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)
Re-Accredited "A+" Grade by NAAC
Sri Shivarathreeshwara Nagara Mysuru - 570015, Karnataka

Regulation & Syllabus

B.Sc. MEDICAL LABORATORY TECHNOLOGY
2023

BSc

REGULATIONS AND CURRICULUM

B.Sc. MEDICAL LABORATORY TECHNOLOGY

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Sri Shivarathreeshwara Nagara, Mysuru - 570015, Karnataka

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 in CTVS [B.Sc. (PA)]
j) Bachelor of Science in Optometry [B.Sc. (optometry)]
k) Bachelor of Science in Forensic Science [B.Sc. (FS)]
l) Bachelor of Science (Honors) in Genetics & Genomics [B.Sc. (G & G)]
m) Bachelors of Occupational therapy (BOT)

2. Eligibility for admission

A candidate seeking admission to the Bachelor of Science Degree in Allied HealthSciences [a) to m) 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 AHER, Mysore (JSSAHER) with Physics, Chemistry and Biology as principal subjects of study.

OR

b) Pre-degree course from a recognized University considered as equivalent by JSSAHER, (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 JSSAHER 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 andBiology, as principal subject

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 thetenure 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 ofthe 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.

3. Duration of the course

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

4. Medium of instruction

The medium of instruction and examination shall be in English.

5. 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 and practical's/ clinicals separately) 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 in that semester. However, students will have to put up 75% attendance in the additional classes conducted by the department to appear for supplementary examination.

6. 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 40% marks in the **IA theory and practical separately** 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.

7. Subject and hours of in for theory and practical's

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 year subjects.

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Practical hours	Credits	Total hours	Total credits
Core - 1	Anatomy	45	3	15	1	30	1	90	5
Core - 2	Physiology	45	3	15	1	30	1	90	5
Core - 3	Basic Biochemistry	45	3	15	1	30	1	90	5
Ability Enhancement -1	English	30	2	-	-	-	-	30	2
Ability Enhancement - 2	Kannada	30	2	-	-	-	-	30	2
Value added course 1	Yoga	15	1	-	-	15	-	30	1
Total Credits	20								

Table II: Distribution of teaching hours in Second Semester subjects

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Practical hours	Credits	Total hours	Total credits
Core - 4	Pathology	45	3	15	1	30	1	90	5
Core - 5	Microbiology	45	3	15	1	30	1	90	5
Core - 6	Pharmacology	45	3	15	1	30	1	90	5
Value added course 2	Health care	30	2	-	-	-	-	30	2
Allied - 1	Psychology	30	2	-	-	-	-	30	2
Skill Enhancement-1	Soft skills	15	1	-	-	-	-	15	1
Total Credits	20								

Table III: Distribution of teaching hours in Third Semester subjects

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 7	Biochemistry I	45	3	15	1	90	3	150	7
Core - 8	Pathology I	45	3	15	1	90	3	150	7
Core - 9	Microbiology I	45	3	15	1	90	3	150	7
Skill Enhancement-2	Computer application	30	2	-	-	-	-	30	2
Value added course-3	Environment Science and Health	30	2	-	-	-	-	30	2
Total Credits	25								

Table IV: Distribution of teaching hours in Fourth Semester subjects

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 10	Biochemistry II	45	3	15	1	90	3	150	7
Core - 11	Pathology II	45	3	15	1	90	3	150	7
Core - 12	Microbiology II	45	3	15	1	90	3	150	7
Skill Enhancement-3	Biostatistics and Research methodology	30	2	-	-	-	-	30	2
Value added course -4	Constitution of India	30	2	-	-	-	-	30	2
Total Credits	25								

Table V: Distribution of teaching hours in Fifth Semester subjects

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 13	Biochemistry III	45	3	15	1	90	3	150	7
Core - 14	Pathology III	45	3	15	1	90	3	150	7
Core - 15	Microbiology III	45	3	15	1	90	3	150	7
Elective 1		30	2	-	-	-	-	30	2
Allied - 2	Medical Ethics	30	2	-	-	-	-	30	2
Total Credits	25								

Table VI: Distribution of teaching hours in Sixth Semester subjects

Category	Subjects	Theory hours	Credits	Tutorials hours	Credits	Modality Posting + Practicals	Credits	Total hours	Total Credits
Core - 16	Biochemistry IV	45	3	15	1	90	3	150	7
Core - 17	Pathology IV	45	3	15	1	90	3	150	7
Core - 18	Microbiology IV	45	3	15	1	90	3	150	7
Elective-2		30	2	-	-	-	-	30	2
Allied-3	Hospital Management	30	2	-	-	-	-	30	2
Total Credits	25								

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
Accident Investigation	Forensic Medicine
Forensic Psychology	Forensic Medicine
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
DNA Typing	Forensic Medicine
Introduction to biometry	Forensic Medicine

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 *(compulsory on payment basis)	All courses	IV	Emergency medicine
Small Project/data Analysis/Industrial visit	All courses	V	Concerned departments of the Course
Advanced cardiac lifesupport compulsory on payment basis for the said courses	Respiratory Care Technology, Emergence Medicine Technology, Anaesthesia and OT Technology, Cardiac Care Technology	VI	Emergency medicine

8. End Semester Examination

a) University examinations (UE): The University shall conduct examination forthe 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, value added courses 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/Value based/Allied/Elective) from first to fifth semester to appear for the sixth semester University examination.

9. Scheme of Examination:

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

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

Category	Subjects	Theory				Practical			
Core - 1	Anatomy	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core - 2	Physiology	40	60	-	100	15	35	-	50
Core - 3	Basic Biochemistry	40	60	-	100	15	35	-	50
Ability Enhancement -1	English		-	50	50	-	-	-	-
Ability Enhancement - 2	Kannada	-	-	50	50	-	-	-	-
Value added course 1	Yoga	-	-	50	50	-	-	-	-

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

Category	Subjects	Theory				Practical			
Core - 4	Pathology	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core - 5	Microbiology	40	60	-	100	15	35	-	50
Core - 6	Pharmacology	40	60	-	100	15	35	-	50
Value added course 2	Health care	-	-	50	50	-	-	-	-
Allied - 1	Psychology	-	-	50	50	-	-	-	-
Skill Enhancement-1	Soft skills			50	50				

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

Category	Subjects	Theory				Practical			
Core – 7	Biochemistry I	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core – 8	Pathology I	40	60	-	100	15	35	-	50
Core – 9	Microbiology I	40	60	-	100	15	35	-	50
Skill Enhance ment-2	Computer application	-	-	50	50	-	-	-	-
Value added course-3	EnvironmentScience and Health	-	-	50	50	-	-	-	-

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

Category	Subjects	Theory				Practical			
Core - 10	Biochemistry II	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core - 11	Pathology II	40	60	-	100	15	35	-	50
Core - 12	Microbiology II	40	60	-	100	15	35	-	50
Skill Enhancement-3	Biostatistics and Research methodology	-	-	50	50	-	-	-	-
Value added course -4	Constitution of India	-	-	50	50	-	-	-	-

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

Category	Subjects	Theory				Practical			
Core – 13	Biochemistry III	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core – 14	Pathology III	40	60	-	100	15	35	-	50
Core – 15	Microbiology III	40	60	-	100	15	35	-	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			
Core – 16	Biochemistry IV	IA	UE	NUE	Total	IA	UE	NUE	Total
		40	60	-	100	15	35	-	50
Core – 17	Pathology IV	40	60	-	100	15	35	-	50
Core – 18	Microbiology IV	40	60	-	100	15	35	-	50
Elective 2		-	-	50	50	-	-	-	-
Allied-6	Hospital Management	-	-	50	50	-	-	-	-

Question paper pattern for end semester University theory examinations(60 marks): Duration-2hours

I. Short Essay: 04 questions out of 06 = 04x05=20
II. Short Answer: 10 questions = 10x03=30
III. Very Short Answer: 05 questions = 05x02=10
Total = 60 Marks

Question paper pattern for end semester Non-University theory examinations(50 marks)
MCQs 50 marks/Written theory assessment for 50 marks/Theory & practical assessment for 50 marks

10.Examiners

- 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 two internal/One Internal & one External examiners. Theory paper shall be valued by both the examiners.
- 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.

11. 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.

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

12. Grading of performances

a. Letter grades and grade points allocations

Based on the performances, each student shall be awarded a final letter grade atthe 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 marksand 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 PointAverage (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade PointAverage' (SGPA). The SGPAis the weighted average of thegrade 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' SGPAis 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 forany 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 shallthen be computed as:

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

c. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VI semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VI 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:

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

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,…. .

13. 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

14. Carry over

A candidate who fails in core/language/skill enhancement/value based/allied/elective subjects of first semester to Fifth semester shall be permitted to carryover those subjects upto fifth semester. However, the candidate must have passed all the previous subjects (core/language/skill enhancement/value based/ allied/elective) to appear for the sixth semester University examination.

15. 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.

16. 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.

17. Award of degree

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

18. 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.

19. 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.

B.Sc. Medical Laboratory Technology
Program outcomes

At the end the program the Medical Laboratory technology student should be able to

PO1: Demonstrate comprehensive knowledge and skills in basic sciences for laboratory technology

PO2: Demonstrate the comprehensive skills to facilitate diagnosis in medical laboratories with expertise in phlebotomy, collection of samples, handling, processing and storage of patient samples in various sections of laboratory services.

PO3: Handle, follow appropriate equipment maintenance procedures and protocols, identify problems and trouble shoot in routine practice

PO4: Demonstrate the acquisition of technical skills, analyse problem solving techniques to identify errors in laboratory with appropriate root cause analysis with corrective and preventive actions.

PO5: Demonstrate the capability to perform the routine laboratory tests with knowledge of advanced laboratory tests pertaining to pathology, microbiology and Biochemistry with appropriate quality assurance protocols.

PO6: Communicate effectively with patients, peers, and doctors and be a competent technical professional to pursue their career in Medical Laboratory Technology by providing accurate, reliable and timely repeorts conforming to standards in the field of laboratory medicine.

PO7: Ability to adhere to medical ethics and maintain strict confidentiality and not disclose any information of the patient at any phase to unauthorised persons.

PO8: Appropriate maintenance of records in routine practice and compliance to standards in various accreditation processes.

I Semester

Core-1 Anatomy

Course Outcome:

At the end of the course, students should know

CO1: Demonstrate the acquisition of comprehensive knowledge of basic tissues of the body.

CO2: Demonstrate the acquisition of comprehensive knowledge of gross anatomy of muscles, joints and organ system of human body

CO3: Demonstrate the acquisition of analysing the applied aspects concerned to human body.

CO4: Demonstrate the skill of identification of viscera of organ systems of human body

CO5: Demonstrate the skill of identification of microscopic structure of basic tissues and organs and correlate with their functions

CO6: Demonstrate the acquisition of comprehensive knowledge regarding the general embryology with congenital anomalies

Theory:

Unit I **03hrs**

Organization of the human body

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 membrane, cytoplasm, cell organelles

Cell division – definition and main events in different stages of mitosis and meiosis

Tissues – Tissues of the body

Characteristics, functions and locations of different types of tissues

Epithelial tissue – definition, classification with examples

Glands – classification with examples

Connective tissue and Nervous tissue

Unit II

Locomotion and Support **06hrs**

Locomotion and support

Cartilage – structure, types with examples

Skeletal system

Classification, structure, functions and ossification

Name, location and features of bones of the body.

Joints – Definition, types of joints with examples

Name, location, type, bones forming, movements possible in the synovial joints of the body.

Muscular system

Muscular tissue – skeletal muscle - gross anatomy and histology

Cardiac and smooth muscle – histology

Muscles of upper limb, lower limb, thorax, abdomen and head and neck

Unit III

Maintenance of the Human Body **12hrs**

Cardio-vascular system

Types and structure of blood vessels, capillaries

Heart – location, coverings, external and internal features of heart,Blood supply of heart

Systemic arteries and veins – major arteries and veins of the body

Lymphatic system
Lymphoid organs – structure and functions
Respiratory system
Organs of respiration, location, features of nasal cavity, pharynx, larynx, trachea, bronchi, lungs and pleura
Digestive system
Organs of digestive system, location, features of oral cavity, Tongue, pharynx, oesophagus, stomach, intestine and accessory organs of digestion – salivary glands, liver and pancreas.

