Bachelor of Vocation (B.Voc.) in “Medical Laboratory and Molecular Diagnostic Technology”

Syallabus of
Skill Development Component

APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester I)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme								
						Theory					Practical			
		Credits	Theory Period	Pr Period	Total Periods	Duration Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA
1.	English and Communicative English –I	4	4	-	4	3	70	30	100	40	-	-	-	100
2.	Soft Skill Development –I	4	4	-	4	3	70	30	100	40	-	-	-	100
3.	Aptitude development –I	4	4	-	4	3	70	30	100	40	-	-	-	100
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**

B] Skill Development Component Credits: 18

Sr. No.	Theory Paper/ Practical	Subjects	Teaching Scheme(Hrs/Week)			Credits	Examination Scheme					
			Th	Pr.	Total		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks	
								External Marks (Th)	Internal Marks (IA)		Th.	Pr.
1	I	Paper – I	4	-	4	4	3	70	30	100	40	-
2	II	Paper – II	4	-	4	4	3	70	30	100	40	-
3	Practical-I /Workshops –I /Labs-I / Internship-I	Practical based on Paper I of skill development	-	5	5	4	6	70	30	100	-	40
4	Practical-II- Workshops –II /Labs-II / Internship-II	Practical based on Paper II of skill development	-	5	5	4	6	70	30	100	-	40
5	Field Work / Industrial Visit / Production (Report writing/ Presentation)	-	-	-	-	2	-	-	50	50	-	20
		Total	**8**	**10**	**18**	**18**	**-**	**280**	**170**	**450**	**80**	**100**

Note:

1. Th = Theory; Pr = Practical; WS=Workshops/ LB=labs/ PR=Production/FW=Field Work/INT=Internship IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3 **Credit Calculations**

One credit would mean equivalent of 15 periods of 60 minutes each, for Theory & Practical's.

For internship/ Field work, the Credit Weightage for equivalent hours shall be 50% of that for lectures.

The strength of Batch of Practical /Workshop / internship / Field visit / production for Under Graduates classes shall be 16 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.

APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester II)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme								
						Theory					Practical			
		Credits	Theory Period	Pr Period	Total Periods	Du Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA
1.	English and Communicative English –II	4	4	-	4	3	70	30	100	40	-	-	-	100
2.	Soft Skill Development – II	4	4	-	4	3	70	30	100	40	-	-	-	100
3.	Aptitude development – II	4	4	-	4	3	70	30	100	40	-	-	-	100
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**

B] Skill Development Component Credits: 18

Sr. No.	Theory Paper/ Practical	Subjects	Teaching Scheme(Hrs/Week)			Credits	Examination Scheme					
			Th	Pr.	Total		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks	
								External Marks (Th)	Internal Marks (IA)		Th.	Pr.
1	I	Paper - I	4	-	4	4	3	70	30	100	40	-
2	II	Paper - II	4	-	4	4	3	70	30	100	40	-
3	Practical-I-Workshops –I /labs-I / Internship-I	Practical based on Paper I of skill development	-	5	5	4	6	70	30	100	-	40
4	Practical-II-Workshops –II /Labs-II / Internship-II	Practical based on Paper II of skill development	-	5	5	4	6	70	30	100	-	40
5	Field Work / Industrial Visit / Production (Report writing/ Presentation)	-	-	-	-	2	-	-	50	50	-	20
		Total	**8**	**10**	**18**	**18**	**-**	**280**	**170**	**450**	**80**	**100**

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APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester III)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme									
						Theory					Practical				
		Credits	Theory Period	Pr Period	Total Periods	Du Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA	
1.	English and Communicative English –III	4	4	-	4	3	70	30	100	40	-	-	-	100	
2.	Soft Skill Development –III	4	4	-	4	3	70	30	100	40	-	-	-	100	
3.	Aptitude development –III	4	4	-	4	3	70	30	100	40	-	-	-	100	
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**	

B] Skill Development Component Credits: 18

Sr. No.	Theory Paper/ Practical	Subjects	Teaching Scheme(Hrs/Week)			Credits	Examination Scheme					
			Th	Pr.	Total		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks	
								External Marks (Th)	Internal Marks (IA)		Th.	Pr.
1	I	Paper - I	4	-	4	4	3	70	30	100	40	-
2	II	Paper - II	4	-	4	4	3	70	30	100	40	-
3	Practical-I- Workshops –I /Labs-I / Internship-I	Practical based on Paper I of skill development	-	5	5	4	6	70	30	100	-	40
4	Practical-II- Workshops –II /Labs-II / Internship-II	Practical based on Paper II of skill development	-	5	5	4	6	70	30	100	-	40
5	Field Work / Industrial Visit / Production (Report writing/ Presentation)	-	-	-	-	2	-	-	50	50	-	20
		Total	**8**	**10**	**18**	**18**	**-**	**280**	**170**	**450**	**80**	**100**

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APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester IV)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme									
						Theory					Practical				
		Credits	Theory Period	Pr Period	Total Periods	Du Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA	
1.	English and Communicative English –IV	4	4	-	4	3	70	30	100	40	-	-	-	100	
2.	Soft Skill Development –IV	4	4	-	4	3	70	30	100	40	-	-	-	100	
3.	Aptitude development –IV	4	4	-	4	3	70	30	100	40	-	-	-	100	
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**	

B] Skill Development Component Credits: 18

Sr. No.	Theory Paper/ Practical	Subjects	Teaching Scheme(Hrs/Week)			Credits	Examination Scheme					
			Th	Pr.	Total		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks	
								External Marks (Th)	Internal Marks (IA)		Th.	Pr.
1	I	Paper - I	4	-	4	4	3	70	30	100	40	-
2	II	Paper - II	4	-	4	4	3	70	30	100	40	-
3	Practical-I-workshops –I /Labs-I / Internship-I	Practical based on Paper I of skill development	-	5	5	4	6	70	30	100	-	40
4	Practical-II-Workshops –II /Labs-II / Internship-II	Practical based on Paper II of skill development	-	5	5	4	6	70	30	100	-	40
5	Field Work / Industrial Visit / Production (Report writing/ Presentation)	-	-	-	-	2	-	-	50	50	-	20
		Total	**8**	**10**	**18**	**18**	**-**	**280**	**170**	**450**	**80**	**100**

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3 **Credit Calculations**

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APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester V)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme									
						Theory					Practical				
		Credits	Theory Period	Pr Period	Total Periods	Du Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA	
1.	English and Communicative English –V	4	4	-	4	3	70	30	100	40	-	-	-	100	
2.	Soft Skill Development –V	4	4	-	4	3	70	30	100	40	-	-	-	100	
3.	Aptitude development –V	4	4	-	4	3	70	30	100	40	-	-	-	100	
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**	

