrophotometric analysis and agarose gel electrophoresis will reveal the concentration and the purity of the genomic DNA. Elution Buffer (ET) is used to dilute samples and to calibrate the spectrophotometer, measure the absorbance at 260 nm, 280 nm, and 320 nm using a quartz microcuvette. Absorbance readings at 260 nm should fall between 0.1 and 1.0. The 320 nm absorbance is used to correct for background absorbance. An absorbance of 1.0 at 260 nm corresponds to approximately 50 ?g/ml of DNA. The A260 - A320 /A280 -A320 ratio should be 1.6-1.9. Purity is determined by calculating the ratio of absorbance at 260 nm to absorbance at 280 nm. DNA purified by this method is free of protein and other contaminants that can inhibit PCR or other enzymatic reactions.

Concentration of DNAsample (?g/ml) = 50 x A260 x dilution factor.

2. Protocol for PCR

Introduction

The polymerase chain reaction (PCR) is a technique widely used in molecular biology. It derives its name from one of its key components, a DNA polymerase used to amplify a piece of DNA by in-vitro enzymatic replication. As PCR progresses, the DNA generated is used as a template for replication. This sets in motion a chain reaction in which the DNA template is exponentially amplified. With PCR it is possible to amplify a single or few copies of a piece of DNA across several orders of magnitude, generating millions or more copies of the DNA piece. PCR is used to amplify specific regions of a DNAstrand (the DNAtarget).

The PCR reaction requires the following components:

DNAtemplate - The sample DNAthat contains the target sequence. At the beginning of the reaction, high temperature is applied to the original double-stranded DNA molecule to separate the strands from each other.

DNA polymerase - A type of enzyme that synthesizes new strands of DNA complementary to the target sequence. The first and most commonly used of these enzymes is Taq DNA polymerase (from Thermis aquaticus), whereas Pfu DNA polymerase (from Pyrococcus furiosus) is used widely because of its higher fidelity when copying DNA. Although these enzymes are subtly different, they both have two capabilities that make them suitable for PCR: 1) they can generate new strands of DNAusing a DNAtemplate and primers, and 2) they are heat resistant.

Buffer (solution) - maintains the pH of a solution when small amounts of acid or base are added

Primers - short pieces of single-stranded DNA that are complementary to the target sequence. The polymerase begins synthesizing new DNA from the end of the primer.

Nucleotides (dNTPs or deoxynucleotide triphosphates) - single units of the bases A, T, G, and C, which are essentially "building blocks" for new DNA strands.

RT-PCR (Reverse Transcription PCR) is PCR preceded with conversion of sample RNA into cDNA with enzyme reverse transcriptase.

Materials and equipment required for PCR

1. Pipettes
2. Sterile filter pipette tips
3. Sterile nuclease-free water
4. PCR Reagents - buffer, dNTPs, MgCl2, enzymes, etc
5. 10 µm primers
6. 1.5 mL centrifuge tubes
7. 0.2 mL PCR tubes
8. Freezer
9. Ice or cold blocks
10. Centrifuge
11. PCR Machine

Method

One negative and one positive control are to be used in duplicate (DNA grade H2O only).

Set up as per the following example.

1 = -ve control 2 = +ve control 3 = test sample 1 4 = test sample 2

1. Bring DNA template aliquots to room temperature. Gently mix (DNA can sheer if it is mixed too violently) and softly spin down (using a centrifuge on low rpm).
2. Thaw and mix the PCR reagents before softly spinning them down (using a centrifuge on low rpm). Keep reagents cool on ice while out on the bench.

PCR master mix preparation

Sl No.	Reagents	Volume for 25 reactions	Volume for individual tubes
1.	Water		37.44 µl
2.	10 X PCR buffer	125 µl	5 µl
3.	dNTP (10 mM)	35 µl	1.4 µl
4.	Forward Primer (100 p mole/ µl)	7 µl	0.28 µl
5.	Reverse Primer (100 p mole/ µl)	7 µl	0.28 µl
6.	*Taq* Polymerase (2.5 units/ µl)	15 µl	0.6 µl
Total volume		1125 µl	45 µl

3. Make-up the PCR master mix into a 1.5 mL micro centrifuge tube. Mix well and softly spin down (using a centrifuge on low rpm). Keep master mix cool on ice while out on the bench.
4. Place individual PCR reagents back into freezer.
5. Aliquot 45 µl PCR master mix into labelled (with PCR #) 0.5 mL thin-walled PCR tubes.
6. Add sterile nuclease-free water to 'negative control' PCR tubes.
7. Close all lids and transfer the tubes to the area outside the designated PCR room or PCR cabinet where the DNA/PCR template is to be added.
8. Open lids individually to add 5 µl DNA/PCR template. Close lids immediately after adding DNA/PCR template.
9. Gently mix and spin down tubes using a centrifuge on low rpm.
10. Place tubes in PCR machine, select program and start cycle.