Unit IV **12hrs**
Excretory system and reproductive system
Organs of urinary system, location and features of kidneys, ureter, urinary bladder and urethra
Male and female reproductive organs. Location, features of scrotum, testis, epididymis, vas deferens, seminal vesicle, ejaculatory ducts, prostate gland, penis and spermatic cord
Location and features of uterus, its supports, uterine tube, ovary and mammary gland
Embryology I - IV week – gametogenesis, structure of sperm, growth of the ovarian follicles, events of 1st, 2nd and 3rd weeks of development, folding of embryo, derivatives of germ layers, placenta

Unit V
Control Systems of the Body **12hrs**
1. Nervous system
Introduction, coverings and blood supply of brain and spinal cord
Spinal cord – location, external features and internal structure of spinal cord
Brain – subdivisions, location, external features and internal structure of medulla oblongata, pons and midbrain, cerebellum and cerebrum.
Thalamus and hypothalamus
Basal ganglia
Ventricles – location, formation and circulation of CSF
Cranial nerves

2.Sense organs
Location and features of olfaction, eye, ear and skin

3.Endocrine system
Name of the endocrine glands, location and features, histology of pituitary gland, thyroid gland, parathyroid, suprarenal gland, pancreas, testis and ovary. Hormones secreted by each gland.

Practical **30hrs**
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 ofupper 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 andfeatures 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 : 35 Marks

1. Gross Anatomy - Discussion of any one specimen 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
3. Histology discussion of any one demonstrated slide

Recommended Books Recent Editions:

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

Course Outcome

At the end of the course, students should know

CO1: Demonstrate the acquisition of comprehensive knowledge in the basic physiological concepts of general physiology.

CO2: Demonstrate the acquisition of comprehensive knowledge of circulation in human body.

CO3. Demonstrate the acquisition of comprehensive knowledge of all organ system of the body

CO4. Perform and analyse the investigation of blood.

Contents

Theory

Unit -I

General physiology and Blood

General Physiology **(2 Hrs)**

- Homeostasis with body fluid compartments
- Cell membrane, types of transport across cell membrane
- Membrane potential-RMP & AP

Blood **(7Hrs)**

- Composition and function of blood:Haemopoiesis
- Haemoglobin : types & functions:RBC structure & function ,destruction. Anaemia & Jaundice
- WBC: types & functions. Immunity: definition & classification
- Platelets: structure & function. Haemostasis :steps in brief ,anticoagulant eg
- Blood groups: types, incompatibility, blood transfusion.
- Lymph: composition and functions

Unit -II

Digestive system & Respiratory system

Digestive System **(3Hrs)**

- Organization and functions of digestive system
- Saliva: composition & functions
- Mastication and deglutition
- Functions of stomach
- Gastric juice: composition & functions
- Types of gastric motility
- Liver: functions, bile juices: composition & function, functions of gall bladder
- Pancreatic juice: composition & functions
- Small intestine: succus entericus, types of motilities
- Large intestine: functions

Respiratory system **(4 Hrs)**

- Functions of respiratory system. Mechanism of breathing {inspiration and expiration}
- Surfactant: composition and function. Lung volumes and capacities
- Pulmonary ventilation, alveolar ventilation, dead space

- Transport of oxygen and carbon di oxide {only difference}
- Hypoxia: definition, types, dyspnea, apnea, hyperventilation

Unit -III
Cardiovascular and Endocrine system
Cardiovascular system **(4Hrs)**

- List the properties of cardiac muscle
- Origin spread of cardiac impulse
- ECG: Definition, normal ECG, diagram in lead II
- Cardiac cycle: definition, normal duration, phases
- Heart sounds types, normal characteristics
- Blood pressure: Definition, components, normal values, factors affecting it
- Name different regional circulation, effect of exercise on CVS (brief)

Endocrine System **(7 Hrs)**

Name the different endocrine glands, hormones secreted by them
HORMONE: Structure, Function, name the disorders involved with that hormone{hypo and hyper secretion}

Unit -IV
Excretory system and Reproductive system
Excretory System **(4Hrs)**

- Types of nephrons and its differences, JG Apparatus
- GFR: definition , normal values , factors affecting
- Tubular functions: absorption and secretion in different segment
- Micturition process
- Skin and body temperature

Reproductive system **(3Hrs)**

- Puberty in male and female
- Spermatogenesis, semen composition& analysis
- Functions of Testosterone
- Functions of Estrogen
- Functions of Progesterone.
- Menstrual cycle: uterine and ovarian cycle (brief only)
- Contraception both in men and women: types

Unit -V
Muscle nerve physiology, Nervous system and Special senses
uscle nerve physiology **(2Hrs)**

- Classification of neurons and nerve fiber. List of properties of nerve fibers Neuroglia: types
- Types of muscle, steps of neuromuscular transmission ,E-C coupling ,muscle contraction

Nervous system **(5Hrs)**

- Synapse: types, list properties, list functions
- Receptor: structure, type, sensation carried by it , list the properties

- Reflex: reflex arc, classification, functions
- Ascending tract: list them and its function
- Descending tract: list them and its function
- Cerebral cortex: different lobes and its functions
- functions of basal ganglia, thalamus, hypothalamus
- functions of cerebellum
- CSF: composition and function

Special senses **(4Hrs)**

- Olfaction: tract, types of smell, odorant, receptor, name the applied aspect
- Gustation: pathway, types of tastes, taste buds, name the applied aspect
- Vision: rods, cones, differences, dark & light adaptation, visual pathway & name the applied aspect, errors of refraction & its correction, colour blindness, cataract
- Audition: functions of external ear, middle ear & inner ear, content of middle ear & inner ear, Organ of Corti, hearing pathway, name the applied aspect

Practicals **(30 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: 35 Marks

1. Estimation of Hemoglobin.
2. Determination of Blood Groups.
3. Determination of Bleeding and Clotting time.
4. Spotters-Haemocytometer, (Identification of cells) Differential Count,Sphygmomanometer, Spirometer . - 15 marks

Recommended Books Recent Editions

1. A.K.Jain, Human Physiology and Biochemistry for Physical Therapy and Occupational Therapy, 1st Ed. Arya Publication.
2. Dr. Venkatesh.D and Dr. Sudhakar H.S. Basic of Medical Physiology, 3rd Ed.,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, 8th Ed. AryaPubliction.
2. Guyton (Arthur) Text Book of Physiology.13rd Ed. Prism Publishers.
3. Ganong (William F) Review of Medical Physiology. 27th Ed. Appleton.

I Semester

Core- 3- Basic Biochemistry

Course outcome:

At the end of the course, students should know

CO1: Demonstrate acquisition of comprehensive knowledge of cellular structure with its functions

CO 2: Demonstrate acquisition of comprehensive knowledge and skills related to Biomedical importance of macromolecules and micromolecules

CO 3: Demonstrate acquisition of comprehensive knowledge of the enzymes

CO 4: Demonstrate acquisition of comprehensive knowledge and skills related to biochemical components of blood, urine and body fluids.

CO 5: Demonstrate acquisition of comprehensive knowledge of biochemical importance of nutrition

CO 6: Demonstrate acquisition of comprehensive knowledge of quality control and biomedical waste management in medical laboratory.

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. Definition & Classification of Proteins based composition, conformation, and function. Functions Plasma proteins, Biologically important peptides and their functions, and Immunoglobulins -structure and functions

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

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

Unit II 06 hrs

Enzymes & Acid base balance

Enzymes- Definition and Classification. Factors affecting enzyme activity. Coenzymes and Cofactors. Enzyme inhibition – types and their importance.

Acids, Bases & Body Buffers -Definition with examples, and regulation of pH in brief.

Unit III 12hrs

Vitamins & Minerals

Vitamins-Classification, Sources, RDA, Functions (in brief), deficiency manifestations and hypervitaminosis of fat-soluble vitamins A, D, E and K.

Sources, RDA, Functions (in brief), deficiency manifestations of water-soluble vitamins – Thiamine. Riboflavin, Niacin, Pyridoxine, Biotin, Pantothenic acid, Folic acid , cobalamin and Ascorbic acid.

Minerals-Classification.

Calcium, Phosphorus, Iron , copper Iodine, zinc, calcium, phosphorous, sodium, potassium & chloride -Sources, RDA, Functions (in Brief), deficiency manifestations.

Unit IV 05hrs

Nutrition, Blood chemistry & Urine Chemistry

Nutrition- Nutrients, Calorific value of food, BMR and factors affecting BMR, respiratory quotient and its applications, biological value of proteins,nitrogen balance, Protein energy malnutrition.
Blood chemistry- Biochemical components & their reference ranges in normal & diseased states- glucose, urea ,creatinine , electrolytes, total proteins and albumin.

Unit V 10hrs

Clinical Biochemistry-

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 30hrs

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

Practical Examination (35marks)

1. Identification carbohydrates or NPN substances - 10 Marks
2. Color reactions of Proteins - 15 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

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 TakingWhy 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 recordingand 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 agroup 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.

3. Paragraph Structure

A paragraph consists of 3 main structures :

1. Claim
2. Evidence
3. Analysis

d) Enlargements of VocabularyRoots: 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 - ifyou 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?

- Author
- Title

- Place of publication
- Publisher
- Date of publication
- Page 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 notcommonly 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).
3. 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 VocabularyRoots - 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 newspaperson sporting events.

e) Practice In Writing

Exercises and assignments on report writing for students

Unit VI

Verbal Communication

1. Discussions And Summarization Tips on taking minutes of a meetingWhy 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 themeeting.

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 willbe 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 understandright 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 idea
3. 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.
4. 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 andclassmates, 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 dialogues, 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. Thefollowing 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. Dialoguealso enhances the story line and plot.

a) Exposes Character Traits
   Through indirect characterization, dialogue reveals details about a character bywhat 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 thestory. 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

ಕನ್ನಡ : ಒಂದು

ಪಠ್ಯಕ್ರಮದ ರೂಪರೇಖೆ

ಸ್ಥಾನ	: ಬಿ.ಎಸ್.ಸಿ. (ಅಲೈಡ್ ಹೆಲ್ತ್ ಸೈನ್ಸ್‌ಕೋರ್ಸ್) ಮೊದಲವರ್ಷ
ಸಮಯ	: 30 ಘಂಟೆಗಳು (ಮೂವತ್ತು ಘಂಟೆಗಳು)
ಪಠ್ಯಕ್ರಮದ ವಿವರಣೆ	: ವಿದ್ಯಾರ್ಥಿ/ ವಿದ್ಯಾರ್ಥಿನಿಯರು ದಿನನಿತ್ಯ ಸಂಪರ್ಕಿಸಬಹುದಾದ ಜನಸಾಮಾನ್ಯರೊಡನೆ ಶುಶ್ರೂಷೆಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಕನ್ನಡದಲ್ಲಿ ಸಂಭಾಷಣೆ ಮಾಡಲು ಹಾಗೂ ತಿಳುವಳಿಕೆ ನೀಡಲು ಸಹಕಾರವಾಗುವಂತೆ ಪಠ್ಯಕ್ರಮದ ಮಾದರಿಯನ್ನು ಅಳವಡಿಸುವುದು.
ಉದ್ದೇಶ	: ದಿನಬಳಕೆಯ ವ್ಯವಹಾರದಲ್ಲಿ ಶುಶ್ರೂಷಣೆಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಕನ್ನಡ ಭಾಷೆಗೆ ಅಳವಡಿಕೆ. ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಭಾಷೆಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಪಠ್ಯಕ್ರಮದ ವಿವರಣೆ

