Re-Accredited by NAAC with 'A' Grade
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Fax : +91 - 261 - 2227312
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન મેડીકલ ટેકનોલોજી વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવનાર B.Sc. મેડિકલ ટેક્નોલોજીના અભ્યાસક્રમમાં સુધારો કરવા અંગે વિચારણા કરતા મેડીકલ ટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૯/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ ભલામણ કરેલ છે જે વિજ્ઞાન વિદ્યાશાખાનાં ડીનશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલ તા.૨૩/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૦૪ થી સ્વીકારી મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

મેડીકલ ટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૯/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨

:: આથી ઠરાવવામાં આવે છે કે, B.Sc. Medical Technology ના અભ્યાસક્રમમાં Subject Code MT ના બદલે MLT કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૨૩/૦૩/૨૦૨૨ની ઠરાવ ક્રમાંકઃ ૦૪

:: આથી ઠરાવવામાં આવે છે કે, મેડીકલ ટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૯/૦૩/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંકઃ૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં ડીનશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરેલ B.Sc. Medical Technology ના અભ્યાસક્રમમાં Subject Code MT ના બદલે MLT શૈક્ષણિક વર્ષ ૨૦૨૨–૨૩ થી અમલમાં આવે તે રીતે મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./મેડીકલ ટેકનોલોજી/પરિપત્ર/૬૫૩૪/૨૦૨૨
તા.૩૧–૦૩–૨૦૨૨

ઈ.ચા. કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન મેડીકલ ટેકનોલોજી વિષયની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

Academic Council Dt.23-03-2022
Item No. 4 Encl. 3

Veer Narmad South Gujarat University

Surat – 7

Syllabus of

B. Sc. Medical Laboratory Technology

(As per CBCS)

Effective from 2022 - 2023

F. Y. B. Sc. Semester – I

MLT 01: Organization of clinical laboratory

COURSE- MLT: 01	Organization of clinical laboratory	CREDIT- 02	2hrs/week

UNIT – 1 Human Health and Clinical Diagnosis in Developing Countries

1.1 Medical Care in India
1.2 Status of Medical Laboratories in Developing Countries
1.3 Commonly Requested Laboratory Tests in India and Other Developing Countries
1.4 Ethics and Law of laboratory Operation

UNIT – 2 Preparation of Laboratory Solutions and Glasswares

2.1 Preparation of laboratory solutions
2.2 Laboratory calculations and Diluting solutions
2.3 Preparation of Buffer solutions
2.4 pH of solutions and indicators
2.5 Introduction of general Laboratory Glassware
2.6 Care and maintenance of Glassware
2.7 Calibration of Glassware

UNIT – 3 Laboratory Organization

3.1 Organization of Laboratory
3.2 Functional Components and Role of Individual Components of Laboratory
3.3 Various types of Laboratories
3.4 A Standard Clinical Laboratory Set up

UNIT - 4 Laboratory Safety

4.1 Implementing a Laboratory Health and Safety Programme
4.2 Safe Laboratory Premise and Personnel Safety Measures

4.3 Laboratory First Aid Kit

4.4 Biosafety Levels and Biosafety Programme

4.5 Decontamination of Infectious Material and Disposal of Laboratory Waste

References :

A.Kolhatkar , J Ochei , *Medical Laboratory Science- Theory and Practice* ,Tata McGraw-Bhalani Pub.

H. A. Modi, *Elementary Microbiology, Fundamentals of Microbiology ,Volume-1*, Akta Prakashan , Nadiad.

Kanai L. Mukherjee, Medical *Laboratory Technology-A Procedure Manual for Routine Diagnostic Tests* ,Volume-1 ,Tata McGraw-Hill Pub Publishing Company ltd.