PCR cycle condition

The PCR reaction will be carried out under the following optimized conditions

Sl No.	Step	Temperature	Time
1.	Lid Temperature	105°C	
2.	Initial Denaturation	94°C	5 mins
3.	Denaturation	94°C	1 min 30 sec
4.	Annealing	63°C	2 mins
5.	Extention	72°C	2 mins
6.	Go to step 3	Repeat 39 cycles	
7.	Final extention	72°C	5 mins
8.	Final hold	4°C	Forever
9.	End		

11.Return DNA/PCR templates to freezer/fridge.

Note

Handle all reagents carefully, but be particularly careful with enzymes since they are highly sensitive to temperature and mechanical damage. Remove enzymes from freezer at the last possible moment and add immediately to master mix, return immediately to freezer.

Avoid too much pipetting and vortexing once enzymes are added (mix by flicking and inversion).

Detection of PCR product in Agarose Gel

Ethidium bromide is a fluorescent dye which detects both single- and double-stranded DNA. However, the affinity for single-stranded DNA is relatively low compared to double-stranded DNA. Ethidium bromide contains a planar group which intercalates between the bases of DNA and, when bound to DNA, results in an increase in fluorescence yield. Ethidium bromide stained DNA is detected by ultraviolet radiation. At 254 nm, UV light is absorbed by the DNA and transmitted to the dye; at 302 nm, and 366 nm, UV light is absorbed by the bound dye itself. In both cases, the energy is re-emitted at 590 nm in the red-orange region of the visible spectrum.

DNADetection Procedure:

Prepare an Agarose gel:

* (1X) TAE solution - 40ml
* Agarose powder - 0.64gram

To prepare 1X TAE Buffer: Add 90ml of distilled water to 10 X TAE Buffer.

1. Mix agarose in 1X TAE solution and boil preferably till the agarose completely dissolves.
2. This can be achieved in microwave oven. Remove and cool to around 50% temperature condition, and add 4µl of ethidium bromide to the agarose solution. Gently swirl the flask, and mix well.
3. Seal all the side of the platform, so as not to allow the buffer to run out.
4. Set the comb in the gel platform and pour the agarose buffer solution in to the platform
5. Allow the gel to set for 30 minutes.
6. After the gel is set, gently remove the comb from the platform
7. Place the Agarose gel in to submarine electrophoresis unit.
8. Pour 1X TAE Buffer solution such that the gel is fully immersed in to the buffer.
9. Add 4µl of Gel loading buffer to each of the master mix tube, and around 10 µl of the final product in to the well comb.
10. Connect the positive and negative leads of the electrophoresis to the power pack suitably.
11. Load the last comb with 10µl of DNAMarker (100 bp ladder)
12. Run the electric current at around 230 volts and around 15 amps for about 20 - 30 minutes.
13. Once the respective bands are seen at approximately half the distance of the gel, stop the current and view the gel in a Transilluminator.

3. Conventional PCR for 16SrDNA and HPV L1 Capsid protein

Preparation of master mix

Sl No.	Reagents	Volume for 30 reactions	Volume for individual tubes
1.	Water	687µl	22.9µl
2.	10 X PCR buffer	90 µl	3 µl
3.	dNTP (10 mM)	18µl	0.6 µl
4.	Forward Primer (10 p mole/ µl)	30 µl	1 µl
5.	Reverse Primer (10 p mole/ µl)	30 µl	1 µl
6.	*Taq* Polymerase (2.5 units/ µl)	15 µl	0.5 µl
7.	Template DNA		1 µl
Total volume			30 µl

PCR cycle condition : The PCR reaction will be carried out under the following optimized conditions