ಘಟಕಒಂದು (ಆರು ಘಂಟೆಗಳು)	: ಅಕ್ಷರಮಾಲೆ, ಸ್ವರಗಳು, ವ್ಯಂಜನಗಳು,, ಕಾಗುಣಿತ, ಬರವಣಿಗೆ, ಅಭ್ಯಾಸ.
ಚಟುವಟಿಕೆ	: 1. ಕನ್ನಡ ವರ್ಣಮಾಲೆಯ ಅಕ್ಷರಗಳನ್ನು ಬರೆಯಿರಿ.
ಘಟಕಎರಡು (ಆರು ಘಂಟೆಗಳು)	: ಪದಪರಿಚಯ, ಪದಪುಂಜ, ದಿನಬಳಕೆಯ ಪದಗಳು, ಸಂಬಂಧಗಳು, ನಾಮಪದ, ಸರ್ವನಾಮ, ಅಂಕಿಗಳ ಪರಿಚಯ, ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು.
ಚಟುವಟಿಕೆ	: 1. ನಿಮಗೆ ತಿಳಿದಿರುವ ವಿವಿಧ ರೋಗಗಳ ಹೆಸರುಗಳನ್ನು ಪಟ್ಟಿಮಾಡಿ. 2. ನಿಮಗೆ ತಿಳಿದಿರುವ ತಿಂಡಿ – ತಿನಿಸುಗಳ ಹೆಸರುಗಳನ್ನು ಪಟ್ಟಿಮಾಡಿ.
ಘಟಕಮೂರು (ಆರು ಘಂಟೆಗಳು)	: ಲಿಂಗ, ವಚನ, ಅವ್ಯಯ, ತಿಂಡಿ – ತಿನಿಸುಗಳ ಪರಿಚಯ, ದೇಹದ ಅಂಗಗಳ ಪರಿಚಯ, ವಿವಿಧ ಬಗೆಯ ರೋಗಗಳ ಪರಿಚಯ.
ಚಟುವಟಿಕೆ	: ರೋಗಿಯ ವಿವರ ತಿಳಿಯಲು ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಬಳಸಲಾಗುವ ನಮೂನೆಯ ಮಾದರಿಯನ್ನು ರಚಿಸಿ.
ಘಟಕ ನಾಲ್ಕು (ಆರು ಘಂಟೆಗಳು)	: ಶುಶ್ರೂಷಣಾ ಪದಗಳು, ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಬಳಸುವ ವಿವಿಧ ನಮೂನೆಗಳ ಪರಿಚಯ, ನಮೂನೆಗಳ ರಚನೆ.
ಚಟುವಟಿಕೆ	: ಶುಶ್ರೂಕರು ಮತ್ತು ರೋಗಿಯ ನಡುವಿನ ಸಂಭಾಷಣೆಯ ಮಾದರಿಯನ್ನು ತಯಾರಿಸಿ.
ಘಟಕ ಐದು (ಆರು ಘಂಟೆಗಳು)	: ಶುಶ್ರೂಕರ ಹಾಗೂ ರೋಗಿಗಳ ನಡುವೆ ನಡೆಯುವ ಸಂಭಾಷಣೆಗೆ ಬೇಕಾದ ವಾಕ್ಯಗಳ ಪರಿಚಯ.

ಅಧ್ಯಯನಕ್ಕೆ ಶಿಫಾರಸ್ಸು ಮಾಡಲಾಗಿರುವ ಗ್ರಂಥಗಳು

1. ಕನ್ನಡ ವ್ಯಾಕರಣ (8,9 ಮತ್ತು 10ನೇ ತರಗತಿಗಳಿಗೆ ಕರ್ನಾಟಕ ಸರ್ಕಾರ, ಪಠ್ಯಪುಸ್ತಕಗಳ ಇಲಾಖೆ)	
2. ವ್ಯವಹಾರಿಕಕನ್ನಡ	: ಎಚ್ಚೆಸ್ಕೆ
3. ಪತ್ರಲೇಖನ	: ಕನ್ನಡಸಾಹಿತ್ಯಪರಿಷತ್ತು
4. ಲೇಖನಕಲೆ	: ಎನ್‌ಪ್ರಹ್ಲಾದರಾವ್
5. ಆರೋಗ್ಯ ಮತ್ತು ಇತರೆ ಪ್ರಬಂಧಗಳು	: ಡಾ॥ ಪಿ.ಎಸ್ ಶಂಕರ್
6. ವೈದ್ಯ ಪದಗಳ ಹುಟ್ಟುರಚನೆ	: ಡಾ॥ ಡಿ.ಎಸ್.ಶಿವಪ್ಪ

ಕನ್ನಡ: ಎರಡು

ಪಠ್ಯಕ್ರಮದರೂಪರೇಖೆ

ಸ್ಥಾನ	: ಬಿ.ಎಸ್ಸಿ(ಅಲೈಡ್ ಹೆಲ್ತ್ ಸೈನ್ಸ್‌ಕೋರ್ಸ್) ಮೊದಲ ವರ್ಷ
ಸಮಯ	: 30 ಘಂಟೆಗಳು (ಮೂವತ್ತು ಘಂಟೆಗಳು)
ಉದ್ದೇಶ	: ಜನರ ಆರೋಗ್ಯದ ಬಗ್ಗೆ ಸಮುದಾಯಕ್ಕೆ ತಿಳುವಳಿಕೆ ಕೊಡುವುದು.

Value Added Course
Yoga

Learning Objectives

1. To define Yoga and understand the history of yoga
2. To understand general concept and practice of yoga.

Syllabus

Yoga theory- 15 hours

Unit I: History & Origin of Yoga: **(2 hours)**

1.1 Introduction to Yoga
1.2 Introduction to Yoga education & its importance.
1.3 Evolution of Yoga- Concept about yoga origin, Pre-vedic & Vedic period
1.4 Modern view about yoga.

Unit: II General Perspective of Yoga **(3 hours)**

1.1 Definitions of Yoga, Objectives of Yoga, Importance of yoga and Misconceptions about Yoga,
1.2 Principles of Yoga,
1.3 Brief Introduction of schools of Yoga.
1.4 Yogic Lifestyle.

Unit: III Introduction to Yoga practises: **(10 hours)**

3.1 Standing & Sitting Series of Asanas
3.2 Supine & Prone Series of Asanas.
3.3 Relaxation technique & its importance.
3.3 Pranayama & its importance

REFERENCE:

1. Lal Basant Kumar: Contemporary Indian Philosophy, Motilal Banarsidas Publishers Pvt. Ltd, Delhi, 2013
2. Dasgupta S. N: History of Indian Philosophy, Motilal Banarsidas, Delhi, 2012
3. Singh S. P: History of Yoga, PHISPC, Centre for Studies in Civilization Ist, 2010
4. Singh S. P & Yogi Mukesh: Foundation of Yoga, Standard Publication, New Delhi, 2010
5. G.C pande, Histroy of science, philosophy, and culture of Indian Civilization Vol.VII part 10 Centre for Studies in Civilisations.
6. Asana, Pranayama, Bandha, Mudra by Swami Satyananda Saraswati Bihar School of Yoga.

Yoga practical **15 hours**

All Yogic sessions will be started with brief theory of technique of yogic practices, name of the practice, precautionary measures to be taken before, during and after practice of yoga & its benefits. This will enhance the students to learn different techniques of yoga.

Unit I: Breathing Practices & Sukshma Vyayama (Loosening exercise)

1.1 Hands stretch breathing , Hand In & out breathing.

1.2 Sukshma Vyayama*: All Joints Rotation*: Fingers, Wrist, Elbows, Shoulder rotation, Neck Flexion/ Extension, Neck rotation, knee movements & ankle joint movements

1.3 Hip rotation, extension and all possible movements.

1.4 Stretching: Forward, Backward & Sideward bending & Situps.

Unit II: Asanas, Pranayama & Relaxation technique.

1.1 Suryanamaskara (12 Series of asansa)

1.2 Standing Series: Ardha Chakräsana , Ardhakati Chakräsana, Trikonasana, Vrikshansana, Tadasana;

1.3 Sitting Series: Vajräsana, paschimotasnasana Ustrasana, Vakrāsana,; **Prone Series:** Bhujangasana, Shalabasana ;**Supine series:** Uttitapadasana & setubhandasana,

1.4 Pranayama & Relaxation technique: Suryabedana, Chandrabedana, Anuloma Viloma; Relaxation technique- Quick relaxation technique.

Reference:

1. Asana by Swami Kuvalyananda Kaivalyadhama, Lonavla.
2. Asana, Pranayama, Bandha, Mudra by Swami Satyananda Saraswati Bihar School of Yoga.
3. Light on Yoga, by B.K.S Iyengar,Harper Collins Publishers.
4. Surya Namaskar by Saraswati, Swami Satyananda, Bihar School of Yoga.

II Semester

Core 4-General Pathology

Course outcome:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge of cell pathology and repair

CO2: Demonstrate the acquisition of comprehensive knowledge of pathogenesis, morphology and complications of hematological diseases of the body.

CO3: Perform and analyse basic hematology techniques.

CO4: Acquisition of Knowledge of workflow and to perform basic investigations in Transfusion medicine and clinical pathology.

CO5: Demonstrate the acquisition of comprehensive knowledge of handling, storage and quality assurance of cytology lab.

Unit I **10 hrs**

General pathology-Introduction- & scope of pathology

1. Cell injury and Cellular adaptations- Normal cell, Cell injury- types, etiology, morphology, Cell death-autolysis, necrosis, apoptosis, Cellular adaptations- atrophy, hypertrophy, hyperplasia, metaplasia.
2. Inflammation-Introduction, acute inflammation-vascular events, cellular events, chemical mediators, chronic inflammation- general features, granulomatous inflammation, tuberculosis.
3. Healing and repair- Definition, different phases of healing, factors influencing wound healing, fracture healing.
4. Haemodynamic disorders- Edema, hyperemia, congestion, hemorrhage, embolism, thrombosis, infarction.
5. Neoplasia- defintion, nomenclature, features of benign and malignant tumors, spread of tumors, dysplasia, carcinoma in situ, precancerous lesions.
6. Environmental and nutritional pathology-smoking, obesity and vitamin deficiencies.

Unit- II **10 hrs**

Hematological Disorders **5 hrs.**

1. Introduction and hematopoiesis
2. Anemia-introduction and classification (morphological and etiological).
3. Iron deficiency anemia: distribution of body iron, iron absorption, causes of iron deficiency, lab findings, megaloblastic anemia: causes, lab findings.
4. Hemolytic anemias: definition. Causes, classification, and lab findings.
5. WBC disorders- quantitative disorders, leukemia-introduction, Pancytopenia.
6. Bleeding disorders- Introduction, Classification, causes of inherited and acquired bleeding disorders, thrombocytopenia, DIC, laboratory findings.

Basic Hematological Techniques **5 hrs**

1. Characteristics of good technician, Blood collection- methods (capillary blood, venipuncture, arterial puncture) complications, patient after care.
2. Anticoagulants, transport of the specimen, preservation, effects of storage, separation of serum and plasma, universal precautions.
3. Complete hemogram- CBC, peripheral smear, BT, CT, PT, APTT, ESR, PCV

4. Automation in hematology-principles of autoanalyzer -3 part, 5 part and six part analysers and coagulometer-interpretation of autoanalyzer results.
5. Disposal of the waste in the laboratory.

Unit- III **5 hrs**

Transfusion Medicine

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

Clinical Pathology

1. Examination of cerebrospinal fluid-physical examination, chemical examination, microscopic examination.
2. Examination of body fluids (pleural, pericardial and peritoneal), physical examination, chemical examination, microscopic examination.
3. Sputum examination.

Unit- IV **10 hrs**

1. Blood collection- methods (capillary blood, venipuncture, arterial puncture) complications, patient after care.
2. Handling and storage of samples in hematology
3. Interpretation of autoanalyzer results- complete blood count and erythrocyte Indices- MCV, MCH, MCHC.
4. Reticulocyte staining and counting.
5. Staining of peripheral smear and Differential leucocyte count
6. Quality assurance in hematology.
7. Introduction and basics of histopathology –Handling, storage, and processing of specimens.

Unit- V **10 hrs**

1. Introduction to clinical pathology and Urinalysis- collection. Preservatives, physical, chemical examination and microscopy
2. Physical examination; volume, color, odor, appearance, specific gravity and pH,
3. 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.
4. Handling and storage of samples in cytology and clinical pathology.
5. Quality assurance in cytology and clinical pathology

Practicals **30 hrs**

1. Laboratory organization- Reception of specimen, dispatch of reports, records keeping. Laboratory safety guidelines.
2. SI units and conventional units in hospital laboratory.
3. Basic requirements for hematology laboratory, glasswares for hematology, pipettes and equipments for haematology lab and anticoagulant vials.
4. Blood collection- methods (capillary blood, venipuncture, arterial puncture) complications, patient after care.
5. Determination of haemoglobin.