B] Skill Development Component Credits: 18

Sr. No.	Theory Paper/ Practical	Subjects	Teaching Scheme(Hrs/Week)			Credits	Examination Scheme					
			Th	Pr.	Total		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks	
								External Marks (Th)	Internal Marks (IA)		Th.	Pr.
1	I	Paper - I	4	-	4	4	3	70	30	100	40	-
2	II	Paper - II	4	-	4	4	3	70	30	100	40	-
3	Practical-I- Workshops –I /Labs-I / Internship-I	Practical based on Paper I of skill development	-	5	5	4	6	70	30	100	-	40
4	Practical-II- Workshops –II /Labs-II / Internship-II	Practical based on Paper II of skill development	-	5	5	4	6	70	30	100	-	40
5	Field Work / Industrial Visit / Production (Report writing/ Presentation)	-	-	-	-	2	-	-	50	50	-	20
		Total	**8**	**10**	**18**	**18**	**-**	**280**	**170**	**450**	**80**	**100**

Note:

1. Th = Theory; Pr = Practical; WS=Workshops/ LB=labs/ PR=Production/FW=Field Work/INT=Internship IA = Internal Assessment.
2. Minimum marks for passing will be 40% of the total marks allotted to that paper / practical.
3 **Credit Calculations**

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For internship/ Field work, the Credit Weightege for equivalent hours shall be 50% of that for lectures.

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APPENDIX 'A'

Teaching & Examination Scheme

DIPLOMA (ONE YEAR), ADVANCE DIPLOMA (TWO YEARS), BACHLOR OF VOCATION (B. Voc)

(THREE YEARS DEGREE COURSE – SEMESTER PATTERN)

B. Voc. **(Semester VI)**

A] General Education Component Credits: 12

Sr. No.	Subject		Teaching Scheme Hrs / Week			Examination scheme								
						Theory					Practical			
		Credits	Theory Period	Pr Period	Total Periods	Du Hrs	Max Th.	Max IA	Total	Min Pass	Du Hrs	Max Mar Pr.	Min Pass Mar.	Total Marks Th.Pr.IA
1.	Applied Computer Skills- I	4	4	-	4	3	70	30	100	40	-	-	-	100
2.	Applied Computer Skills- II	4	4	-	4	3	70	30	100	40	-	-	-	100
3.	Applied Computer Skills- III	4	4	-	4	3	70	30	100	40	-	-	-	100
	Total	**12**	**12**	**-**	**12**	**-**	**210**	**90**	**300**	**120**	**-**	**-**	**-**	**300**

B] Skill Development Component Credits: 18

*** Industry Based Project**

Sr. No.	Subjects	Examination Scheme				
		Duration (Hrs)	Max. Marks		Total Marks	Min. Passing Marks
			External Marks	Internal Marks		
1	Project Work	3	200	100	300	120
2	Project Seminar	3	100	50	150	60
	Total	**-**	**300**	**150**	**450**	**180**

Note:

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3 **Credit Calculations**

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From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER - I
PAPER - I
FUNDAMENTALS OF ANATOMY AND PHYSIOLOGY

Unit-I

A) Body as a whole and its constituents

The cells, tissues and organization of the body

Tissues- epithelial, connective, muscle, nervous

Cell regeneration, membranes, glands, Organization of the body

Bones of the skeleton, Axial skeleton, Appendicular skeleton, Cavities of the body,Cranial, thoracic, abdominal, pelvic.

B) Blood

Composition of blood

Erythrocytes-Structure and functions

Leucocytes-Types, Structure and functions

Platelets- Structure and functions, Hemostasis

Haemoglobin, Blood groups, Coagulation Factors, Anaemia & Immunoglobulins

C) Cardiovascular System

Heart-Functional anatomy; Properties of heart muscle; Heart as a pump; Cardiac output and venous return; Vascular system; Systemic arterial blood pressure

Unit-II

A) Respiratory System

Basic features and functional anatomy, Ventilation, Functions, Lungs Volumes and capacities

B) Digestive System

Elementary functional anatomy; Salivary glands; Stomach and its secretion; Liver, pancreas and their role in digestion, Bile, Small and large intestine; Movement of alimentary tract; Gastrointestinal hormones and their functions

C) Excretory system

Functional anatomy of kidney; Mechanism of formation of urine; Water, electrolyte and acid-base balance; Skin and its functions

Unit-III

A) Nervous System

Elementary neuroanatomy; Properties of neurons; Nerve impulse, Types of nerves; Synapse and chemical transmitters; Central nervous system-Neuroglia, membranes of; brain and spinal cord, Ventricles of brain and cerebrospinal fluid.

Brain- cerebrum, cerebellum

Spinal cord- structure

Peripheral nervous system-Spinal nerves and cranial nerves

Autonomic nervous system-Sympathetic NS, Parasympathetic NS.

Functions of ANS

Central visceral regulations

B) Special senses and Endocrinology

Eye and Ear (in brief)-

a) List of Endocrine Glands; Hormones : Their secretion and functions (in brief)

Unit-IV: A) Reproductive System

Female reproductive system; Anatomy- External and internal parts; Puberty, menstrual cycle, Fertilization.

Male reproductive system- Elementary anatomy; Functions of male reproductive system

B) Muscular System

Muscles characteristics

Properties of skeletal muscles

Properties of smooth muscles

PRACTICAL

ANATOMY

1. Identification and description of all anatomical structures.
2. The learning of Anatomy by demonstration only through dissected parts, slides, models, charts etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic and abdominal viscera, face and brain).
4. Demonstration of skeleton - articulated and disarticulated.

PHYSIOLOGY

1. Measuremeandnt of pulse, blood pressure.
2. Elicitation of Reflexes and jerks.
3. Identification of blood cells by study of peripheral blood smear.

Suggested Readings:

1. Anatomy and physiology in health and illness - Wilson Katheen, Anne Waugh ; Churchill livingstone
2. Concise medical physiology - Sujit Chaudhari; Central
3. Textbook of medical physiology - Arthur Guyton and Hall; W.B. Saunders
4. Understanding medical physiology R. L. Bijlani, Jaypee

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER - I
PAPER - II
GENERAL PATHOLOGY & GENERAL MICROBIOLOGY

Unit-I GENERAL PATHOLOGY (Part I)

1. Cell Injury and Cellular Adaptations.

a) Normal Cell
b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling.
c) Cell death : types- autolysis, necrosis, apoptosis & gangrene.
d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia.

2. Inflammation

a) Acute inflammation - vascular event, cellular event, inflammatory cells.
b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma.