Monica Cheesbrough, *District Laboratory Practice in Tropical Countries* ,Part 1, Cambrige Editions

P. B. Godkar , D.P. Godkar, *Textbook of Medical Laboratory Technology*,3rd Edition, Hill Pub

MLT 02: Equipments and Instruments in Medical Technology Laboratory

COURSE- MLT: 02	Equipments and Instruments in Medical Technology Laboratory	CREDIT- 02	2hrs/week

UNIT – 1 Microscopy

1.1 Introduction and Properties of light
1.2 Basic terminologies: Refraction and refractive Index, Magnification, Numerical aperture, Resolution and Resolving power
1.3 Components, working principle and operation of Bright field microscope
1.4 Dark field microscopy
1.5 Phase contrast microscopy
1.6 Fluorescence microscopy
1.7 Electron microscopy
1.8 Care and maintenance of microscope

UNIT – 2 Photometer, Potentiometer and Osmometer

2.1 Colorimeter
2.2 Spectrophotometer
2.3 Potentiometer
2.4 Osmometer

UNIT – 3 Equipments of Sterilization

3.1 Autoclave
3.2 Hot Air Oven
3.3 Incinerator
3.4 Filters : Depth filters, Membrane filters and HEPA filter

UNIT – 4 Other Laboratory Equipments

4.1 Centrifuge
4.2 Incubator
4.3 Distillation unit
4.4 Weighing Balance

References :

A. D. Darji, *Elements of Microbiology*, 2nd Edition, Nirav Prakashan, Ahmedabad.

A.Kolhatkar , J Ochei , *Medical Laboratory Science- Theory and Practice* ,Tata McGraw-Bhalani Pub.

H. A. Modi, *Elementary Microbiology, Fundamentals of Microbiology* ,*Volume-1*, Akta Prakashan , Nadiad.

Kanai L. Mukherjee, Medical *Laboratory Technology-A Procedure Manual for Routine Diagnostic Tests* ,Volume-1 ,Tata McGraw-Hill Pub Publishing Company ltd.

P. B. Godkar , D.P. Godkar, *Textbook of Medical Laboratory Technology*,3rd Edition, Hill Pub

MADICAL LABORATORY TECHNOLOGY

F. Y. B. Sc. Semester I Practical

1. Study of Compound Microscope
2. Study of living organism by light microscopy (Hanging drop and wet mount)
3. Study of microorganism by Dark Field Microscopy
4. Study of Laboratory glassware and its calibration
5. Standardization of 1 ml volumetric pipette
6. Cleaning and preparation of glassware for sterilization
7. Study of Laboratory reagents
8. Preparation of Solution (Molar, Normal and Percent)
9. Preparation of various dilutions from stock solution
10. Study of Laboratory Instruments and Equipments
11. Study of Laboratory Hazards and First Aid measures
12. Disposal of Biomedical waste
13. Measurement and adjustment of pH by pH meter.

References :

Kanai L. Mukherjee, Medical *Laboratory Technology-A Procedure Manual for Routine Diagnostic Tests* ,Volume-1 ,Tata McGraw-Hill Pub Publishing Company ltd.

A. Kolhatkar , J Ochei , *Medical Laboratory Science- Theory and Practice* ,Tata McGraw-Hill Pub

P. B. Godkar , D.P. Godkar, *Textbook of Medical Laboratory Technology*,2nd Edition, Bhalani Pub.

Monica Cheesbrough, *District Laboratory Practice in Tropical Countries* ,Part 1, Cambrige Editions.

Patel, R.J., and Patel,R.K.,(2000).*Experimental Microbiology,Volume 1&2*,Aditya Pub

F. Y. B. Sc. Semester – II

MLT 03: Fundamentals of Medical Technology

COURSE- MLT: 03	Fundamentals of Medical Technology	CREDIT- 02	2hrs/week

UNIT – 1 Collection, Preservation, Transportation and Storage of Blood

1.1 Preparation of patient and specimen collection material
1.2 Responsibilities of Phlebotomist
1.3 Blood collection procedure
1.4 Specimen types and anticoagulant selection
1.5 Separation of serum and plasma
1.6 Vacutainers
1.7 Transportation of the specimen
1.8 Storage of the specimen

UNIT – 2 Collection, Preservation, Transportation and Storage of other Clinical Samples

2.1 Urine
2.2 Feces
2.3 CSF
2.4 Sputum, throat and mouth specimen
2.5 Eye and ear specimen
2.6 Wound, abscesses, burn and sinuses specimen
2.7 Urogenital specimen