6. Determination of ESR and PCV.
7. RBC count and TLC by hemocytometer.
8. Differential leukocyte count and Absolute eosinophil count
9. Interpretation of autoanalyser results- complete blood count and erythrocyte Indices- MCV, MCH, MCHC.
10. Reticulocyte staining and count.
11. Introduction to clinical pathology and Urinalysis- collection. Preservatives, physical, chemical examination and microscopy- semiautomated and automated methods

    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.
12. Charts.

Practical Examination: 35 marks.

1. Spotters
2. Hemoglobin estimation and blood grouping
3. Charts
4. Urinalysis

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 bookagency, 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. Methods John 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

Course outcome:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of knowledge of morphology of bacteria, viruses, parasites and fungal pathogens causing human infections

CO2: Demonstrate capability to practice appropriate sterilization and disinfection techniques used in microbiology

CO3: Demonstrate the acquisition of knowledge of immunity, immunization schedule and role of Immunoprophylaxis.

CO4: Demonstrate the acquisition of knowledge about infection control and practices in laboratory.

CO5: Demonstrate capability to explain the concepts and principles of compound microscope and its applications

Theory

Unit - I **10 hours**

General Microbiology

- Introduction to Medical microbiology and Classification of microorganisms
- Morphology and Physiology of bacteria
- Sterilization and Disinfection practices followed in a tertiary care centre including CSSD and recent advances.
- Culture methods
- Infection
- Specimen collection and laboratory diagnosis of infectious diseases

Immunology

1. Antigen
2. Antibodies
3. Immunity
4. Vaccines and immunization schedule, Immunoprophylaxis

Unit – II **8 hours**

Systemic bacteriology

- Staphylococcus, *Streptococcus pyogenes* and Pneumococcus
- Overview of Clostridia and *C. tetani*
- M. tuberculosis
- Enterobacteriaceae - Klebsiella, *E. coli,* Proteus
- Non-fermenters - Pseudomonas and Acinetobacter

Unit – III **8 hours**

Parasitology

- Introduction to parasitology and lab diagnosis of parasitic infections
- Protozoa - *Entamoeba histolytica*, Giardia, trichomonas, Malaria, Hook worm and Round worm

Unit – IV **9 hours**

Mycology

- Introduction to mycology and lab diagnosis of fungal infections
- Yeasts - Candida and Cryptococcus
- Moulds – Aspergillus, Zygomycetes

Virology

- General properties of viruses and laboratory diagnosis of viral infections
- Blood borne viral infections - Hepatitis B and C viruses, HIV

Unit – V **10 hours**

Applied microbiology

- Hospital acquired infections - Causative agents, transmission methods, investigation, prevention and control of hospital Acquired infections.
- SSI, VAP, CAUTI, CLABSI
- Overview of opportunistic infections – Definition, predisposing factors and etiological agents
- Standard and universal precautions
- Biomedical waste management

Practicals

- Compound microscope and demonstration of the parts.
- Demonstration of sterilization equipment's - hot air oven, autoclave- principle, mechanism of action, preparation of the materials and quality control
- Disinfection practices in a tertiary care centre - Disinfection of OT, Wards, OPD, dialysis units and laboratories
- Testing of water, air and environmental surveillance
- Demonstration of commonly used culture media with and without growth- Nutrient agar, blood agar, chocolate agar, Mac Conkey medium, Lowenstein-Jensen media, AST plate and Robertson cooked meat broth
- Classification of Stains and Procedure and interpretation of Grams staining

Practical examination : 35 marks

Spotters, Culture media, Equipments, Slides
Discussion:
1.Gram stain
2.Ziehl- Neelsen stain

Reference Books

1. Ananthanarayan & Panikar's Textbook of Microbiology – Latest Edition University Press.
2. Parasitology (protozoology and helminthology Parasitology) by K D Chatterjee
3. Textbook of Practical Microbiology for MLT by C P Baveja, Arya publications
4. Textbook for laboratory technicians by RamnikSood. Jaypee publishers
5. Textbook of parasitology by Paniker. 7th edition

II Semester

Core - 6 - Pharmacology

Course outcome:
At the end of the course student should be able to
CO1: Demonstrate the acquisition of comprehensive knowledge of basics of pharmacology
CO2: Demonstrate the acquisition of comprehensive knowledge about the pharmacokinetics and pharmacodynamics of drugs
CO3: Demonstrate the capability of enlisting the drugs used on various organ system of the body including hormones and chemotherapy
CO4: Demonstrate the capability of enlisting the drugs used on emergency conditions
CO5: Demonstrate the capability of enlisting the uses of various devices and instruments used in hospital setting.
C06: Demonstrate the skills of identifying the devices, instruments, drugs and dosage forms

UNIT I- General Pharmacology, ANS, PNS. **9 Hrs**
Sources of Drugs
Route of drug administration
Pharmacokinetics (Absorption, Metabolism, Distribution, Excretion)
Pharmacodynamics (Mechanisms of action)
Adverse drug reactions
ANS : Adrenergic drugs -Adrenaline,
Anti adrenergic-alpha and beta blockers
Cholinergic drugs-Acetyl choline
Anti cholinergic agents-Atropine

Unit II- PNS, CVS, Renal system **9 hrs**
Skeletal muscle relaxants-
Local anaesthetics-lignocaine, LA + vasoconstrictor
CVS-ionotropic agents -Digoxin,
Antianginal drugs-GTN,
Antihypertensives-
Management of different types of shock and Plasma expanders
Renal system-Diuretics Antidiuretics-Vasopressin

Unit III- CNS, Blood **9 hrs**
CNS-general Anaesthetics
Sedative hypnotics-
Antiepileptics
Opioid analgesics-
NSAIDS-
Respiratory system-treatment of cough And Bronchial asthma
Blood-Hematinics, Anticoagulants -Warfarin, Heparin
Thrombolytics & Antiplatelet drugs-streptokinase,/ aspirin,

Unit IV- GIT, Chemotherapy **9 hrs**
GIT-drugs used in peptic ulcer-
Antiemetics -Metaclopromide, Domperidone, Ondensetron
Purgatives & Laxatives
Drugs used in Diarrhoea- ORS, Super ORS, Antimotility drugs (loperamide, diphenoxylate)
Chemotherapy-general considerations MOA, Resistance, Prophylaxis

Unit V- Chemotherapy, Hormones **9 hrs**

Anti-bacterial, anti-fungal, anti-viral, anti-protozoal, anti-helminthic
Cancer chemotherapy (names, common Adverse effects, general principles in the treatment of cancer)
Hormones-Thyroid and antithyroid drugs, Insulin, glucagon, antidiabetic drugs, corticosteroids, oestrogen, progesterone, oxytocin

Practicals **30 hrs**

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

Practical examination: 35 marks

1. Dosage Forms
   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: Inhalers, Rota halers, Space halers, Drip sets, Vaso fix, Ryle's tube, Urinary catheter, Endotracheal tube, Hand gloves
3. 10 Spotters

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 understand concept of disease and its disease causation.
3. To know the Health care delivery system in India
4. To understand epidemiology of common infectious diseases of India.
5. To know various National Health Programmes of India
6. To have overview of First Aid and Bio-Medical Waste management Principles and guidelines

Content:

Unit I

1a. 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.

1b. Dimensions of Health

Physical dimension, mental dimension, Social dimension etc;

1c. Determinants of Health

The factors which determine human health like social, economic, cultural, nutritional factors, etc. will be discussed. Common health problems in India - Communicable diseases, Non communicable diseases, MCH problems, Nutritional problems, Environmental sanitation, Glance over National Health profile.

Unit II

2a. Concept of disease and causation.

Germ theory of disease, Epidemiological triad, Natural History of disease, concept of prevention. Definition of Epidemiology.

2b. Epidemiology of common infectious diseases

Brief epidemiology of Tuberculosis, Malaria, Dengue, HIV, Leprosy

Unit III

3a. Evolution of health care delivery systems

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

3b. 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.

Unit IV

4a. 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.
Primary Health care- current status in India- Status of health care infrastructure; Health team concept.

4b. Secondary and tertiary health care: Delivery of services
Community Health centre; First referral unit; District hospital.

Unit V
5a. National Health Programmes- Communicable diseases
Introduction; National Vector Borne Disease Control Programme; National Leprosy Eradication Programme; National Tuberculosis Elimination
Programme; National AIDS Control Programme; Universal Immunization Programme; National Rural Heath Mission.

5b. National Health Programmes- Non-communicable diseases
National Programme for Control of Blindness; National Programme for control of Diabetes, Cardiovascular diseases, Cancer and Stroke (NPCDCS); National Mental Health Programme. Nutritional programmes.

5c. National Health Programmes – Maternal and Child Health
Reproductive and Child Health Programme; Integrated Management of Neonatal and Childhood Illnesses; National Nutritional Anemia Prophylaxis Programme

Unit VI
6a. 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

6b. Biomedical Waste (BMW) Management
Sources of Bio-medical waste, principles of bio-medical waste management, step in management of BMW**.**

Recommended Books Recent Editions

1. Park K. Park's Textbook of Preventive and Social Medicine. 26th ed. Jabalpur: Banarsidas Bhanot Publishers, 2015. p.135-141
2. Suryakantha. Textbook of Community Medicine with recent advances. 6th 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

DESCRIPTION

This course is designed to enable the students to develop understanding about basic concepts of psychology and its application in personal and professional life. It further provides students opportunity to recognize the significance and application of counselling skills.

Objectives

On completion of the course, the students will be able to

1. Identify the importance of psychology in individual and professional life.
2. Understand biological basis of human behaviour
3. Understand mental health and hygiene
4. Understand personality and gain experience in personality assessment
5. Understand stress and learn coping strategies
6. Learn suicide prevention and counselling skills

Unit -I

Meaning of Psychology
Scope of Psychology- Scope, branches and methods of psychology
Relationship with other subjects
Applied psychology to solve everyday issues

Unit -II

Personality Introduction: Meaning, definition, Classification, measurement and evaluation of personality

Unit -III

Biological basis of behavior –Introduction

- Body mind relationship
- Genetics and behaviour
- Inheritance of behaviour
- Brain and behaviour.
- Psychology and sensation – sensory process normal and abnormal.

Unit-IV

Mental health and mental hygiene

- Concept of mental health and mental hygiene
- Characteristic of mentally healthy person
- Warning signs of poor mental health
- Promotive and preventive mental health strategies and services
- Defense mechanism and its implication
- Frustration and conflict – types of conflicts and measurements to overcome

Unit-V

- **Intelligence** – Meaning of intelligence – Effect of heredity and environment in intelligence, classification, Introduction to measurement of intelligence tests – Mental deficiencies

- **Learning –** Definition of learning, types of learning, Factors influencing learning – Learning process, Habit formation
- **Memory**-meaning and nature of memory, factors influencing memory, methods to improve memory, forgetting

Unit VI

Stress

1. Hans Selye Model of stress. Lazarus and Folkman model of stress.
2. Sources of stress. Stress, disease and health.
3. Coping strategies and styles- emotion focused and problem focused
4. Relaxation techniques

Unit VII:

Counselling

- Counselling-meaning and definition.
- Micro skills of counselling
- Psychotherapy- meaning and definition.
- Relaxation-types.
- Suicide and suicide prevention

Recommended Books Recent Editions.

1. C.P. Khokhar (2003) Text book of Stress Coping and Management Shalab Publishing House.
2. S.M.Kosslyn and R.S.Rosenberg (2006) Psychology in Context. PearsonEducation Inc.
3. C.R. Carson, J.N. Bitcher, S.Mineka and J.M. Hooley (2007), Abnormal Psychology13th, Pearson Education, Inc.
4. D.A. Barlow and V.M. Durand (2004) Abnormal Psychology Wadsworth,Thompson Learning, 3rd edition USA.
5. R.J . Gerrig & P.G. Zimbardo (2006) Psychology and life, Pearson Education, Inc.
6. Pestonjee, D.M. (1999). Stress & Coping, The Indian Experience 2nd edn. NewDelhi, Sage India Publications.