Unit-II GENERAL PATHOLOGY (Part II)

1. Haemodynamic Disorders :
Oedema, hyperemia, congestion, haemorrage, circulatory disturbances, thrombosis,
ischaemia & infarction .

2. Neoplasia :
Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor.

3. Healing
Definition, different phases of healing, factors influencing wound healing.

Unit-III GENERAL MICROBIOLOGY (Part I)

1. General characters and classification of Bacteria.

2. Characteristics of Bacteria
Morphology - Shape, Capsule, Flagella, Inclusion, Granule, Spore.

3. Growth and Maintenance of Microbes
Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO_2 requirement, temperature, pH, light.

4. Sterilization and Disinfection.
Physical agents- Sunlight, Temperature less than 100^0C, Temperature at 100^0C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

Unit-IV GENERAL MICROBIOLOGY (Part II)

1. **Culture Media**
   Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media
2. **Staining Methods**
   Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation
3. **Collection and Transportation of Specimen**
   General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood.
4. **Disposal of Laboratory/Hospital Waste**
   Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

PRACTICAL

GENERAL PATHOLOGY

1. Components & setting of the Compound microscope.
2. Focusing of object.
3. Use of low & high power objectives of microscope.
4. Use of oil immersion lens.
5. Care and Maintenance of the microscope.
6. Different types microscopy
   - Dark field microscopy
   - Fluorescence Microscopy
7. Electronic Microscopy in brief.

GENERAL MICROBIOLOGY

1. Preparation of swabs/sterile tubes & bottles.
2. Preparation of smear.
3. Staining.: Gram & Ziehl -Neelsen staining.
4. Preparation of Culture media.
5. Identification and study of instruments.
6. Identification of common microbes.

Suggested Readings:

1. Textbook of Pathology - Harsh Mohan; Jaypee
2 Basic Pathology - V.Kumar, S.Robbins; Harcourt
3 Pathology - Emanuel Rubin; Lippincot
4 Pathology - Ian Cree; Chapanmann Hall
5. Text Book of Microbiology - Pelczar, Chan, Kreig
6. Bacteriology - A.J. Salle
7. Text Book of Microbiology - Vol I and Vol II - Powar and Daginawala
8 Text Book of Microbiology - Stanier
9. Human Anatomy, Physiology & Health Education by Harie R. Berasari, Gandhi & Goel
10. Textbook of Medical Physiology by Guyton and Hall
11. Human Physiology by Chaudhary

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER - II
PAPER - I
BASICS OF BIOCHEMISTRY, INSTRUMENTS AND REAGENTS

Unit-I

A) Chemistry of carbohydrates and their related metabolsim -

Introduction, definition, classification, biomedical importance & properties.

Brief outline of meatbolism : Glycogenesis and glycogenolysis (in brief), Glycolysis, citric acid cycle and its significance, HMP shunt and Gluconeogenesis (in brief), regulation of blood glucose level.

B) Hyperglycemia and Hypoglycemia

Diabetes mellitus - definition, types, features

Gestation diabetes mellitus

Glucose Tolerance test, glycosuria

Hypoglycemia & its causes

Unit-II

A) Chemistry of Proteins and their related metabolism -

Introduction-Definition Classification Biomedical importance ; Metabolism: Catabolism of amino acids, Removal of NH2 group Transformation, Deamination

Decarboxylation- Ammonia formation & transport

Urea cycle, Metabolic disorders in urea cycle

Fate of some important amino acids- Phenylalanine, Tyrosine & Tryptophan

Creatine, Creatinine

-

B) Chemistry of Lipids and their related metabolism

Introduction-Definition Classification ;Biomedical importance; essential fatty acids

Metabolism: Beta oxidation of fatty acids

Fatty liver, Ketosis

Cholesterol & its clinical significance

Lipoproteins in the blood & their functions

Atherosclerosis

Unit-III

A) Chemistry of Nucleic acid and metabolism

Introduction-Definition

Elementary chemistry of DNA and RNA

Structure of nucleotide

DNA and RNA molecule and its structure

Functions of nucleic acids

Nucleotide metabolism- purines and pyrimidines

B) Enzymes

Introduction- definition; Classification ; Coenzymes, isoenzymes, properties

Mechanism of action of enzymes; Factors affecting enzyme action

Enzyme inhibition and regulation

Diagnostic value of serum enzymes - Creatinine kinase, alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc

Unit-IV

A) Laboratory instruments

Principle and working of basic laboratory instruments -- Autoclave, Hot air oven, Incubator, pH meter, water bath, centrifuge, Refrigerator, colorimeter, Balance, Flame photometer, Microscope

B) Reagent preparation

Concept of molarity and normality - Molar, Normal and percent solution preparation; Dilution of the concentrated solution to desired concentration

PRACTICAL

1. Introduction
   Aim, basis, interpretation, safety in clinical biochemistry Laboratory
2. Laboratory organization

Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.

3. Identification of Carbohydrates (qualitative tests).
4. Identification of Proteins (qualitative tests).
5. To study general properties of the enzyme (Urease) & Achromatic time of Salivary amylase.
6. Urine analysis - normal & abnormal constituents of urine.
7. CSF & Semen Analysis - Gross & Microscopic.
8. Glucose tolerance test & Glycosylated haemoglobin.
9. Centrifugation : Principle, types & applications.
10. Chromatography : Definition, types, RF value, description of paper chromatography & applications.
11. Uses, Care and Maintenance of various instruments of the laboratory.

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani
2. Text book of biochemistry for medical students by D M Vasudevan; Jaypee
3. Fundamentals of biochemistry by J L Jain; S Chand
4. Biochemistry by D Voet, J Voet; Wiley
5. TB of biochemistry and human biology by G P Talwar; Prentice Hall
6. MOLBIO by Avinash and Kakoli Upadyay; Himalaya Publishing house
7. Clinical Biochemistry by G.Guru
8. Principal of Biochemistry by Lehninger

12. Principal of Biochemistry by M. A. Siddiqi
13. Principal of Biochemistry by David L. Nelson
14. Medical Laboratory Technology Volume II by Kanai L Mukherjee
15. Medical Laboratory Technology Volume III by Kanai L Mukherjee

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER - II
PAPER - II
CLINICAL BIOCHEMISTRY & BASIC HEMATOLOGICAL TECHNIQUES

Unit-I Bioinstrumentation

1. **Photometry-**Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry– colorimetry, spectrophotometry, flame photometry, fluuorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.
2. **Electrophoresis -** Principle, Types & Applications.
3. **Autoanalysers -** Principle & Applications

Unit-II

A) Water and Mineral Metabolism-
Distribution of fluids in the body, ECF & ICF, water metabolism, dehydration, mineral metabolism, macronutrients (principal mineral elements) & trace elements.