Sl No.	Step	Temperature	Time
1.	Lid Temperature	105°C	
2.	Initial Denaturation	94°C	5 mins
3.	Denaturation	94°C	1 min 30 sec
4.	Annealing	60°C	2 mins
5.	Extention	72°C	2 mins
6.	Go to step 3	Repeat 39 cycles	
7.	Final extention	72°C	5 mins
8.	Final hold	4°C	Forever
9.	End		

Product size: 990 bp and 450bp

4. Western blot procedure

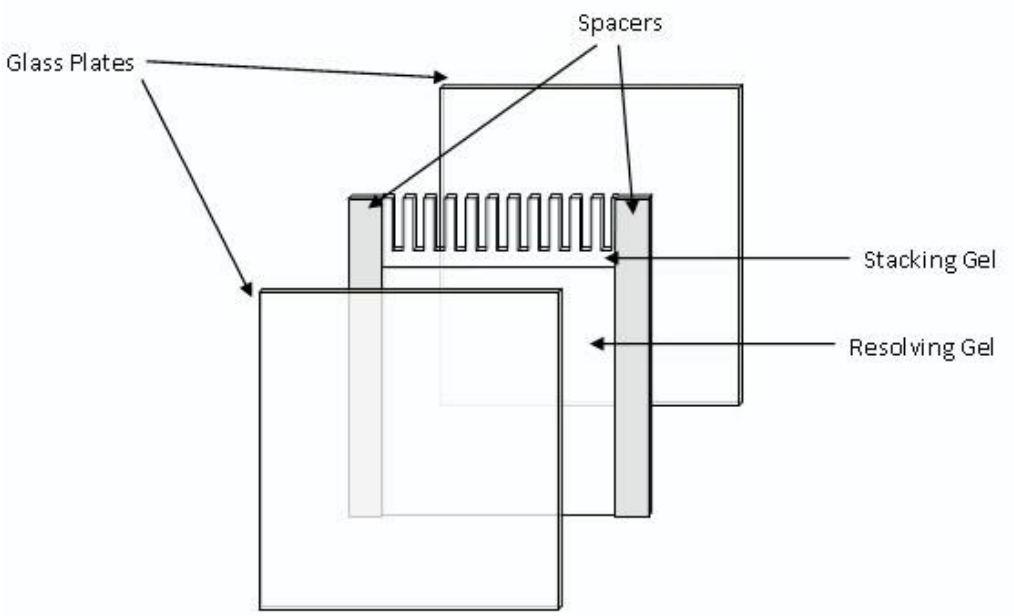
Purpose: To separate the proteins from cell lysates

Materials required:

1. For SDS Page:
   i. Acrylamide-30%
   ii. 1.5M Tris HCL (PH 8.8): 18.5 g of tris base in 50 ml of distilled water adjust the PH to 8.8 using 1 N HCl and then make up the volume to 100 ml using distilled water.
   iii. 0.5M tris HCL (PH 6.8): 6g of tris base in 50ml of distilled water, adjust the PH to 6.8 using 1 N HCl and make up the volume to 100ml using distilled water.
   iv. 10% SDS: 1 g of SDS/SLS in 10 ml of distilled water.
   v. Sample loading buffer (4X) 1ml: 10% glycerol- 100?l
      SDS-0.02g
      Bromophenol blue-pinch
      0.5M tris- 830?l
      50mM DTT : 100?l of 500mM DTT
   vi. Running Buffer (5X) : Tris base- 45g (0.18M)
      Glycine-216g (1.44M)
      SDS-15g make up the volume to 2 liters.

Procedure:

1. Take the glass plates required for PAGE, assemble them by using scotch cellophane tape.



SDS-Page Gel Setup

2. Check for leakage using distilled water. Once there is no leakage prepare the separating gel and pour the gel up-to 3/4th of the plate.