Skill Enhancement Course

Soft Skills

Learning objectives

- To give each student a realistic perspective of work and work expectations
- To help formulate problem solving skills, to guide students in making appropriate and responsible decisions
- To create a desire to fulfill individual goals, and to educate students about unproductive thinking, self-defeating emotional impulses, and self- defeating behaviors

Unit I

Definition of soft skills, Soft skills and Hard Skills, Advantage of Soft Skills,
Real life scenarios, Measurement of soft skills.
Self Discovery, Definition of Self, Identification of Strengths and weakness of self, Setting goals, Personal beliefs, values and ethics.

Unit II

Mindsets: Types of Mindsets, Developing a learning and Growth mindset,
Developing a positive outlook towards life, Increasing emotional and Spiritual intelligence.
People skills, Types of people - passive, assertive and aggressive people, Developing assertive personality, dealing with aggressive and submissive people.

Unit III

Communication Skills: Definition of Communication, Verbal and Nonverbal communication, Telephone and internet communication, Common mistakes in communication.
Interpersonal skills: Listening skills, Understanding body language, polite communication and people friendly attitude.

Unit IV

Time management: Importance of punctuality, Efficient time handling,
Avoiding leakage of time and procrastination
Stress Management: Definition of Stress, Positive and negative stress. Handling major projects through effective delegation.

Unit V

Organizational behavior: Definition of an organization, Understanding the rules and regulations of an organization, Creating an ideal working Environment.
Professional attitude-Definition and developing an effective professional attitude.
Leadership Skills: Developing a positive attitude, Presentation and public speaking skills, effective handling of the team and sub ordinates. Recognizing and encouraging talents in Sub ordinates.

Recommended books

1. Barun Mitra (2016), Personality Development and Soft Skills, 2nd edition, Oxford University Press
2. Alex K (2014), Soft Skills Paperback, S Chand & Company
3. Peggy Klaus (2008) The Hard Truth About Soft Skills: Workplace Lessons Smart People Wish They'd Learned Sooner 1st edition, HarperBusiness.
4. Sanjay Kumar, Pushp Lata (2018) Communication Skills Paperback 1st edition, Oxford

University Press
5. John Hayes (1994), Interpersonal Skills: Goal Directed Behavior at Work, Routledge.
6. Gurdeep Singh Gujral (2013) Leadership Qualities for Effective Leaders, VIJ Books (India) Pty Ltd.

BSc Medical Laboratory Technology

III Semester

Core-7- Biochemistry I

Course outcome:

At the end of the course, student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge and skills related to carbohydrates, proteins and lipids with membrane transport

CO2: Demonstrate the acquisition of comprehensive knowledge and skills related to instruments used in the laboratory with laboratory techniques

CO3: Demonstrate the acquisition of comprehensive knowledge about molecular weight and equivalent weight

CO4: Demonstrate the capability of analysing normal and abnormal urine test

Theory:

Unit I

Membrane transport and Carbohydrates **8hrs**

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 **5hrs**

Properties and color reactions of amino acids. Structural organization of proteins. Quantitative estimation of Proteins (Biuret and Lowry's method). Methods of Separation - electrophoresis & chromatography -definition, types ,principle and application.

Lipids **4hrs**

Composition, distribution and functions of Simple lipids, Composition, distribution and functions of phospholipids, sphingolipids, glycolipids and Types & functions of Lipoproteins. Derived lipids- Fatty acids, cholesterol, and Bile salts

Unit III

Introduction to Laboratory apparatus **6hrs**

Introduction to Laboratory apparatus

Pipettes - Different types (graduated, Volumetric, Pasteur and Autopipettes). Burettes, beakers, Petri Dishes-Use, Care & maintenance

Flasks - different types (Volumetric, round bottomed, Erlenmeyer and conical). Use, Care & maintenance Cuvettes, and Desiccators. Dispensers (reagent and sample)

Funnels - different types. Reagent bottles, Wash bottles, Measuring cylinders, Porcelain dish, Test tubes, centrifuge tubes, Tripod stand, Wire gauze, Bunsen burner Use, Care & maintenance Care and cleaning of glass & plastic ware, Different cleaning solutions.

Centrifugation-Principle, Care & maintenance,

Reflux condenser: Use, care and maintenance

Unit IV

Instruments & Techniques **14hrs**

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 & procedure, uses of ascending and descending paper chromatography, Photometry (Colorimetry) and Spectrophotometry. Beer - Lambert law - Verification and limitation. Principle & applications of Turbidimetry, Atomic absorption Spectrophotometry, ELISA and RIA .

Unit V

Concepts of Molecular weight, Equivalent weight **8hrs**

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
Preparation of Normal solutions, (1N sodium carbonate,1N Oxalic acid, 0.1N HCl, 0.1NH2SO4., 0.66N H2SO4.)
Percent solutions- V/V and W/V (Solids, Liquids & acids.) Conversion of percentsolution into molar solution.
Dilutions - Preparing working standards from stock standard, reagent dilutiontechniques.
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 dispensers
2. Balance: Weighing of solids, liquids, and hygroscopic chemicals.
3. Preparation of Normal, Molar, Percent and Standard Solutions. (Stock standard andworking standards) - NaCl, NaOH, H2S04, HCl and Glucose
4. Centrifuge, Vortex mixer, Magnetic stirrer, and Desiccators - Use Care andMaintenance.
5. Colorimeter and Spectrophotometer - Use Care and Maintenance.

Part B:

Identification of substance of physiological importance (Carbohydrate, Protein, NPN substance)

1. Analysis of Normal Urine
2. Analysis of abnormal Urine
3. Spotters

Practical examination: 35 marks

1. Preparations of solutions
2. Identification of substance of physiological importance
3. Analysis of normal urine and abnormal urine
4. Spotters

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

Course Outcome:

At the end of the course the student should be able to

CO 1: Demonstrate the acquisition of comprehensive knowledge and skills related to Handling of specimens in histopathology laboratory with specimen fixation, decalcification and grossing techniques.

CO 2: Demonstrate the acquisition of comprehensive knowledge and skills related to optimally process the tissues for routine paraffin sections and ability to paraffin section cutting, frozen section cutting and mounting of tissue sections.

CO 3: Demonstrate the acquisition of comprehensive knowledge and skills related to different stains in histopathology including Hematoxylin & Eosin stain (H&E) stain and Special stains.

CO 4: Demonstrate the capability to use and maintain equipments including microtomes, tissue processors, automated stainers and cryostat.

CO 5: Apply museum technology skills in fixation of specimens and mounting.

CO 6: Demonstrate the capability of maintenance of records and filing of slides with adequate knowledge on application of computers in histopathology.

CO 7: Demonstrate the skills related to quality assurance protocols in histopathology and awareness of standards required for Accreditation of laboratories.

THEORY:

Histopathology:

Unit I **9 hrs**

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 **9 hrs**

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 **9 hrs**

a. Instrumentation:

I. Automated tissue processor
ii. Microtomes, knives, knife sharpeners 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 **9 hrs**

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
c. Maintenance of records and filing of slides

Unit V **9 hrs**

a. Administration in histopathology, quality control and application of computers.
b. Disposal of the waste in the laboratory
c. Accreditation of laboratories:
    i. Quality assurance
    ii. Roles and responsibilities of technicians in accreditation
    iii. Maintenance of records and compliance of standards in accreditation

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: 35Marks
1. Hematoxylin and Eosin stain
2. Special stain
3. Section cutting
4. Record and spotters

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 I

Course Outcomes:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge about the concepts of infection and immunity with emphasis on applied aspects of immunity and laboratory techniques of antibiotic susceptibility testing.
CO2: Demonstrate the acquisition of comprehensive knowledge about various fungal infections with emphasis on basic laboratory diagnosis of the common earmarked fungal infections and various Mycotoxins causing hazard to humans.
CO3: Demonstrate the acquisition of comprehensive knowledge about morphology, pathogenesis, infections and laboratory diagnosis of primary bacterial infections.
CO4: Perform the common serological & immunological tests.
CO5: Perform the basic bacteriology processing techniques such as staining, media preparation & culture techniques.
CO6: To apprentice the laboratory techniques of antibiotic susceptibility testing.

Theory:

UNIT I **8 hrs**

Immunology I

- Infection - Classification, sources, types & methods of transmission, Factors predisposing to microbial pathogenicity, Types of infectious diseases
- Antigen - Definition, Types & Biological classes of antigens
- Antibodies - Definition, Properties, Structure, Types and functions of antibodies and monoclonal antibodies
- Antigen antibody reactions-Agglutination, Precipitation, Opsonization, Activation of compliment, Neutralization

Unit II **8 hrs**

Immunology II

- Structure and functions of immune system-central & peripheral lymphoid organs, cells of lymphoreticular system, T & B cell maturation, Null cells, MHC
- Immune response -Humoral immunity and cell mediated immune response
- Hypersensitivity reactions - Definition & types of hypersensitivity reactions
- Autoimmune disorders - mechanisms, classification & pathogenesis of autoimmune diseases

UNIT III **10hrs**

Mycology

- General Mycology: Introduction, classification of fungi and laboratory diagnosis of fungal infections
- Superficial mycoses: Malassezia, T nigra, T pedis, Dermatophytes.
- Subcutaneous mycoses: Mycetoma, Rhinosporidiosis, Sporotrichosis7
- Systemic mycoses: Histoplasmosis, Blastomycosis, Coccidioidomycosis, Para coccidiosis.
- Opportunistic fungi: Candida, Cryptococcus, Aspergillus, Penicillium, Zygomycetes
- Mycotoxins

UNIT IV **10hrs**

Bacteriology - Morphology, pathogenesis, infections caused and identification of following bacteria

- Staphylococcus
- Streptococcus, Enterococcus and pneumococcus.
- Corynebacterium diphtheriae
- *Clostridia perfringens, C. tetani*
- Bacillus
- Mycobacteria – *M. tuberculosis, M. leprae,* Atypical mycobacteria
- Actinomycetes, Nocardia

UNIT V **09hrs**

Bacteriology 2- Morphology, infections caused and identification of following bacteria

- *Neisseria meningitidis, Neisseria gonorrheae*
- Enterobacteriaceae - Escherichia, Klebsiella, Enterobacter, Proteus, Salmonella, Shigella, *Yersinia enterocolitica*
- *Vibrio cholerae*
- Pseudomonas and Acinetobacter, Brucella
- Spirochetes

Practicals:

- **Serology** – Principle, procedure and interpretation of common serological and immunological tests Widal, ASLO, RA, RPR

Mycology- Preparation of fungal media and reagents

a) KOH mount and Lactophenol cotton blue stain
b) Tease mount, LCB, Slide culture technique
c) Identification of fungal cultures by microscopic and macroscopic examination - Candida, Cryptococcus, Trichophyton, Microsporum, Aspergillus, Rhizopus and Penicillium
d) Fungal culture stock maintenance

Basic techniques in Bacteriology

- Media preparation – packing, sterilization, pouring, washing, dicontamination
- Staining techniques **–** Preparation of smears and fixation**,** Gram stain, Ziehl-Neelsen staining
- Culture methods – Inoculation techniques
- Clinical sample processing
- Identification of bacteria based on the biochemical tests and culture media –and Antibiotic susceptibility technique

Practical Examination: 35marks

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- 15 marks

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

Reference Books Recent Edition

1. Ananthanarayan & Panikar. Medical Microbiology, Revised 8th Edition University Press.
2. Textbook of Practical Microbiology for MLT by C P Baveja, Arya publications
3. Textbook of Mycology by Arora.
4. Textbook for Laboratory Technicians by Sood

III Semester

Skill Enhancement-1 Computer Application

Learning Objectives

1. To know various aspects of basic components of computer
2. To learn the modes of application of basic utility of the computer

Content

Introduction to Computer & Operating System: **Introduction to computers** – Definition, Characteristics, Generation, Applications, Classifications, Hardware, Software, Computer Arithmetic & Number System, Decimal, Binary, Octal & Hexadecimal System.

Arithmetic Operations on Binary Numbers. ASCII, EBCDIC, BCD codes, Fixed point & floating point representation of numbers.