UNIT – 3 Physical Methods of Sterilization

3.1 Sterilization by Moist heat
3.2 Sterilization by Dry heat
3.3 Radiation as a sterilizing agents
3.4 Filteration

UNIT – 4 Chemical Methods of Sterilization & disinfection

4.1 Common terminologies for microbial control
4.2 Characteristics of an ideal disinfectants
4.3 Mode of action of disinfectant

4.4 Major groups of antimicrobial chemical agents: Phenol and phenolic compounds, Alcohol, Halogen and Heavy metals
4.5 Gaseous chemical sterilants

References

H. A. Modi, *Elementary Microbiology, Fundamentals of Microbiology* ,Volume-1, Akta Prakashan , Nadiad.

Kanai L. Mukherjee, Medical *Laboratory Technology-A Procedure Manual for Routine Diagnostic Tests* ,Volume-1 ,Tata McGraw-Hill Pub Publishing Company ltd.

P. B. Godkar , D.P. Godkar, *Textbook of Medical Laboratory Technology*,3rd Edition, Hill Pub

MLT 04: Introduction to Microbial world

COURSE- MLT: 04	Introduction to Microbial world	CREDIT- 02	2hrs/week

UNIT – 1 Microbial world and its Identification

1.1 Origin of microorganisms
1.2 Medical Microbiology and its development
1.3 Phenotypic characteristics for microbial identification
1.4 Genetic characteristics for microbial identification

UNIT – 2 Eukaryotic microbes: Morphology and Economic Importance

2.1 Common features of Eukaryotic cells
2.2 Molds
2.3 Yeast
2.4 Protozoa

UNIT – 3 Atypical bacteria: Morphology, cultivation and Pathogenic significance

3.1 Rickettsia
3.2 Chlamydia
3.3 Mycoplasma
3.4 Actinomycetes

UNIT – 4 Viruses and Bacteriophage

4.1 General structural properties of Viruses
4.2 Types of viral infections
4.3 Viruses and cancer
4.4 General Characteristics of Bacteriophage
4.5 Lytic cycle and Lysogeny

Reference:

H. A. Modi, *Elementary Microbiology, Fundamentals of Microbiology* ,Volume-2 (An Introduction to Microbial World), Akta Prakashan , Nadiad.

J. M. Willey, L. M. Sherwood, C. J. Woolverton, *Prescott's Microbiology,* 8th Edition, McGrowHill International Edition.

Nester Anderson, Roberts, Pearsall, *Nester's Microbiology*, International Edition, McGrow HillPub.

MADICAL LABORATORY TECHNOLOGY

F. Y. B. Sc. Semester II Practical

1. Study of Bacteriological and Mycological Media
2. Study of Morphological Characteristics of Microorganisms: Size, Shape, Arrangement
3. Cultivation of microorganisms on Slant, Stab, Broth and Plate.
4. Preparation of Anticoagulated bulbs
5. Separation of Plasma and Serum from blood
6. Differential staining technique
7. Diagnosis of Tuberculosis from sputum by Acid Fast staining technique
8. Detection of Spirochaetes from dental carries by staining technique
9. Detection of *Corynrbacterium diphtheria* by metachromatic staining technique
10. Detection of *Bacillus anthracis* bt spore staining technique
11. Detection of *Klebsiella pneumoniae* by capsule staining technique
12. Study of Fungi: *Aspergillus, Mucur, Rhizopus, Fusarium, Candida albicans, Saccharomyces cerevisiae*
13. Cultivation of Bacteriophage (Demonstration)
14. Bactericidal effect of U.V. rays on microbial growth
15. Bactericidal effect of Formaldehyde on microbial growth
16. Bactericidal effect of Antiseptic and Disinfectant on microbial growth

References :

P. B. Godkar , D.P. Godkar, *Textbook of Medical Laboratory Technology,*2nd Edition,Bhalani Pub.

Monica Cheesbrough, *District Laboratory Practice in Tropical Countries* ,Part 1, CambrigeEditions.