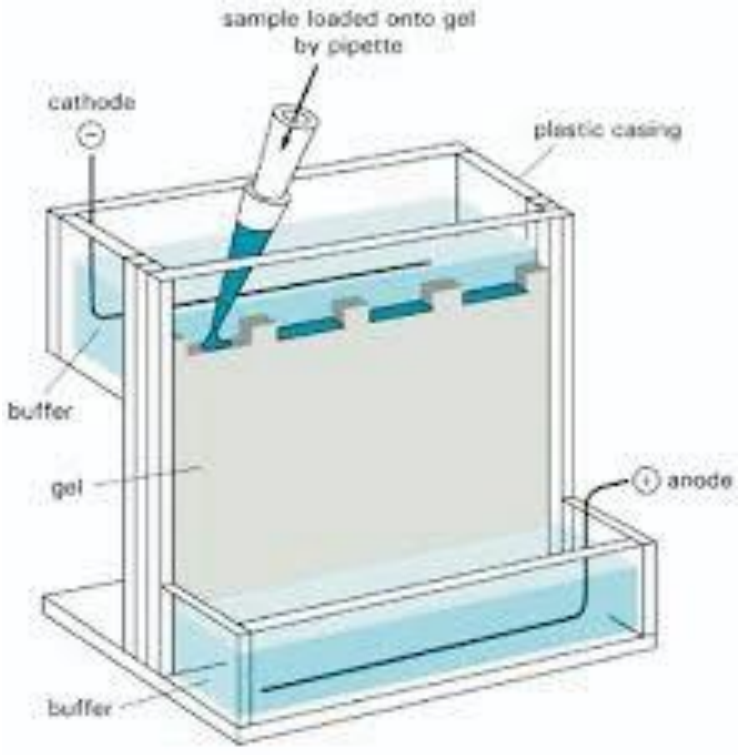
Separating gel(12%)	**Volume (5ml)**	**10ml**	**15ml**	**30ml**
Tris HCl 1.5M pH-8.8	1.25ml	2.5ml	3.75ml	7.5ml
Distilled water	1.45ml	2.9ml	4.35ml	8.7ml
10 % SDS	..	100 ìl	150 ìl	300ìl
30% acrylamide	2ml	4ml	6ml	12ml
1.5% APS	0.25ml	0.5ml	0.75ml	1.5ml
TEMED	2.5 ìl	5 ìl	7.5 ìl	15ìl

3. Remove any air bubble by adding some isopropanol on top of the separating gel. Allow the gel to Polymerise(20 minutes) and remove the isopropanolby holding the tissue paper at one corner and inverting the gel. Wash with distilled water twice.
4. Now mix the stacking gel reagents and pour over the separating gel until the edge of the plate and then place the comb.

Stacking gel(4%)	**Vol ume (5ml)**	**10ml**	**15ml**	**30ml**
Tris HCl 0.5M pH - 6.8	1.25ml	2.5ml	3.75ml	7.5ml
Distilled water	2.82ml	5.65ml	8.45ml	16.95ml
10 % SDS	50 ìl	100 ìl	150 ìl	300 ìl
30%acrylamide	0.625ml	1.25ml	1.87ml	3.75ml
1.15% APS	0.25ml	0.5ml	0.75ml	1.5ml
TEMED	5 ìl	7.5ìl	10 ìl	20 ìl

5. Once the gel has polymerized remove the comb carefully and add distilled water to remove the air bubbles and then drain them off.
6. Place the gel in the unit such that the wells face the cathode and add the running buffer.
7. Calculate the concentration of the proteins and load at least 100?g of sample and the protein marker mixed with the sample loading buffer. Adjust the concentration of sample loading buffer to 1x.

8. After loading the samples fill the upper reservoir tank with running buffer.
9. Connect the anode and the cathode to the power outlet and set for50V and allow for the run till dye enters into separating gel then increase the voltage to 100V.
10. Keep the track of the dye to ensure the run is complete and turn off the power when it reaches the edge of the plate (2 hours)

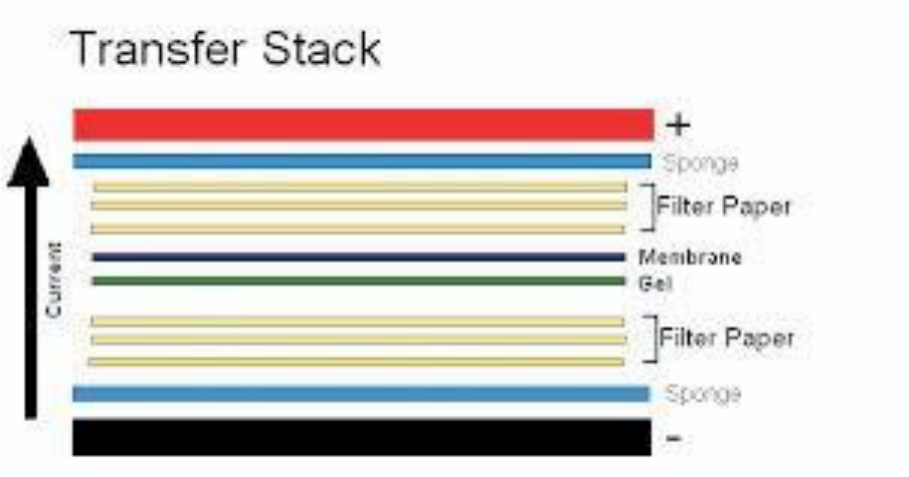


Transfer of the bands from the gel to the membrane:

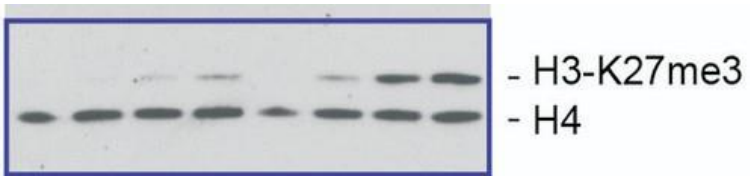
1. Transfer buffer: Tris base: 25mM
   Glycine: 192mM
   Methanol: 20%
2. TBS(10x): Sodium Chloride- 80g
   Tris base- 24.2g
   Make up-to 1000ml and adjust the PH to 7.6
3. TBST: TBS with 0.2% Tween
4. Blocking buffer: 3 % BSA in TBST.

Procedure:

1. Set the transfer apparatus; soak the sponge and the filter papers in the transfer buffer.
2. Cut the required amount of PVDF membrane and activate them in methanol for 30 seconds.
3. Place the sponges and filter papers, above the black plate, followed by the gel and then the membrane and again the filter paper followed by sponge and the red plate.
4. Place the membrane and the gel in the transfer unit such that the gel faces the cathode.



5. Add the 1X transfer buffer and allow for the transfer to occur for 2-4 hours at 100 Volts at4?C.
6. After the transfer, carefully remove the membrane and rinse once with distilled water and then add the Blocking buffer and leave it for 1 h at 37?C.
7. Add the primary antibody to the fresh blocking buffer diluted 1:2000 times (5?l of Ab in 10 ml of blocking buffer) and keep for 2 hour at room temperature or overnight at 4?C
8. Remove the blocking buffer with Ab after the incubation and store upto 1 week. Wash thrice with TBST10min.
9. Add the secondary antibody to the fresh blocking buffer diluted 1:4000 times (2.5?l of Ab in 10 ml of TBST) and keep for 2 hat room temperature.
10. Wash thrice with TBST and rinse with distilled water.
11. Add the ECL-Enhanced chemiluminescence (1:1 diluted) 2ml to the membrane and keep it in dark for 5 minutes.
12. Place the membrane in the gel doc and capture the bands.



Histone Protein confirmation using western blot

VI Semester
Allied-6- Hospital Management

1. **Quality Concepts:** Definition of Quality, Dimensions of Quality, Basic concepts of Total Quality Management, Quality Awards. Accreditations for hospitals: Understanding the process of getting started on the road to accreditation, National and International Accreditation bodies, overview of standards- ISO (9000 & 14000 environmental standards), NABH, NABL, JCI, JACHO.

2. **Hospital Information System:** Hospital Information System Management and software applications in registration, billing, investigations, reporting, ward management and bed distribution, medical records management, materials management and inventory control, pharmacy management, dietary services, management, information processing. Security and ethical challenges.

3. **Inventory Control:** Concept, various costs of inventory, Inventory techniques-ABC, SDE / VED Analysis, EOQ models. Storage: Importance and functions of storage. Location and layout of stores. Management of receipts and issue of materials from stores, Warehousing costs, Stock verification.

4. **Equipment Operations management:** Hospital equipment repair and maintenance, types of maintenance, job orders, equipment maintenance log books, AMCS, outsourcing of maintenance services, quality and reliability, concept of failure, equipment history and documents, replacement policy, calibration tests, spare parts stocking techniques and polices

5. **Biomedical Waste Management:** Meaning, Categories of Biomedical Wastes, Colour code practices, Segregation, Treatment of biomedical waste-Incineration and its importance. Standards for waste autoclaving, microwaving. Packaging, Transportation & Disposal of biomedical wastes