B) Vitamins- Fat & water soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.

C) Liver Functions & their Assessment- Based on:
Carbohydrate metabolism; Protein metabolism; Lipid metabolism.
Measurements of serum enzyme levels
Bile pigment metabolism, Jaundice, its types and their biochemical findings.

D) Renal Function Tests- Various Tests, GFR & Clearance

Unit-III

A) Cardiac Profile - In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases

B) Different methods of Glucose Estimation - Principle advantage and disadvantage of different methods

C) Different methods of Cholesterol Estimation - Principle, advantage and disadvantage of different methods.

Unit-IV

A) Basic Hematological Techniques
Preparation of blood collection –
Basic steps for drawing blood by vein, capillary and artery puncture; Complications during and after blood collection
Specimen rejection criteria for blood
Anticoagulants- types and concentration Transport of blood sample Effect of storage on blood cell morphology Universal precautions

PRACTICAL

Clinical Biochemistry (By Colorimeter / Spectrophotometer)

1. Blood urea estimation
2. Serum creatinine estimation
3. Serum uric acid estimation
4. Serum total protein estimation
5. Serum albumin estimation
6. Serum globulin estimation
7. Serum glucose estimation
8. Total cholesterol estimation
9. HDL and LDL cholesterol (direct) estimation.
10. Triglyceride estimation
11. Serum Bilirubin total estimation
12. Serum Bilirubin direct estimation
13. Serum amylase estimation
14. Serum GOT (AST) estimation
15. Serum GPT (ALT) estimation
16. Alkaline phostase estimation
17. Acid phosphatase estimation
18. Serum sodium estimation
19. Serum potassium estimation
20. Serum chloride estimation
21. CK-NAC estimation

Hematology Practicals

1. Basic requirements for hematology laboratory.
2. Glasswares and Equipments for Hematology.
3. Anticoagulant vial preparation.
4. Determination of Blood group by ABO blood group system
4. Complete Blood Counts.
5. Determination of Hemoglobin.
6. TRBC Count by Hemocytometers.
7. TLC by Hemocytometer.
8. Differential Leukocyte count.
9. Determination of Platelet Count.
10. Determination of ESR by wintrobes.

Suggested Readings:

1. Biophysical Chemistry by Upahyay, Upadhyay, Nath; Himalaya Publishing house
2. Text book of medical laboratory technology by Praful Godkar; Bhalani
3. Essential haematology by A.V.Hoffbrand; Black well
4. De Gruchy's Clinical Haematology in medical practice by Frank Firkin, C Chester man; Black well
5. Principles of haematology Peter Haen WCB

6. Haematology by Emamanuel Besa; Harwal
7. Text Book of Microbiology by Ananthnarayan and Paniker
8. Clinical diagnosis and management by laboratory methods by Bernard Henry; W B Saunders
9. Text book of biochemistry for medical students by D M Vasudevan; Jaypee
10. TB of biochemistry and human biology by G P Talwar; Prentice Hall
11. Biophysical Chemistry by Dr. Nath, Avinash Upadyay and Kakoli Upadyay; Himalaya Publishing house
12. Clinical Biochemistry by G.Guru

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER - III
PAPER - I
SYSTEMIC BACTERIOLOGY, MYCOLOGY, VIROLOGY AND HEMATOLOGICAL DISORDERS

Unit-I Systemic Bacteriology –

Morphology, cultural characteristics, biochemical reaction, \pathogenesis/disease caused and lab diagnosis of - *Staphylococcus, Streptococcus, Pneumococcus, Neisseira gonorrhoea, Neisseira meningitis, Cornybacterium diptheriae, Mycobaterium, Clostridium, E.coli, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio and Spirochaetes*

Unit-II Mycology –

Morphology and Structure of fungi Classification of fungi, Nutrition and cultivation of fungus, Cutaneous and Sub cutaneous and Systemic Mycosis (in brief), Lab diagnosis of fungal Infections, Opportunistic fungal infections

Unit-III Virology

General characters of viruses, Lab diagnosis of viral infections, Bacteriophages.
Retro viruses - HIV, Hepatitis virus, Pox virus.
Picrona virus - Polio
Orthomyxo virus –Influenza,
Arbo virus – Chikungunya, Dengue
Herpes and Adeno virus

Unit-IV Hematological Disorders

a. Classification of Anemia : Morphological & etiological.
b. Iron Deficiency Anemia : Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings.
c. Megaloblastic Anemia : Causes, Lab findings.
d. Hemolytic Anemia : Definition, causes, classification & lab findings.
e. Bone Marrow : Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid
   Schiff, Sudan Black, Myeloperoxidase.
f. Leukemia : Classification, Blood Picture, Differentiation of Blast Cells.

PRACTICAL

SYSTEMIC BACTERIOLOGY

1. Culture Techniques
2. Culture methods & identification of common bacteria on media.
3. Antibiotic sensitivity testing.
4. To perform biochemical test -
   a) IMVic test
   b) Catalase test
   c) Coagulase test
   d) Oxidase test
   e) Gelatin liquefaction test
   f) Urease test
5) Identification of organism from urine, pus and blood samples.

Mycology and Virology

1. Culture Media used for fungus.
2. Fungal culture
3. Methods of lab diagnosis of virus.

Hematology

1. Determination of ESR by Westergeren's method.
2. Determination of PCV by Wintrobes.
3. Erythrocyte Indices- MCV, MCH, MCHC.
4. Reticulocyte Count.
5. Absolute Eosinophil Count.
6. Morphology of Red Blood Cells.
7. Determination of bleeding time
8. Determination of blood clotting time

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani
2. Essential haematology by A.V.Hoffbrand; Black well
3. Text Book of Microbiology by Ananthnarayan and Paniker
4. Medical microbiology by Davis and Dulbacco

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology" (Faculty of Science)
Skill Development Component

SEMESTER - III
PAPER - II
IMMUNOLOGY, SEROLOGY & PARASITOLOGY

Unit-I Immunology

A) Immunity and Immune Response

Immunity- Definition and classification - General Principles of Innate and Acquired Immunity.

Immune Response - Humoral immunity and cell mediated immunity.

B) Antigen and Antibodies

Antigen - Definition, classes, properties.

Antibodies/Immunoglobulins - Definition, Properties, Sub types of Immunoglublins

C) Vaccination - Schedule and Vaccines

D) Structure and Functions of Immune System - Parts of Immune system, T/B cells, other cells and their functions

E) Hyper sensitivity Reactions - General Principles of different types of hypersensitive reactions i.e., type I, II, III, IV and V.