Patel, R.J., and Patel,R.K.,(2000).*Experimental Microbiology,Volume 1&2,*Aditya Pub

S. Y. B. Sc. Medical Technology
Semester – 3

MLT – 05 ENVIRONMENT AND FOOD MICROBIOLOGY

COURSE- MLT: 05	ENVIRONMENT AND FOOD MICROBIOLOGY	CREDIT- 02	2hrs/week

UNIT-1: MICROBIOLOGY OF WATER AND WASTE WATER

1.1 Sanitary analysis of water
1.2 Microbiology of waste water (sewage) treatment
  1.2.1 Reduction of BOD
  1.2.2 Large-scale Sewage Treatment methods
  1.2.3 Small-scale Sewage Treatment methods
1.3 Drinking water treatment and testing
1.4 Microbiology of solid water treatment
  1.4.1 Sanitary Landfills for Solid Waste disposal
  1.4.2 Commercial Composting

UNIT-2: AEROBIOLOGY

2.1 Number and Kinds of organisms in air.
2.2 Enumeration of Bacteria in air.
2.3 Effect of atmospheric temperature and humidity on air microorganisms.
2.4 Role of microorganisms in air

UNIT-3: FOOD MICROBIOLOGY

3.1 Factors influencing Growth of microorganisms in Food
  3.1.1 Intrinsic Factors
  3.1.2 Extrinsic Factors
3.2 Microorganisms in food and Beverage production
3.3 Food spoilage and Preservation
3.3 Food Borne Disease Outbreaks
  3.3.1 Food borne infection
  3.3.2 Food intoxication
3.4 Detection of Food Borne Pathogens
3.5 Probiotics

UNIT-4: SOIL MICROBIOLOGY

4.1 Microorganisms in soil
4.2 Functions of microorganisms in soil
4.3 Nitrogen Cycle and Nitrogen fixation
4.4 Rhizosphere
4.5 Biofertilizers, Bioinsecticides and Biopesticides

REFERENCES:

1) Purohit S. S. (2006). *Microbiology: Fundamentals and Applications,* 7th ed., Agrobios(India).
2) Wiley J. & Sherwood L. (2007). *Prescott, Harley, and Klein's Microbiology*, 9th ed., McGraw-Hill Science/Engineering/Math.
3) Pelczar M. J. & Chan E. C. S. (1998). *Microbiology,* 5th ed., Tata-McGraw-Hill.
4) Powar C. B. & Daginawala H. F. *General Microbiology*, Vol. II, Himalaya Publishing House.
5) Tortora G. J. & Funke B. R. (2006). Microbiology: An Introduction, 9th ed., Benjamin Cummings.
6) Salle A. J. (1984). *Fundamental Principles of Bacteriology,* 7th ed., Tata-McGraw-Hill.

MLT – 06 HUMAN ANATOMY AND PHYSIOLOGY-1

COURSE- MLT: 06	HUMAN ANATOMY AND PHYSIOLOGY-1	CREDIT- 02	2hrs/week

UNIT: 1 INTRODUCTION TO HUMAN BODY

1.1 The Cell- Structure and Function
1.2 Tissues
1.2.1. Epithelial Tissue
1.2.2. Connective Tissue
1.2.3. Muscle Tissue
1.2.4. Nervous Tissue
1.3 Homeostasis
1.3.1. Positive Feedback Mechanism

1.3.2. Negative Feedback Mechanism

UNIT: 2 CIRCULATORY SYSTEM

1.1 Cardiovascular System
- 2.1.1. Structural difference among Arteries, Veins and capillaries
- 2.1.2. Structure of heart
- 2.1.3. Flow of blood through hearth
- 2.1.4. Cardiac cycle
- 2.1.5. Conducting system of heart

2.2 Lymphatic System

2.2.1. Functions of Lymphatic system
2.2.2. Structure and function of Lymphatic organs and tissues

UNIT: 3 NERVOUS SYSTEM

3.1 Central Nervous System
3.1.1. Meninges and Cerebrospinal Fluid (CSF)
3.1.2. Structure and Function of Brain: Cerebrum, Diencephalon, Brain stem, Cerebellum
3.1.3. Structure of Spinal cord: Grey matter & White matter
3.2 Peripheral Nervous System: List of Spinal, Thoracic & Cranial nerves
3.3 Action Potential and Neurotransmitters