Computer Organization & Architecture – Memory hierarchy, Primary Memory - memory unit, SRAM, DRAM, SDRAM, RDRAM, Flash memory. Secondary storage devices include Magnetic Disk, Floppy Disks, Optical Disks, Magnetic Drum

Input Devices, Output Devices.

Softwares – Introductory ideas of System Software, Application Software, Operating Systems, Translators, Interpreters, Compilers, Assemblers, and Generation of Languages.

Operating System : Definition, Introductory ideas of single user and multi-uer operating system, Time sharing, multitasking, multiprogramming, Batch Processing, on-line processing, spooling.

Introduction to Windows – Windows basics, Windows Accessories, Miscellaneous Windows features, Web Features & Browsers.

Networks: Different types of networks and their application

Internet and Intranet: Similarities in Internet and Intranet, Differences in Internet and Intranet, Effective Internet use.

Computer Viruses: Types of computer viruses, Use of Antivirus software

Application of Computer: General and Health industry

Software: Different types based on applications. Download open-source softwares. Convert one file format into another (Pdf to Word, Word to pdf, etc.). Ways to protect the documents

MS Office: (Theory & Practicals)

Word Processing:

- Introduction to Microsoft Word
- Font options in Microsoft Word
- Paragraph Formatting in Microsoft Word
- Heading Styles in Microsoft Word
- Editing Options in the Home Tab
- Clipboard & Format Painter Options in Microsoft Word
- Page Insert Options in Microsoft Word
- Inserting Tables in Microsoft Word
- Insert Pictures in Microsoft Word
- Shapes, Icons & 3d Models in Microsoft Word
- SmartArt Options in Microsoft Word
- Inserting Charts in Microsoft Word

- Text Box & Drop Cap Options in Microsoft Word
- Hyperlink in Microsoft Word
- Header, Footer & Page Number Options in Microsoft Word
- Equations & Symbols in Microsoft Word
- Water Mark, Page Color & Page Border Options in Microsoft Word
- Page Setup Options in Microsoft Word -
- Table of Contents & Table of Figures in Microsoft Word
- Endnote & Footnote Options in Microsoft Word
- Mailings Tab Options in Microsoft Word

Microsoft PowerPoint

- Introduction to Microsoft PowerPoint Interface
- Font & Slide Options in Microsoft PowerPoint
- Paragraph Formatting in Microsoft PowerPoint
- Drawing Tools in Microsoft PowerPoint
- Editing Options in the Home Tab
- Inserting Tables in Microsoft PowerPoint -
- Inserting Pictures in Microsoft PowerPoint
- Screenshot Option in Microsoft PowerPoint
- Inserting Photo Albums in Microsoft PowerPoint
- Inserting Icons in Microsoft PowerPoint
- Inserting 3D Models in Microsoft PowerPoint
- Inserting Smart Arts in Microsoft PowerPoint
- Inserting Charts in Microsoft PowerPoint
- Inserting Videos in Microsoft PowerPoint
- Design Tab Options in Microsoft PowerPoint
- Transitions Tab Options in Microsoft PowerPoint
- Animations Tab Options in Microsoft PowerPoint
- Slide Show Tab Options in Microsoft PowerPoint
- View Tab Options in Microsoft PowerPoint
- Built-in Presentation Templates in Microsoft PowerPoint

Microsoft Excel

- Introduction to Microsoft Excel Interface
- Basic Math Functions
- AutoSum Functions
- Sum IF Function & Remove Duplicates Option
- Sum IF & Sum IFs, Count IF & Count IFs Functions
- Sub Total Function
- Arrays & Sum Product Functions
- Other Math Functions
- Absolute & Relative References
- Formatting Techniques in Excel

- Excel Data Types
- Go to & Replace Options
- Auto Fill Options
- Copy, Paste & Paste Special Options
- Conditional Formatting
- Sort & Filter
- Excel Operators
- Equations Solving in Excel
- Errors in Excel Sheet
- Logical Function IF
- Logical Function IF Error
- Logical Function (IF, Nested IF, OR)
- Logical Function AND
- VLOOKUP Function
- VLOOKUP with Data Validation
- Nested VLOOKUP
- HLOOKUP Function
- Selecting the Chart
- Charts in Excel
- Tables in Excel
- Inserting Comments
- Inserting Hyperlink
- Text Functions
- Date, Time & Reference Functions
- Text to Columns Tool
- Data Consolidation
- Goal Seek Option
- Data Table Option

III Semester

Allied-3- Environment Science and Health

Learning Objectives

- To know various Environmental factors which affect Health
- 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. 26th 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

Course Outcomes:

At the end of the course student should be able to

CO 1: Demonstrate the acquisition of comprehensive knowledge about metabolism of carbohydrates and lipids with applied aspects

CO 2: Demonstrate the acquisition of comprehensive knowledge about radioisotopes and biomedical techniques

CO 3: Demonstrate the acquisition of comprehensive knowledge about basics of endocrinology with thyroid function tests

CO 4: Capability to perform the Quantitative estimation of metabolites and Qualitative experiment of renal and gall stone analysis

SYLLABUS:

Unit I **10hrs**

Digestion and absorption of Carbohydrates and its disorders

Glycolysis -definition, steps, and energetics

Oxidation of pyruvate,TCA cycle its importance

Gluconeogenesis and Cori's cycle – Definition, steps, and significance

Metabolism of glycogen (glycogenesis, glycogenolysis - Definition, steps and regulation)

HMP shunt pathway -steps and significance

Metabolism of fructose and galactose

Inborn errors associated with carbohydrate metabolism-fructosuria, lactose intolerance, galactosemia

Unit II **6hrs**

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 **09hrs**

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,

Synthesis of cholesterol (only crucial intermediates), Fate of cholesterol and compounds derived from cholesterol. Lipoproteins – classification, composition, functions and hyper and hypo lipoproteinemia. Fatty liver and lipotropic factors, atherosclerosis and role of PUFA in preventing atherosclerosis.

Unit IV **10 hrs**

Radioisotopes and its applications, free radicals, and antioxidants

Biomedical techniques - Principle, experimental procedures and applications of chromatography (Paper, Thin layer, affinity and gel filtration chromatography)

Principles, experimental procedures, and application of LCMS and HPLC.

Principles, experimental procedures and application of electrophoresis – agarose gel electrophoresis and PAGE

Unit V **10 hrs**

Endocrinology - Classification of hormones based on chemical nature and second messengers.

Mechanism of action of hormones.
Tests for thyroid function and its interpretation.

Practicals

Part A

1. Quantitative estimation
2. Calibration of Pipettes and Preparation of Protein Free Filtrate
3. Estimation of Blood Glucose by O-Toluidine method and Glucose Oxidase method
4. Estimation of serum Cholesterol by Zak's Method and Cholesterol Oxidase method
5. Estimation of HDL cholesterol by MgCl2 Precipitation Method
6. Estimation of Serum total Proteins and Albumin and determination of Albumin globulin ratio by Biuret and Dye binding method.

Part B :

Qualitative experiment

1. Renal stone analysis
2. Gall stone analysis

Part C:

Case reports,
Carbohydrate metabolism, Glucose Tolerance test charts, Hyperlipidemia charts

Practical Examination: 35marks

Quantitative estimation

Qualitative experiment
Case reports

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

IV Semester

Core 11: Pathology - II

Course Outcomes:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge and skills related to routine and special hematological tests with sample collection

CO2: Demonstrate the acquisition of comprehensive knowledge and skills related to routine coagulation tests and assay of clotting factors

CO3 Demonstrate the acquisition of comprehensive knowledge and skills related to autoanalyser with its maintenance and handling.

CO4: Demonstrate the acquisition of comprehensive knowledge and skills related to peripheral and bone marrow smears, its staining procedures including Romanowsky stains and supravital stains.

CO5: Demonstrate the acquisition of comprehensive knowledge and skills related to routine urine analysis

CO6: Ability to follow quality assurance protocols in hematology with awareness of standards required for Accreditation of laboratories.

Theory:

Unit I: Hematology: **10 hrs**

a. Morphology of blood cells and differential cell count
b. Blood collection, precautions to prevent hemolysis and storage of blood specimens.
c. Anticoagulants- mechanism of action, use of anticoagulants in different tests.
d. Special Hematological tests:
    i. Sickling test
    ii. Osmotic fragility test
    iii. Investigation of G6PD deficiency
e. Hemoglobin Electrophoresis- 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 **10 hrs**

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
g. Automation in coagulation

Unit III: **10 hrs**

Preparation of slides and different stains in hematology:

a. Romanowsky stains: principle and peripheral blood smear staining –Leishman and Giemsa stain in detail, other Romanowsky stains in brief-Wrights, JSB,Field stain
b. Buffy coat preparation
c. Supravital staining for reticulocytes and reticulocyte count
d. Cytochemistry in hematology

Bone marrow aspiration and biopsy study:

e. Needle aspiration and surgical biopsy technique
f. Preperation of smears and staining
g. Perl's stain for marrow iron stores

Unit IV **10 hrs**

a. Automation in hematology-principles of autoanalysers -3 part, 5 part and six part analysers and coagulometer-interpretation of autoanalyser results and flags
b. Calibration, validation and maintenance of analysers.
c. Automation in urine analysis: Dipstick method, semiautomated and automated method
d. Administration in hematology, quality control and application of computers- LIS and HIS

Unit V **5 hrs**

a. Accreditation of laboratories:
    i. Quality assurance in hematology laboratory
    ii. Roles and responsibilities of technicians in accreditation process
    iii. Maintenance of records and compliance of standards in accreditation.
b. Disposal of waste in the laboratory.

Practicals:

1. Blood collection, precautions to prevent hemolysis and storage of blood specimens.
2. Determination of hemoglobin and hematocrit
3. Interpretation of autoanalyser results and flags- complete blood count and erythrocyte Indices- MCV, MCH, MCHC.
4. Determination of ESR
5. Determmination of BT, CT
6. Determination of PT and PTT
7. Blood smear preparation and staining
8. Differential count of white blood cells and Absolute eosinophil count
9. Reticulocyte staining and count
10. Osmotic fragility test
11. Sickling test
12. Urinalysis.
13. 17. Bence jones protein test.

Practical Examination:35marks

1. **Peripheral blood smear preparation and staining**
2. Hemoglobin or PCV
3. Total count and differential count
4. ESR
5. Urine analysis
6. AEC/Reticulocyte count
7. Record
8. Spotters

Recommended 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. 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

Course Outcomes:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge and skills about general parasitology, protozoa and helminths including identification of common parasitology specimens and slides

CO2: Demonstrate the acquisition of comprehensive knowledge and skills related to RNA and DNA viruses

CO3: Demonstrate the skills related to preparation of saline & iodine mounts for stool microscopic examination

CO4: Demonstrate the skills related to preparation of peripheral blood smear & staining and Rapid Diagnostic test for diagnosis of malaria.

CO5: Demonstrate the skills related to procedure for basic viral diagnostic ELISA & ICT card assays.