F) Auto immune disorders

G) Skin Tuberculine test

Unit-II Serology

A) General Terminologies of serology.

B) General features of Antigen- antibody reactions

C) Types of Antigen/antibody Reactions - Precipitation, Agglutination, Complement fixation test, Neutralization, Opsonization, Immune adherence, Immuno fluorescence, Immuno electron microscopic test.

D) Principles, Types & Applications of Immunodiffusion Techniques, Radioimmunoassay & ELISA

Unit-III Parasitology

1. Definition - parastism, HOST, Vectors etc.
2. Classification of Parasites .
3. Phylum Protozoa- general Pathogenic and non pathogenic protozoa.
4. Phylum Nemathelminths/Round words (Nematoda) .
5. Phylum Platyhelminths - class-Cestoda, class-Trematoda.
6. Lab diagnosis of parasitic infections.
7. Protozoa :

   i. Intestinal Amoebae

   a. *E. histolytica* : Life cycle, Morphology, Disease & Lab Diagnosis

   ii. Flagellates of intestine/genitalia

   a. *Giardia lamblia* : Life cycle, Morphology, Disease & Lab Diagnosis

b. *Trichomonas vaginalis* : Life cycle, Morphology, Disease & Lab Diagnosis

iii. Malarial Parasite - a. *Plasmodium vivax* : Life cycle, Morphology, disease & lab diagnosis

b. Differences between *P. vivax, P. malaria, P. falcipaum & P.ovale.*

Unit-IV Nematodes :

A) Intestinal Nematodes :

a. *Ascaris* : Life cycle, Morphology, disease & lab diagnosis

b. Brief discussion about *Enterobius vermicularis* (Thread worm) and *Ancylostoma duodenale* (Hook worm)

Tissue Nematodes :

W. bancrofti - Life cycle, Morphology, Disease & Lab Diagnosis

B) Phylum Platyhelminths

a. Cestodes - *T. solium, T. saginata & E. granulosus.* (in brief)

b. Trematodes - *S. haematobium & F. hepatica* (in brief)

Practical-I

Immunological Techniques

1) WIDAL Test
2) VDRL Test,
3) RA Test
4) CRP Test
5) Pregnancy Test
6) Immunodiffusion
7) Qualitative test for ABO grouping with antisera
8) Qualitative test for Determination of D(Rho) antigen on human red blood cells.
9) To perform direct coomb's test
10. Determination of antistrptolysin O(ASO)
11) To perform C-reactive protein test (CRP)
12) Tuberculine test
13) HIV Test
13) ELISA test

Parasitology

1. Microscopic examination of stool specimen
2. Gross examination and physical examination of stool.
3. Detection of malarial parasite
4. Detection of trypanosomes(the casual agent of sleeping sickness)
5. Laboratory diagnosis of kala azar
6. Quantitative determination of serum (or plasma) igG class antibodies to toxoplasma gondii by ELISA
7. Determination of IgM class antibodies to toxoplasma gondii by ELISA
8. Identification of different ova & cysts in stool samples.

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani

2. Essential haematology by A.V.Hoffbrand; Black well
3. Text Book of Microbiology by Ananthnarayan and Paniker
4. Medical microbiology by Davis and Dulbacco
5. Parasitilogy by C.C. Chatterjee
6. Medical Microbiology by David Greenwood, Richard C. B. Slack and John f. Peutherer
7. Immunology by Kuby
8. Immunology and Serology by Joshi

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER- IV
PAPER – I
ENDOCRINOLOGY, TUMOR AND CANCER MARKERS

Unit-I

Introduction
Difference between hormones and enzymes.
Classification of hormones.
Regulation and general mechanism of action of hormones.
Pituitary gland and hypothalamus
Hormones of the Anterior Pituitary- Growth hormone, Prolactin, Gonadotropin, Follicle Stimulating hormone, Leuteinizing Hormone, Thyroid stimulating hormone (TSH), Adrenocorticotropic hormone (ACTH).
Hormones of neurohypophysis- Oxytocin, Antidiuretic hormone (ADH)

Unit-II

Hormones of the Thyroid gland- chemistry and normal physiology, Thyroid disorders-goiter, myxodema, autoimmune thyroiditis, tumors of the thyroid gland, hyperthyroidism, Graves disease, Calcitonin, Parathyroid Hormone (PTH) Adrenocortical hormones-synthesis and secretion, Aldosterone and its function, Addisons disease, Glucocorticoids and functions, Mineralocorticoids and functions, Cortisol and functions, Cushing's syndrome, Conn's syndrome.
Adrenal medulla-metabolism of catecholamines
Hormones of the gonads - Testosterone, Estrogens, Progesterone, their synthesis and functions.
Human Chorionic Gonadotropin (HCG), hormone, menstrual cycle, Menopause
Hormone of pancreas - Insulin- its metabolic effects on carbohydrates, fats and protein, control of insulin secretion, Glucagon- functions, metabolic effects, blood glucose regulation, Diabetes $_{\text{Mellitus}}$, Somatostatin.
Hormone of kidney - Renin

Unit-III

TUMOR & CANCER MARKERS:

1. Introduction.
2. The Carcinogens-definition.
3. Oncogene-definition-
   Mechanism of action of Oncogenes (outline).

4. Characteristics of growing tumor cells-general and morphological changes, biochemical changes.
5. Tumor Markers- Introduction and definition
6. Clinical applications of tumor markers.
7. Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate dehydrogenase (LDH), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA).

Unit-IV

1. Hormones as tumor markers (introduction of each type in brief).
2. Oncofetal antigens.
3. Alpha feto protein (AFP)
4. Carcino embryonic antigen (CEA)
5. Squamous cell carcinoma (SCC) antigen.
6. Carbohydrate markers (brief introduction of each type)
   CA 15-3, CA 125
7. Blood group antigen (brief introduction of each type)
   CA 19-9, CA 50, CA 72-4, CA 242
8. Bladder cancer markers (introduction in brief) -
   Bladder tumor antigen (BTA)
9. Fibrin- Fibrinogen degradation product (FDP).
10. Nuclear matrix protein (NMP22).
11. Biomarkers still in research (introduction in brief)-
12. Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase

Practical-I

1) Blood grouping and Cross Matching
2) Estimation of T3
3) Estimation of T4
4) Estimation of TSH
5) Estimation of FSH
6) Estimation of LH
7) Estimation of hCG
8) Estimation of Cortisol
9) Estimation of Progesterone
10) Estimation of Testosterone
11) Estimation of Alpha feto proteins (AFP)
12) Estimation of Carcino embryonic antigen (CEA)
13) Estimation of CA- 125
14) Estimation of Prostate specific antigen (PSA)