UNIT: 4 SKELETAL SYSTEM

4.1 Types and function of Bone
4.2 Structure of bone
4.3 List of Axial and Appendicular skeleton bones
4.4 Joints
- 4.4.1. Fibrous Joint
- 4.4.2. Cartilaginous Joint
- 4.4.3. Synovial Joint and its types

REFERENCE:

1) Anne W. & Allison G. (2010). Ross and Wilson; *Anatomy and Physiology in Health and Illness*, 11th ed., Elsevier Churchill Livingstone.
2) Tortora G. J. and Willey B. D. (2014). *Anatomy and Physiology*, India Edition.
3) Chaurasia B. D. (2013). *Human Anatomy*, 6th ed., vol 1,2,3, CBS Publisher & Distributor Pvt Ltd.
4) Andras C. (1999). *Anatomy of the Living Human*, Atlas of Medical Imaging, Konemann.

MLT – 07 GENERAL BIOCHEMISTRY-1

COURSE- MLT: 07	GENERAL BIOCHEMISTRY-1	CREDIT- 02	2hrs/week

UNIT: 1 CHEMISTRY OF CARBOHYDRATE

1.1 Function of carbohydrate
1.2 Classification of carbohydrate
1.3 Monosaccharide:
- 1.3.1 Classification
- 1.3.2 Isomerism
- 1.3.3 Chemical properties: Oxidation, Reduction, Reducing property, Osazone formation & Glycoside formation

1.4 Disaccharide: Classification and structure

1.5 Polysaccharide: Homopolysaccharide (Starch and glycogen), Heteropolysaccharide

UNIT: 2 CHEMISTRY OF LIPID

2.1 Introduction, classification & Biological functions
2.2 fatty acids: Classification, Structure and Biological functions
2.3 Triglyceride: Structure and Properties
2.4 Phospholipid: Classification, structure and functions
2.5 Cholesterol: Structure and properties
2.6 Amphipathic lipids

UNIT: 3 AMINO ACID AND PROTEINS

3.1 Classification of Amino acid
3.2 Classification of Protein
3.3 Structure of protein
    3.3.1 Bonds responsible for protein structure
    3.3.2 Primary structure
    3.3.3 Secondary structure
    3.3.4 Tertiary structure
    3.3.5 Quaternary structure
3.4 Properties of protein
3.5 Denaturation of protein

UNIT: 4 ENZYME

4.1 Nomenclature, Classification and Property
4.2 Mechanism of Enzyme action
4.3 Factors affecting Enzyme activity
4.4 Co enzyme: Classification
4.5 Enzyme inhibition
4.6 Units of Enzyme activity
4.7 Isoenzymes: LDH and ALP

REFERENCES:

1) Satyanarayana U. & Chakrapani U. (2013). *Biochemistry*; 4th ed, Arunabha Sen and Allied (P) Ltd.
2) Vasudevan D. & Sreekumari S. (2005). *Textbook of Biochemistry*; 4th ed, Jaypee Pub
3) Chatterjae M. N. and Shinde R. (2007). *Textbook of Medical Biochemistry*, 7th ed., Jaypee Brothers Publishers.
4) Nelson D. L. & Cox M. M. (2000). *Lehninger Principles of Biochemistry*, 3rd ed., Macmillan Worth Publishers.
5) Rastogi S. C. (2003). *Biochemistry*, 2nd ed., Tata McGrow Hill Publishing Company Limited.