Theory:

UNIT I **10hrs**

Parasitology - I

- General Parasitology: Introduction, classification of parasites & hosts, mode of Transmission
- Protozoology: Classification, infections caused and lab diagnosis of following parasites:
- Entamoeba histolytica
- Giardia
- Trichomonas
- Toxoplasma gondii
- Malaria
- Leishmania
- Coccidian parasites

Unit-II **08Hrs**

Parasitology - II

Helminthology: Classification, infections caused and lab diagnosis of following parasites:

- Cestodes: Taenia, echinococcus, D. latum, *H. Nana.*
- Trematodes: Schistosoma, Fasciola
- Nematodes: Ascaris, hookworm, Strongyloides, Trichuris, trichinella, Enterobius
- Nematodes: Dracunculus, Wuchereria bancrofti

UNIT III **08Hrs**

Virology – I

- General Properties of Viruses, Cultivation of Viruses and Laboratory Diagnosis of Viral Infections
- Basic concepts of Viral infections - Properties, Diseases caused, lab diagnosis and Prevention of DNA viruses
    - Herpes viruses
    - Hepatitis B virus

UNIT IV **10 Hrs**

Virology – II

Basic concepts of Viral infections - Properties, Diseases caused lab diagnosis and Prevention of following RNA viruses:

- Picorna viruses – Polioviruses and Rhinoviruses
- Orthomyxoviruses – Influenza virus
- Paramyxoviruses – Parainfluenza viruses, Mumps virus, RSV, Measles virus, Rubella virus
- Arboviruses – Dengue virus, Chikungunya virus, JE virus, KFD virus

UNIT V **09 HRS**

Basic concepts of Viral infections - Properties, Diseases caused, lab diagnosis and Prevention of following viral infections:

- Rabies virus
- Hepatitis viruses – Hepatitis A, C, D and E viruses
- Retroviruses – HIV virus
- Corona viruses

Practicals

Parasitology:

- Preparation of reagents – Saline, Iodine
    - Stool examination:
    - Saline mount.
    - Iodine mount
- Stool concentration techniques
- Preparation of peripheral blood smear and staining
- Serology in diagnosis of parasitic disease – Rapid diagnostic test (RDTs) for diagnosis of malaria – Principle, procedure
- Identification of parasitology slides and specimens

Virology

- Serological techniques for diagnosis of viral infections - ELISA
- Virology exercise – Principle, procedure and interpretation of ICT card tests for HIV, Hepatitis B virus, Dengue virus

Practical Examination: 35marks

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

Reference Books

1. Ananthanarayan & Panikar's Textbook of Microbiology – Latest Edition University Press.
2. Textbook of Practical Microbiology for MLT by C P Baveja, Arya publications
3. Textbook for laboratory technicians by R. Sood. Jaypee publishers
4. Jawetz Melnick & Adelbergs Medical Microbiology 28 E (A & L LANGE SERIES)
5. Practical Microbiology by S C Parija

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, Normal distribution, Divergence from normality; Skewness and kurtosis

Unit IV
Census and Sampling Methods
Census and sample survey, Common terms used in sampling theory, Non-probability (Non-random) Sampling Methods; Convenience 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; Quantitative vs. Qualitative, Conceptual vs. Empirical

Unit II

Study Designs-Observational Studies

Epidemiological study designs; Uses of Epidemiology, 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 and Randomized Trials, Application of study Designs in Medical Research

Recommended Books Recent Editions.

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, 20.
6. Park K. Park's Textbook of Preventive and Social Medicine. 26th 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 4th Edition - Elsevier Saunders Publication.

IV Semester

Allied-4 Constitution of India

Learning Objective:

1. To know about the fundamental rights and duties of the Constitution.
2. To know about the sustainable development and special rights of the backward class and tribes.

Content:

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 writes.

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, 200

V Semester

Core-13- Biochemistry III

Course Outcomes

At the end of the course student should be able to

CO 1: Demonstrate the acquisition of comprehensive knowledge about metabolism of proteins and hemoglobin.

CO 2: Demonstrate the acquisition of comprehensive knowledge about water and electrolyte balance.

CO 3: Demonstrate the acquisition of comprehensive knowledge about high energy compounds

CO 4: Demonstrate the acquisition of comprehensive knowledge and skills related to organ function tests like liver, kidney, heart and lipid profile.

CO5: Demonstrate the acquisition of comprehensive knowledge about lab automation and quality control

Theory:

Unit I **12hrs**

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 **7hrs**

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

Water and Electrolyte balance: Body water compartments, Donnan membrane equilibrium, osmolality, electrolyte concentration in body fluid compartments, regulation of water balance, electrolyte balance and its disorders

Unit III **6hrs**

High energy compounds. Enzymes of Oxidative Phosphorylation. Components of electron transport chain. Electron Transport and Oxidative Phosphorylation & formation of ATP and its regulation. Inhibitors of Electron Transport, Oxidative Phosphorylation and Uncouplers of Oxidative Phosphorylation

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.

Lipid Profile and Cardiac markers.

Unit V **10hrs**

Automation in clinical laboratory - Chemistry and Immunoassay techniques, Principle & applications of autoanalyzer.

Quality Control: Role of quality control and its importance, LJ chart and Westgard rules,

Sensitivity, Specificity, Accuracy, Reliability and Precision
Internal and external quality control measures, preparation of reagents, standardization of methods

Practicals:
Part A:

1. Estimation of Serum Creatinine by Jaffe's Method
2. Estimation of Urinary Creatinine by Jaffe's Method and calculation of Creatinine Clearance
3. Estimation of Serum Bilirubin by modified Jendrassik and Grofs method
4. Estimation of Blood Urea and calculation of BUN by Di Acetyl Monoxime method
5. Estimation of inorganic phosphorous by Fiske and Subbarow method
6. Estimation of Serum Uric acid by Phospho tungstic acid reduction method.
7. Estimation of Serum Calcium by Arsenazo method

Part B:

Charts on LFT & RFT, Inborn errors of amino acid, quality control, LJ chart and Westgard rules

Practical Examinations: 35marks

1. Quantitative estimation- 2 Exercises - 25 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

Course Outcomes:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge and skills related to samples in cytology with its collection and test procedures.

CO2: Demonstrate the acquisition of comprehensive knowledge and skills related to cytological samples for examination with fixation and sample storage.

CO3: Demonstrate the acquisition of comprehensive knowledge and skills related to preparation of various cytology smears and perform staining including H & E stain, Papanicoloau's stain and May Grunwald Geimsa stain.

CO4: Demonstrate the acquisition of comprehensive knowledge and ability to follow quality assurance protocols in cytology with awareness of standards required for Accreditation of laboratories.

CO5: Demonstrate the acquisition of comprehensive knowledge and skills related to automation in cytology, immunocytochemistry and cytogenetics.

Theory:

Unit I

Cytology Introduction: **9 hrs**

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 **9 hrs**

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

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

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 **9 hrs**

a. Automation in Cytology

1. Cytospin
2. 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 **9 hrs**

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 **9 hrs**

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. Processing and Examination of cerebrospinal fluid (CSF).
2. Processing and 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 MGG may grunwald geimsa staining
7. Hormonal cytology study
8. Cytospin technique
9. Charts

Practical Examinations: 35marks

CSF preparation and cell count

1. Pap Stain
2. MGG stain
3. Charts
4. Spotters

Recommended books recent 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, JohnBernard 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

Course Outcome

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge about normal bacterial flora of the humans.

CO2: Demonstrate the acquisition of comprehensive knowledge about the different antibacterial agents and principle with concepts of antimicrobial susceptibility testing.

CO3: Demonstrate the acquisition of comprehensive knowledge of bacterial pathogens, their lab diagnosis with emphasis on drug resistance and disease prevention.

CO4: Demonstrate the acquisition of comprehensive knowledge about sterilization of culture media and instruments used in Microbiology laboratory.

CO5: Demonstrate the acquisition of comprehensive knowledge about methods, precaution and transportation of appropriate clinical specimen to be collected for Microbiological culture investigations.

CO6: Demonstrate the acquisition of comprehensive knowledge about processing of various clinical samples in Microbiology laboratory with a note on culture stock maintenance.

CO7: Demonstrate the acquisition of skills related to quality control to be used in serology, ELISA, Culture, Media and molecular microbiology section.

CO8: Demonstrate the acquisition of comprehensive knowledge about automated methods used in microbiology laboratory

CO9: Demonstrate the acquisition of comprehensive knowledge about role and responsibilities required for obtaining the accreditation of laboratories

CO10: Preparation of culture media, sterility and quality control

CO11: Demonstrate the acquisition of comprehensive knowledge about biomedical waste management with emphasis on segregation and disposal of waste.

Theory:

Unit I **10 Hrs**

Bacteriology -1

- Normal bacterial flora of the humans
- Antibacterial agents
- Antimicrobial susceptibility testing methods
- Morphology, classification, pathogenesis, infections caused and lab diagnosis, drug resistance and prevention of following bacterial infections
    - Staphylococcus including drug resistance
    - Beta haemolytic Streptococci, Enterococcus and pneumococcus
    - *Corynebacterium diphtheriae*
    - Clostridium

UNIT -II **10 Hrs**

Bacteriology -2

- Morphology, classification, pathogenesis, infections caused and lab diagnosis, drug resistance and prevention of following bacterial infections
    - Bacillus
    - Mycobacteria – *M. tuberculosis, M. leprae,* Atypical mycobacteria
    - Actinomycetes, Nocardia

- Neisseria meningitidis, Neisseria gonorrheae
- Enterobacteriaceae - Escherichia, Klebsiella, Enterobacter, Salmonella, Shigella, Yersinia, Citrobacter, Enterobacter, Proteus, Morganella, Providencia, Serratia
- *Vibrio cholerae and halophilic vibrios, Aeromonas, Plesiomonas*

UNIT III **8hrs**

Bacteriology 3

- Morphology, classification, pathogenesis, infections caused and lab diagnosis, drug resistance and prevention of following bacterial infections
  - Non fermenting Gram negative bacilli - Pseudomonas, Burkholderia, Stenotrophomonas and Acinetobacter
  - Haemophilus, HACEK groups,
  - Brucella and Bordetella
  - Spirochetes – Treponema, Leptospira and Borrelia
  - Chlamydia – *C. trachomatis, C. pneumoniae*

UNIT IV **8hrs**

Miscellaneous bacteria

- Mycoplasma
- Rickettsia
- *Yersinia pestis*
- *Klebsiella granulomatis*
- Campylobacter
- Helicobacter
- *Gardnerella vaginalis*
- Listeria

Unit V **09 Hrs**

Applied microbiology and Recent advances in Microbiology

- Sterilization of Media and instruments – Principle, mechanism of action, preparation, uses, advantages and disadvantages
- Specimen collection, transport and processing of clinical samples
- Preservation and stock maintenance in Bacteriology
- Quality control in Microbiology – Serology, ELISA, Culture, Media and molecular microbiology section
- Automation in microbiology
- Accreditation of Laboratories - Roles and responsibilities
- Integrated Disease Surveillance Programme (IDSP) and National tuberculosis elimination programme (NTEP)

Practicals

1. Staining techniques – Grams, Ziehl-Neelsen stain, Alberts stain
2. Preparation of media, Sterility and quality control
3. Applied bacteriology exercises

- Isolation of bacteria from a Sample
- Identification of bacteria from displayed culture media and biochemical tests and antimicrobial susceptibility testing inoculation by Kirby-Bauer method
- Biomedical waste management in Microbiology

Practical Examinations: 35 marks

1. Grams stain
2. Ziehll-Neelsen stain
3. Spotters - culture media, biochemical test, instruments, slides
4. Applied bacteriology exercises Gram positive, Gram negative bacteria - Staphylococci, M. tuberculosis, E.coli, Klebsiella, S. typhi, Pscudomonas, V. cholerae and Shigella

Reference Books

1. Ananthanarayan & Panikar's Textbook of Microbiology – Latest Edition University Press.
2. Textbook by Practical Microbiology for MLT by C P Baveja, Arya publications
3. Textbook for laboratory technicians by R. Sood. Jaypee publishers
4. Jawetz Melnick & Adelbergs Medical Microbiology 28 E (A & L LANGE SERIES)
5. Practical Microbiology by S C Parija

V Semester

Elective-1

Learning Objectives:

1. To know about the basics of immunohistochemistry or immunofluorescence.

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 running IHC. 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

Serial Dilutions of Primary Antibody	Intensity of staining*					
	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

Learning Objectives:

1. To know about the basics and importance of ethics in the profession

Content:

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

Recommended Books Recent Editions.

1. Medical Ethics & Law, The Cor Curriculum
2. Author - Tony Hope Atla
3. Reference book No. 16715 Center Library

VI Semester

Core 16 – Biochemistry IV

Course Outcomes

At the end of the course student should be able to

CO 1: Demonstrate the acquisition of comprehensive knowledge about nucleotide metabolism
CO 2: Demonstrate the acquisition of comprehensive knowledge and skills related to Genetics and molecular biology
CO 3: Demonstrate the acquisition of comprehensive knowledge about biochemistry of cancer and prevention of common lab accidents.
CO4: Demonstrate the skills related to estimation of serum parameters, CSF analysis and estimation of proteins.

Theory

Unit I **8hrs**

Nucleotide Metabolism- Synthesis and degradation of purines and pyrimidines, nucleosides and nucleotides.
Structure of DNA, different forms of DNA & functions. RNA - Structure and functions.