Other ELISA test

15) Test for HIV
16) Test for Hepatitis B (HBsAg)
17) Test for Hepatitis (HCV)

18) Malaria antigen
19) Tuberculosis-lgG/IgM

Suggested Readings:

Manual of Endocrinology and Metabolism by Norman Levin
Endocrinology by Headley
Ongenomics Handbook edited by William J. Rochelle and Richard A. Shimkets, Humana Presss
Cancer Systems Biology edited by Edwin Wang, CRC press

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER- IV
PAPER – II
CLINICAL PATHOLOGY AND BLOOD BANKING

Unit-I

A) Urine Analysis

Formation and Composition of urine; Collection and preservation of urine; Physical and chemical examination of urine; Microscopic examination of urine; Clinical significance of urine analysis

B) CSF analysis

Formation and composition of CSF; Collection and preservation of CSF; Physical and chemical examination of CSF; Microscopic examination of CSF; Clinical significance of CSF analysis

Unit-II

A) Semen Analysis

Composition of semen; Collection and preservation of semen; Physical and chemical examination of semen; Microscopic examination of semen; Clinical significance of semen analysis

B) Sputum Analysis

Composition of sputum; Collection and preservation of sputum; Physical and chemical examination of sputum; Microscopic examination of sputum; Clinical significance of sputum analysis

C) Cavity Fluids

Transudates and exudates; Synovial fluid analysis; Peritoneal fluid analysis; Pericardial fluid analysis

Unit-III

A) Blood Components

Collection of blood components for fractional transfusion.

Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate.

Preparation of concentrated (packed) Red cells.

Techniques of preparation.

Hemoglobinopathies

B) Compatibility Testing

Purpose

Single tube compatibility techniques using AHG reagent.

Emergency compatibility testing.

Difficulties in cross matching.
Labeling and Issuing cross- matched blood.

Unit-IV

A) Blood Transfusion Reactions

Investigation of a Transfusion reaction.
Hemolytic transfusion reaction.
Actions to take when transfusion reaction occurs

B) Blood Components

Collection of blood components for fractional transfusion.
Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate.
Preparation of concentrated (packed) Red cells.
Techniques of preparation.

C) Blood Donor and Blood Bank Records

Blood donation record book.
Recording results.
Blood donor card.
Blood bank temperature sheet.
Blood bank stock sheet.
Blood transfusion request form.
Maintenance of records, government regulations (FDA)

D) Storage and Transport

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

Practical-II

1. Blood grouping & Cross Matching
2. Routine examination of peritoneal (ascitic) fluid
3. Routine examination of pleural fluid
4. Routine examination of synovial fluid
5. Routine examination of CSF
6. Chemical examination of CSF
7. Urine analysis
8. Staining of Sputum
9. Microscopic Semen analysis
10. Gross examination and physical examination of stool.

Suggested Readings:

Medical Laboratory Sciences, Theory and Practical by A. Kolhatkar
Medical Laboratory Technology – Volume I by Kanai Mukherjee
Medical Laboratory Technology – Volume II by Kanai Mukherjee
Medical Laboratory Technology – Volume III by Kanai Mukherjee

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Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"

Skill Development Component

SEMESTER- V
PAPER - I
HISTOPATHOLOGY, CYTOLOGY TECHNIQUES AND COAGULATION STUDIES

Unit-I

A) Basics of Histopathology-

Introduction to Histopathology, exfoliative Cytology.

Basic steps for Tissue Processing- Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications.

B) Laboratory requirements for Histopathology and Cytology

Chemicals and Reagents

Equipments - Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care and maintenance.

Automated tissue processor - components, working and precautions during use, Tissue floating bath.

Unit-II

Methods of Cytological Staining

Staining Methods - Hematoxylin and Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - Method of preparation.

Reticulin stain;

PAP staining- components and methods.

Unit-III

Coagulation Studies

A)Hemostasis–Definition, Basic concept and principle, Basic steps involved in Hemostasis.

B) Coagulation – a. Basic Physiology, coagulation factors.

Mechanism of blood coagulation- Extrinsic Pathway, Intrinsic Pathway. Regulators of blood coagulation.

Testing of blood coagulation - a. Bleeding Time, Duke's method

Clotting Time- Capillary tube method and Lee white's method. PT, aPTT, TT

Clot retraction time

Determination of fibrinogen.

Unit-IV

Quality Assurance for routine Heamostasis Laboratory

Introduction.
Sample collection technique (Phelbotony)
Sample preparation, Anticoagulant used, Importance of use of Sodium Citrate.
Role in Diseases, Bleeding disorders-
Platelet disorder - Thrombocytopenias - causes including aplastic anemia, D I C IT P
Hemophilia

Practicals-I
Coagulation Studies
1. Precautions to prevent hemolysis
2. Storage of blood specimens
3. Bleeding time & clotting time estimation
4. Prothrombin time estimation
5. aPTT (activated partial thromboplastin time) estimation.
6. Clot retraction time.

Histopathology-
Parts of microtome
Section Cutting of the tissue and staining
Tissue processing
Hand E staining
PAP staining.

Suggested Readings;
1.Text Book of Histology by Gartner
2.Wheater's Histology by Allen Steven
3. Histology for pathologist by Stacey e. Mills
4. Text book of medical laboratory technology by Praful Godkar; Bhalani

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"

Skill Development Component

SEMESTER - V
PAPER - II
MOLECULAR BIOLOGY AND MOLECULAR DIAGNOSTIC TECHNIQUES

Unit-I

A) Replication Of DNA (outline), Characteristics of Genetic Code, Protein synthesis (Outline)

B) Gene regulation and Mutation

- Operator, promoter, regulator, terminator, TATA box, CAT box. Operator concept- Lactose and Tryptophan operons.

Introduction and Types of Mutation; Suppression of Mutation. Mutagens: Introduction, Types and Properties.

DNA Damage, Repair, and Recombination.

Transposable elements and Retrotransposons.

Unit-II Introduction and Application of rDNA technology

Steps involved in rDNA technology, isolation of DNA from different sources, concept

of restriction modification, restriction endonucleases; Introduction of vector and host. Introduction to generation of genomic and cDNA libraries.

Improvement of plant, animals and microbes.

Gene therapy, pharmaceutical products and molecular diagnostics, Molecular pharming. Metagenomics, Metabolic engineering.