MEDICAL LABORATORY TECHNOLOGY
S. Y. B. Sc. SEMESTER III PRACTICAL

1) Study of Enzymatic Activity of Microorganisms/Enzyme Production capability: Dehydrogenase, Decarboxylase, Deaminase, Catalase, Oxidase.
2) Microbiological Analysis of Air.
3) Microbiological Analysis of Water.
   -Detection of Colifoms.
   -Enumeration of Coliforms. (MPN Technique)
4) Microbiological Analysis of Food.
5) Microbiological Analysis of Soil
6) Isolation of Actinomycetes from Soil.
7) Isolation of Anaerobic organisms from Soil.
8) Collection of Blood (Demonstration).
9) Identification of Blood Cells.
10) General scheme for identification of Biomolecules.
11) Qualitative analysis of Carbohydrates
12) Qualitative analysis of Proteins
13) Qualitative analysis of Lipids and Cholesterol
14) Qualitative analysis of Non Protein Nitrogenous Substances
15) Determination of Growth Curve (Demonstration).
16) Isolation of Bacteriophage from Sewage (Demonstration).
17) Examination of Pulse and Blood Pressure (Demonstration).

REFERENCES:

1) Patel R. J. & Patel R. K. (2015). *Experimental Microbiology*, Vol. 1, 9th ed, Aditya.
2) Patel R. J. & Patel R. K. (2015). *Experimental Microbiology*, Vol. 2, 9th ed, Aditya.
3) Chawla R. (2014). *Practical Clinical Biochemistry: Methods and Interpretation*, 4th ed., Jaypee Brothers

S. Y. B. Sc. Medical Technology
Semester – 4

MLT – 08 MICROBIAL METABOLISM AND GENETICS

COURSE-MLT: 08	MICROBIAL METABOLISM AND GENETICS	CREDIT- 02	2hrs/week

UNIT: 1 INTRODUCTION TO METABOLISM

1.1 Introduction
1.2 ATP: The major energy currency of cells
1.3 Redox Reaction
1.4 Methods of energy Production
    1.4.1 ETC and Oxidative Phoshorylation
    1.4.2 Fermentation
1.5 Regulation of Metabolism

UNIT: 2 CATABOLISM AND ANABOLISM

2.1 Anabolism Vs catabolism
2.2 Nutritional Types
2.3 Phototropic fueling reactions
2.4 Chemoorganotrophs
2.5 Chemolithotrophy
2.6 Principles governing biosynthesis

UNIT: 3 GENOME REPLICATION AND EXPRESSION

3.1 DNA as a genetic material
3.2 DNA replications
3.3 Genetic code
3.4 Transcription
3.5 Translation
3.6 Regulation of gene expression

UNIT: 4 MECHANISMS OF GENETIC VARIATION

4.1 Introduction to mutation (Definition, Types in brief)
4.2 Recombination methods
    4.2.1 Transformation
    4.2.2 Transduction
    4.2.3 Conjugation
4.3 Transposable elements
4.4 Evolution in Action: The development of Antibiotic resistance in Bacteria

REFERENCE:

1) Willey J. & Sherwood L. (2013). Prescott, Harely and Klein's Microbiology, 9th ed., McGraw-Hill Science/ Engineering /Math.
2) Jain J. L. & Jain N. (2006). Fundamentals of Biochemistry, 6th ed., S. Chand publications.
3) Satyanarayana U. & Chakrapani U. (2013). *Biochemistry*; 4th ed, Arunabha Sen and Allied (P) Ltd.
4) Chatterjae M. N. and Shinde R. (2007). *Textbook of Medical Biochemistry*, 7th ed., Jaypee Brothers Publishers.

MLT – 09 HUMAN ANATOMY AND PHYSIOLOGY-2

COURSE-MLT: 09	HUMAN ANATOMY AND PHYSIOLOGY-2	CREDIT- 02	2hrs/week

UNIT: 1 DIGESTIVE SYSTEM

1.1 Overview of Structure of Digestive organs
1.2 Function of Digestive organs
1.3 Composition and function of Salivary gland & Saliva, Gastric Juice & Pancreatic Juice
1.4 Digestion and absorption of Nutrients
1.5 Defaecation

UNIT: 2 EXCRETORY SYSTEM

2.1 Structure and function of organs of urinary system: Kidney, Ureter, Urinary bladder, Urethra
  2.1.1. Process of Urine formation
  2.1.2. Micturation
2.2 Structure and function of Skin

UNIT: 3 RESPIRATORY SYSTEM

3.1 Overview of Structure of Upper and Lower Respiratory organs
3.2 Function of Respiratory organs
3.3 Breathing process
3.4 Gaseous exchange
3.5 Regulation of Respiration