Unit II **10hrs**

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 **9hrs**

Techniques in Molecular Biology
PCR(Basics), recombinant DNA technology, gene therapy, blotting techniques, RFLP, DNA fingerprinting.

Unit IV **10hrs**

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

Unit V **8hrs**

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

Part B :

1. Isolation of DNA from blood by non-enzymatic salting out method. Quantification and purity assessment using Nanodrop.
2. Agarose gel electrophoresis of DNA
3. Estimation of proteins by biuret method with standard graph
4. Estimation of proteins in cell lysate using BCA method
5. Western blot analysis -Demo
6. PCR - Demo

Practical Examinations: 35marks

1. Part A
2. Part B

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

VI Semester

Core -17- Pathology IV

Course Outcomes:

At the end of the course student should be able to

CO1: Demonstrate the acquisition of comprehensive knowledge related to principles of immunohematology, blood collection, infectious marker determination, compatibility testing and coomb's testing.

CO2: Demonstrate the acquisition of comprehensive knowledge about basics of transfusion medicine, hazards, component preparation, quality control and apheresis techniques.

CO3: Demonstrate the skills related to blood banking with application in safety precautions, quality assurance, biomedical waste management and automation in Blood banking.

Theory:

Immunohematology and Blood transfusion

Unit I **9 hrs**

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 **9 hrs**

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 **9 hrs**

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 **9 hrs**

Compatibility testing and coombs test, antibody screening

- 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 **9 hrs**

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

- 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 Examinations: 35marks
Blood grouping and typing ks Cross matching
Record
Spotters

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

Course outcomes:

At the end of the course student should be able to
CO1: Demonstrate the acquisition of comprehensive knowledge about viruses, its morphology, various viral cultivation methods, general viral pathogenesis, approach to viral lab diagnosis and prevention of viral infections.
CO2: Demonstrate the acquisition of comprehensive knowledge and skills related biosafety precautions while processing samples for viral diagnosis
CO3. Ability to analyse and perform various serological tests for HIV, HBV and Hepatitis C viral diagnosis.
CO4:. Demonstrate the acquisition of comprehensive knowledge about recent and advanced techniques used in diagnosis of viral infections

Theory:

Unit 1 **9 hrs**

- Introduction to virology
- General Properties of viruses, cultivation of viruses, pathogenesis, laboratory diagnosis and prevention of Viral Infections
- Antiviral drugs
- Biosafety for processing of viruses
- Morphology, pathogenesis, diseases caused, lab diagnosis and prevention of following viruses:
    - Pox viruses
    - Herpes viruses

Unit II **8 Hrs**

- Morphology, pathogenesis, diseases caused, lab diagnosis and prevention of following viruses:
    - Bacteriophage
    - Adenoviruses
    - Picornaviruses

UNIT III **8 hrs**

- Morphology, pathogenesis, diseases caused, lab diagnosis and prevention of following viruses:
    - Orthomyxoviruses
    - Paramyxoviruses
    - Rhabdoviruses

UNIT IV **10 hrs**

- Morphology, pathogenesis, diseases caused, lab diagnosis and prevention of following viruses:
    - Arboviruses - JE, Dengue, KFD, Chikungunya and Yellow fever
    - Hepatitis Viruses

UNIT V **10 hrs**

- Morphology, pathogenesis, diseases caused, lab diagnosis and prevention of following viruses:
  - Oncogenic Viruses
  - Retroviruses - HIV Virus
  - Miscellaneous - Prions, SARS Corona viruses, Rotavirus and Ebola Virus
  - Viruses causing diarrhoea
  - Emerging and re-emerging viral infections

Practicals:

1. Virology exercise – Spot tests - HIV, HBV, HCV
   ELISA - HIV, HBV, HCV
   CLIA – Hepatitis markers
2. Virology applied exercises - Identification of the virus in a case scenario
3. Advance techniques in virology

Practical examinations: 35 marks

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

Reference Books

1. Ananthanarayan & Panikar's Textbook of Microbiology – Latest Edition University Press.
2. Textbook of Practical Microbiology for MLT by C P Baveja, Arya publications
3. Textbook for laboratory technicians by R. Sood. Jaypee publishers
4. Jawetz Melnick & Adelbergs Medical Microbiology 28 E (A & L LANGE SERIES)
5. Practical Microbiology by S C Parija

VI Semester

Elective 2: Molecular Techniques

Learning objective:

Student be able to describe and demonstrate the basic molecular techniques

Content:

1. Protocol for DNA Isolation

Aim: To learn the technique of isolation of DNA from 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 DNA is 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 DNA is 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 A solution (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 for Binding
   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:

A homogenous 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 DNA when 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. DNA Elution

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 DNA depends 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 DNA concentration, but will reduce the overall DNA yield.

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 DNA sample (?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 DNA strand (the DNA target).

The PCR reaction requires the following components:

DNA template - The sample DNA that 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 DNA using a DNA template 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 25reactions	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
10. 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.

DNA Detection 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 DNA Marker (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.

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

3. Western blot procedure

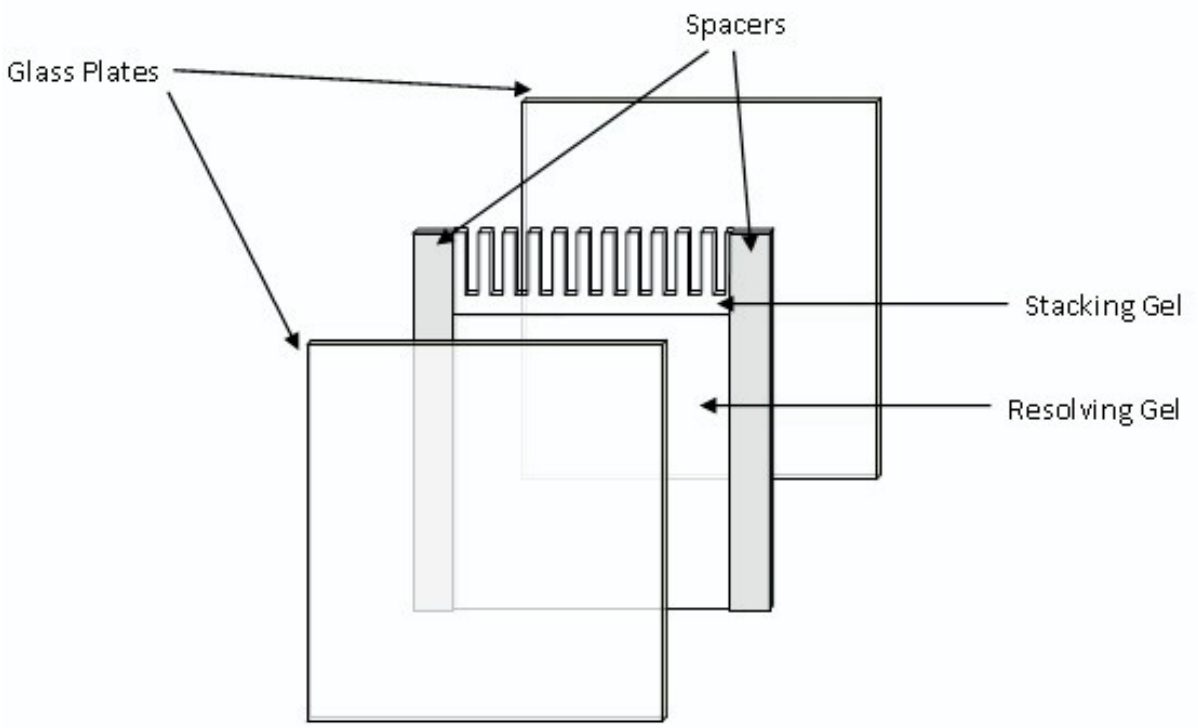
Purpose: To separate the proteins from cell lysates

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

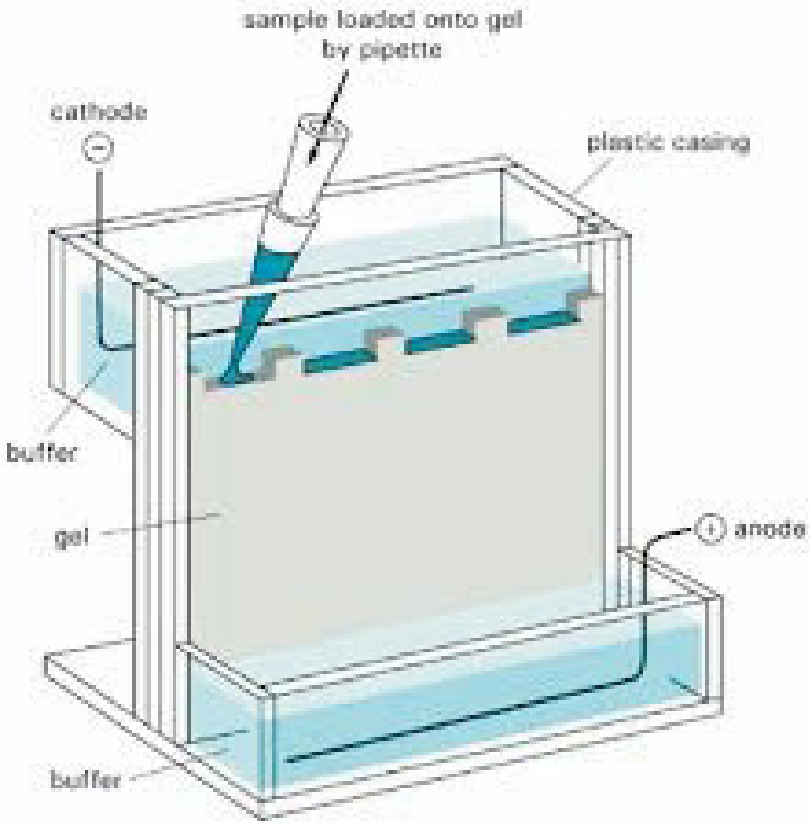
2. Check for leakage using distilled water. Once there is no leakage prepare the separating gel and pour the gel up-to 3/4th of the plate.

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%)	**Volume (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)

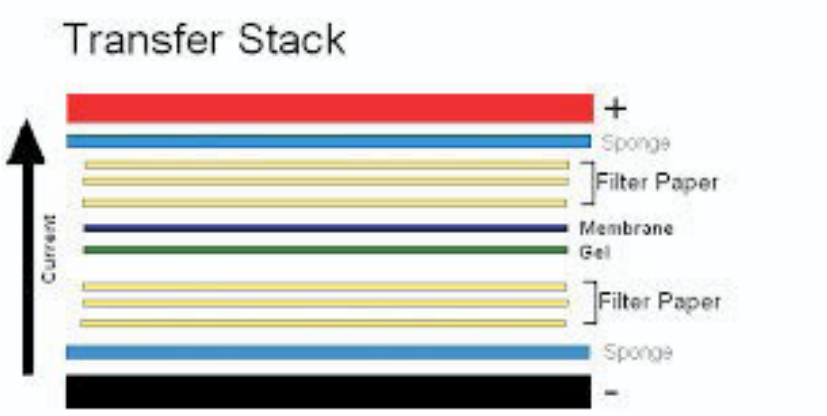


Transfer of the bands from the gel to the membrane:

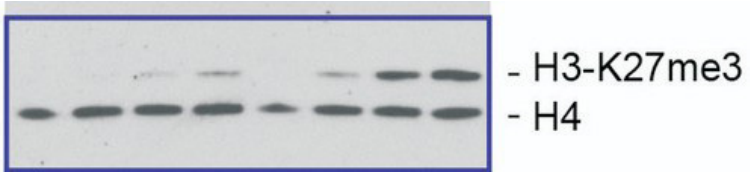
1. Transfer buffer: Tris base: 25mM Glycine: 192mM
   Methanol: 20%
2. TBS(10x): Sodium Chloride- 80g Tris base- 24.2g
   Make up-to 1000ml and adjust the PH to 7.6
3. TBST: TBS with 0.2% Tween
4. Blocking buffer: 3 % BSA in TBST.

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 at 4?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

Learning objective:

1. To know about the various quality concepts
2. To learn about the Hospital information system, inventory control, equipment operations management and biomedical waste management.

Content:

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.