Unit-III A) Gene amplification through PCR and Types -

Polymerase Chain Reaction: Principle, methodology, primer designing, types of polymerase and factors affecting PCR, advantages, limitations and application PCR. Variants of PCR: Reverse Transcriptase PCR, Real Time PCR, Inverse PCR, anchored PCR, nested PCR, hot start PCR, multiplex PCR, touchdown PCR, ARMS (amplification refractive mutation system) PCR

B) DNA fingerprinting methods

Methodology and application of DNAfingerprinting methods (RFLP with probe introduction, RAPD, AFLP, SSR, SCAR, DGGE).

Unit-IV

Definition, scope and need of Forensic Science,

Tools and Techniques of Forensic Science

General Methods of Investigation --

Narco analysis: History, Importance as an investigative tool, methods as use of drugs,
Hypnosis etc. Limitations and legal aspects .
Brain fingerprinting: Concepts, History,
Significance, method, future perspective of the
technique, limitations.

Criminal Profiling: Introduction, Importance,
Profile of the victim and culprit, investigative
strategy, crime scene characteristics, limitations.

DNA Profiling --

Introduction, History of DNA Typing
DNA typing systems- RFLP analysis,
PCR amplifications, sequence polymorphism.
Analysis of SNP, Y- STR. Mitochondrial DNA,
Allele frequency determination, match probability- database, quality control, certification and accreditation.
Forensic Significance of DNA profiling:
Applications in disputed paternity cases, child swapping, missing person's identity
Status of development of DNA profiling in India and abroad.
New and future technologies: DNA chips
Limitations of DNA profiling.

Biologic evidence –

Importance, nature, location, collection, evaluation and tests for identification of Hair and Fibres, saliva, sweat, urine, blood, fecal matter, vaginal secretions and tests for their identification
Blood grouping from stains of blood, semen,saliva and other body fluids by Absorption inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status.

Emerging Forensic Techniques

PCR, Terminal Restriction Fragment Length
Polymorphism (TRFLP), Amplified Fragment
Length Polymorphism (AFLP), Single Stranded
Conformation Polymorphism Analysis (SSCP),
Thermal and Denaturating Gradient Gel
Electrophoresis (TGGE, DGGE)

Practicals-II

1. PCR
2. Isolation of Genomic and plasmid DNA
3. Restriction Digestion
4. Western Blotting
5. Gradient Gel Electrophoresis

6. Single strand conformation polymorphism
7. FISH

Suggested Readings:

1. Gene VIII (2004) and Gene IX (2008). B. Lewin Oxford
2. Molecular biology of The Cell Alberts et al. Garland science
3. Cell and molecular Biology, Concepts and experiments Gerald Karp Wiley
4. Lehninger Principles of Biochemistry Nelson LD and Cox WH Freeman
5. Molecular Biology of the Cell Lodish et al., WH Freeman
6. Principle of gene manipulation Old and Primerose Blackwell
7. Gene cloning T.A. Brown Nelson Thornes 8 Recombinant DNA Watson et. al. WH Freeman
8. Methods of Forensic Science Curry, A. S. Interscience, New York
9. Forensic Biology Chowdhari, S. B P R & D, Govt of India
10. Forensic Science Hand book Richard saferstein Prentice Hall

From 2018-2019

Bachelor of Vocation (B.Voc.) in "Medical Laboratory and Molecular Diagnostic Technology"
Skill Development Component

SEMESTER-VI

PROJECT WORK

Industry Based Project
❖ Project Work
❖ Project Seminar

UGC Sponsored B.Voc. Course in
"Medical Laboratory and Molecular Diagnostic Technology"

List of Books, Learning Resources and References

S.N.	Title of the Book	Author
01	A guidebook to Biochemistry	Michael Yudkin
02	A Manual of Laboratory and Diagnostic Tests (6/ e)	Frances Fischbach
03	Anatomy and Physiology	Ross and Wilson
04	Anatomy and Physiology	N Murgesh
05	Anatomy and Physiology for nurses	Evelyn Pearce
06	Anatomy and Physiology for nurses	Sears
07	Anatomy and Physiology for nurses	Pearson
08	Anatomy and Physiology: Understanding the Human Body	Clark
09	At the Bench : A Laboratory Navigator	Kathe Barker
10	At the Helm : A Laboratory Navigator	Kathe Barker
11	Atlas of haematology (5/e)	G.A. McDonald
12	Bacterial Metabolism	Gerhard
13	Basic Medical Laboratory techniques	Barbara H. Estridge *et al*
14	Biochemistry	Voet and Voet
15	Biochemistry	Stryer
16	Biochemistry	U. Satyanarayan. and U. Chakrapani
17	Biology in the Laboratory	Doris Helms
18	Biometrics Identity	Sameer Nanawati
19	Biopharmaceutical and Pharmacokinetics	Chatwal, G.R.
20	Biostatistics : A Foundation for Analysis in Health Sciences	Wayne W. Daniel
21	Biotechnological Innovations in Health Care	Butterworth – Heinmann
22	Calculations for Molecular Biology	Stephenson
23	Cell Molecular Biology	Gerald Karp
24	Churchill's Medical Dictionary	Churchill Livingstone
25	Churchill's Medical Dictionary	Churchill Livingstone
26	Clinical Biochemistry	Richard Luxton
27	Clinical Diagnosis and Management by Laboratory method0 (20/e)	John Bernard Henary
28	Clinical Haematology	Christopher A. Ludlam
29	Clinical Laboratory Management	Lynne Shore
30	Clinical Pediatric Neurology	Gerals Fenichel
31	Color Atlas and Synopsis of Clinical Dermatology	Thomas Fitzpatrik
32	Color atlas of basic Histopathology	---
33	Companion to Microbiology	Alan Bull and Paulin Meadow
34	Current topics in AIDS (Volume I)	M.S. Gotlib
35	Di Fiore's Atlas of Histology	Di Fiore
36	Drugs for the heart	Lionrl H. Opie
37	Endocrinology	Headley
38	Fundamental Principles of Bacteriology	Salle, S.J.