UNIT: 4 REPRODUCTIVE SYSTEM

4.1 Structure of Male Reproductive organs
4.2 Spermatogenesis
4.3 Structure of female Reproductive organs
4.4 Oogenesis

REFERENCE:

1) Anne W. & Allison G. (2010). Ross and Wilson; *Anatomy and Physiology in Health and Illness*, 11th ed., Elsevier Churchill Livingstone.
2) Tortora G. J. and Willey B. D. (2014). *Anatomy and Physiology*, India Edition.
3) Chaurasia B. D. (2013). *Human Anatomy*, 6th ed., vol 1,2,3, CBS Publisher & Distributor Pvt Ltd.
4) Andras C. (1999). *Anatomy of the Living Human*, Atlas of Medical Imaging, Konemann.

MLT – 10 GENERAL BIOCHEMISTRY-2

COURSE-MLT: 10	GENERAL BIOCHEMISTRY-2	CREDIT- 02	2hrs/week

UNIT: 1 HORMONE

1.1 Introduction
1.2 Classification
1.3 Mechanism of action of Steroid Hormone
1.4 Mechanism of action of Non-steroid Hormone through cAMP & cGMP as a secondary messenger
1.5 Mechanism of action of Non-steroid Hormone through Phosphatidyl inositol/ Calcium as a secondary messenger
1.6 Nuclear receptor mechanism of Non-steroid hormone

UNIT: 2 MINERALS

2.1 General Function and Classification
2.2 Calcium: Biochemical function, Dietary requirement, Source, Adsorption, excretion and Disease state
2.3 Hormonal regulation of blood calcium
2.4 Biochemical function, Dietary requirement, Source, Adsorption, excretion and Disease state of: Sodium, Potassium and Chloride

UNIT: 3 NUCLEIC ACID

1.1 Introduction
1.2 Nucleoside: Components, Nomenclature and Structure
1.3 Nucleotide: Components, Nomenclature and Structure
1.4 Structure and types of DNA
1.5 Structure and types of RNA

UNIT: 4 VITAMINS

4.1 Introduction
4.2 Classification
4.3 Structure, daily requirements, dietary sources, biological functions and deficiency manifestation of fat soluble vitamins
4.4 Structure, daily requirements, dietary sources, biological functions and deficiency manifestation of water soluble vitamins

REFERENCES:

1) Satyanarayana U. & Chakrapani U. (2013). *Biochemistry*; 4th ed, Arunabha Sen and Allied (P) Ltd.
2) Vasudevan D. & Sreekumari S. (2005). *Textbook of Biochemistry*; 4th ed, Jaypee Pub

3) Chatterjae M. N. and Shinde R. (2007). *Textbook of Medical Biochemistry*, 7th ed., Jaypee Brothers Publishers.
4) Nelson D. L. & Cox M. M. (2000). *Lehninger Principles of Biochemistry*, 3rd ed., Macmillan Worth Publishers.
5) Rastogi S. C. (2003). *Biochemistry*, 2nd ed., Tata McGrow Hill Publishing Company Limited.

MEDICA LABORATORY TECHNOLOGY
S. Y. B. Sc. SEMESTER IV PRACTICAL

1) Isolation and Identification of pathogens from Urine sample based on morphological, cultural and biochemical characteristics (*Staphylococcus aureus, Escherichia coli, Enterobacter aerogenes, Klebsiella pneumoniae, Proteus vulgaris, Pseudomonas aeruginosa*)
2) Isolation and Identification of pathogens from Stool sample based on morphological, cultural and biochemical characteristics (*Staphylococcus aureus, Escherichia coli, Enterobacter aerogenes, Proteus vulgaris, Bacillus cereus, Salmonella spp*)
3) Isolation and Identification of pathogens from Sputum sample based on morphological, cultural and biochemical characteristics (*Klebsiella pneumoniae, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa*)
4) Isolation and Identification of pathogens from Pus sample based on morphological, cultural and biochemical characteristics (*Pseudomonas aeruginosa, Staphylococcus aureus*)
5) Isolation and Identification of pathogens from CSF sample based on morphological, cultural and biochemical characteristics (*Klebsiella pneumoniae*)
6) Physical and Chemical Analysis of Blood.
7) Physical and Chemical Analysis of Saliva.
8) Physical and Chemical Analysis of Gastric Juice.
9) Physical and Chemical Analysis of Bile Juice.
10) Physical and Chemical Analysis of Urine.