39	Gel Electrophoresis of Nucleic Acids	D. RickWood and B.D. Hames
40	Gene VII	Benjamin Lewin
41	Gene VIII	Benjamin Lewin
42	General Microbiology	Stanier
43	Haematology (International edition)	Emmanuel C.Besa
44	Haematology (Pathophysiological basis for clinical practice (3/e)	Stephen M. Robinson
45	Haematology for students Practitioners	Ramnik Sood
46	Hand book of Medical Laboratory Technology (2/e)	V.H. Talib
47	Hospital Acquired Infections	Dr. V. Muralidhar
48	Human Physiology	Andrew Davis
49	Immunology	Riott
50	Immunology	Rao, C.V.
51	Immunology	Kuby
52	Immunology	Roitt, Jonathaan Brostoff and David Male
53	Immunology and Serology	Joshi
54	Instrumental Analysis	Chatwal Anand
55	Laboratory Reference	Jane Roskams
56	Manual of Endocrinology and Metabolism	Norman Levin
57	Medical Bacteriology	Peter Hawkey
58	Medical Bacteriology	Peter Hawkey
59	Medical Dictionary	Oxford
60	Medical Informatics	Mohan Bansal
61	Medical Laboratory Management	Sangeeta Sharma et al
62	Medical Laboratory Sciences, Theory and Practical	A. Kolhatkar
63	Medical Laboratory Technology – Volume I	Kanai Mukherjee
64	Medical Laboratory Technology – Volume II	Kanai Mukherjee
65	Medical Laboratory Technology – Volume II	Kanai Mukherjee
66	Medical Laboratory Technology Methods and Interpretation (5/e)	Ramnik Sood
67	Medical Microbiology	Paniker and Satish Gupte
68	Medical Microbiology	Paniker and Satish Gupte
69	Medical Mycology	Dr. Jagdish Chander
70	Medical Parasitology	R.L. Ichhpujani and Rajesh Bhatia
71	Medicinal Chemistry	Ashutosh Kar
72	Microbiology	Pelczar
73	Microbiology	Prescott
74	Molecular and antibody Probes in Diagnosis	Mathew R. Walker
75	Molecular and Antibody Probes in Diagnosis	Mathew R. Walker
76	Molecular Biology in Medicine	Timothy M. Cox
77	Molecular Biology in Medicine	M. Cox
78	Molecular Biotechnology	Glick
79	Neurodegenerative Diseases	Donald B. Calne
80	Outline of Biochemistry	Conn Stumpf
81	Pharmaceutical Microbiology	Hugo
82	Pharmacology	H.P. Rang
83	Physicians' Desk Reference	Edward Barnhart
84	Practical Clinical Biochemistry	Harold Varley
85	Practical Haematology	J.B. Dacie

86	Practical Haematology (8/e)	Sir John
87	Practical Medical Microbiology - (Vol. I and II)	Mackie and MacCartney
88	Practical Medical Microbiology - (Vol. I and II)	Mackie and MacCartney
89	Principal of Biochemistry	M. A. Siddiqi
90	Principles of Biochemistry	David L. Nelson
91	Principles of Biochemistry	Lehninger
92	Principles of Clinical Toxicology	Gosses
93	Principles of Clinical Toxicology	Thomas
94	Principles of Genetics	Gardner
95	Principles of Internal Medicine	Isselbacher
96	Proteins and Proteomics : Laboratory Manual	Richard J. Simpson
97	Research Methodology in Medical Sciences	Chandorkar
98	Text book of Medical Biochemistry	Chaterjee and Shinde
99	Text book of Microbiology	Ananthanereyan and Paniker
100	Text book of Parasitology	N.C. Dey
102	Text book of Parasitology	Chaterjee
103	Textbook of Biochemistry and Human Biology	G.P. Talwar
104	Textbook of Medical Laboratory Technology	Godkar and Godkar
105	Textbook of Medical Physiology	Guyton and Hall
106	Zinsser Microbiology	Joklik and Willett
107	Oxford Practical Grammar	Eastwood, John
108	Essential English Grammar	Murphy, Raymond
109	Practical Communication Skills	Chrissie Wright
110	Business Communication	Sinha, K. K.
111	Business English	Taylor, Ken.
112	English Vocbulary in Use	Mccarthy, Micheal.
113	Business Letters, Emails	Shirley Taylor
114	The Craft of Business Letter Writing	Monipally, M. Matthew.
115	Presentations Laws	Anne
116	Telephoning and Teleconferencing Skills	Ken Taylor
117	Business and Administrative Communication	Locker, o. Kitty
118	Presentation Skills in English	Bob Dignen
119	Public Speaking	Osbrn, Micheal
120	Communication in Organisation	Dalmer Fisher
121	Keep Talking : Communicative Fluiency Activities for Language Teaching	Friederike Klippel
122	A Handbook for English Language Laboratories	E. Sureshkumar
123	Cambridge Idioms Dictionary	Cambridge
124	Write to the Point : How to Communicate in business with style and purpose	Salvatore J. Iacone
125	Commercial Correspondence and Office Management	R. S.N. Pillai
126	Comdex Computer Course Kit	Gupta, V.
128	Computer Fundamentals	P.K. Sinha
129	Excel 2010 Inside Out	Dodge, Mark
130	Information Technology for Management	Lucas, Henry C.
131	A Foundation Course in Value Education	R R Gaur, R Sangal, G P Bagaria, 2009
132	Fundamentals of Ethics for Scientists and Engineers	E G Seebauer and Robert L. Berry, 2000

133	Human Values, New Age International Publishers	A.N. Tripathy, 2003
134	Environment Biology	Agarwal, K. C. 2001
135	Environment Protection and Laws	Jadhav, H and Bhosale, V.M. 1995
136	Waste Water Treatment	Rao M. N. and Datta A.K. 1987
137	Environment Science (1st Indian Edition)	Daniel D. Chiras 2010
138	Essentials of Environment Science	Joseph
139	Environment Pollution Control Engineering	Rao, C.S.
140	Perspectives in Environmental Studies	Kaushik, A.
141	Clinical Biochemistry	G. Guru
142	Handbook of Biochemistry	M.A. Siddique
143	Textbook of Medical Biochemistry	S. Ramkrishnan
144	Biochemical Techniques	K. Choudhary
145	Blood Banking Operations	G. Gurur
146	Blood Banking Training Manual	Indian Society for Blood Banking
147	Practical Medical Microbiology	Mackie and MacCartney
148	Textbook of Medical Microbiology	R. Ananthnarayan and C.K. J. Paniker
149	Invertebrate Zoology	E.L. Jordan / V.S. Verma
150	Concepts of Ecology	N. Arunumugam
151	Essentials of Cytology	C.B. Powar
152	Cell Biology , Genetics and Evolution	N. Arunumugam
153	Zoology of F.Y.B.Sc. Volume I and II	S.S. Bhattacharya
154	Zoology of S.Y.B.Sc. Volume I , II and III	S.S. Bhattacharya and S.G. Yeragi
155	Molecular Biology	V.S. Verma and V.V. Agrawal
156	Embryology, Ecology and Physiology	N. Arunumugam
157	Manual of Zoology	Ekumarnath Ayyer
158	Fundamentals of Cytogenetics and Genetics	Mahabali Ram
159	Human Anatomy, Physiology and Health Education	Harie R. Berasari , Gandhi and Goel
160	Communication skills in English	Sasikumar V, Kiranmai Dutt, P and Geetha Rajeevan
161	Critical Thinking: An Introduction	Alec Fisher