REFERENCE:

1) Patel R. J. & Patel R. K. (2015). *Experimental Microbiology*, Vol. 1, 9th ed, Aditya.
2) Patel R. J. & Patel R. K. (2015). *Experimental Microbiology*, Vol. 2, 9th ed, Aditya.
3) Chawla R. (2014). *Practical Clinical Biochemistry: Methods and Interpretation*, 4th ed., Jaypee Brothers

MLT – 11: BACTERIOLOGY AND VIROLOGY

COURSE- MLT: 11	BACTERIOLOGY AND VIROLOGY	CREDIT- 02	2hrs/week

Unit 1 Human-microbe interactions

1.1 Normal Flora of Human Body
1.2 Patterns of infectious disease in a population
1.3 Establishment of Infectious disease
1.4 Epidemiology and Epidemiological methods
1.5 Nosocomial infections: Source, Surveillance, Prevention, Control
1.6 Emerging and Reemerging infectious disease and pathogens
1.7 Antibiotic sensitivity tests

Unit 2 Bacterial Disease I: Causative Agents, Pathogenesis, Laboratory diagnosis and Prophylactic measures

2.1 Gas Gangrene
2.2 Tetanus
2.3 Plague
2.4 Leptospirosis
2.5 Diphtheria
2.6 Pertussis
2.7 Tuberculosis
2.8 Pneumonia

Unit 3 Bacterial Diseases II: Causative Agents, Pathogenesis, Laboratory diagnosis and Prophylactic measures

3.1 Syphilis
3.2 Gonorrhea
3.3 Urinary Tract Disease
3.4 Bacterial Food Poisoning
3.5 Enteric Fever
3.6 Cholera
3.7 Helicobacter infection

Unit 4 Viral Diseases : Causative Agents, Pathogenesis, Laboratory diagnosis and Prophylactic measures

4.1 Mumps, Measles, Rubella
4.2 Rabies

4.3 Polio-myelitis
4.4 AIDS
4.5 Hepatitis
4.6 Influenza
4.7 Dengue
4.8 Chikungunya

References:

- Greenwood, D., Slack, R., Peutherer, J. 1998, *Medical Microbiology; A guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control,* 15th Ed., ELST with Churchill Livingstone.
- Willey, J. M., Sherwood, L. M. and Woolverton, C. J. 2014, *Prescott, Harley, and Klein's Microbiology; 9th ed.* , McGraw Hill Education.
- Ananthanarayan and Paniker. 2013, *A Textbook of Microbiology, 9th ed.,* Universities Press. (Arti Kapil – Editor)
- Eugene W. Nester, 2001. *Microbiology: A human perspective* 3rd ed., McGraw Hill New York.

Additional References:

- Collee, J.G., Fraser, A.G., Marmion, B.P. and Simmins, A. 1996, Mackie & McCartney *Practical Medical Microbiology,* 14 ed. Churchill Livingstone
- Pelczar, Chan, R., *Microbiology,* 4th ed., Tata McGraw Hill Publishing Co. Ltd.
- Murray, Baron, Pfaller, Tenover, Yolken, Mannual of Clinical Microbiology, 6th ed., American Society for Microbiology.
- Konemam E. W, *Color Atlas and Textbook of Diagnostic Microbiology,* 5thed., Lippincott.
- *Prescott*

MLT – 12: CLINICAL PATHOLOGY

COURSE- MLT: 12	CLINICAL PATHOLOGY	CREDIT- 02	2hrs/week

Unit 1 Urine and Gastric Juice Analysis

1.1 Composition, Collection & Preservation of Urine
1.2 Routine Urine Analysis – Physical, Chemical and Microscopic
1.3 Automated Urine Analysis & Reagent Strip Method
1.4 Pregnancy Test
1.5 Collection, Composition and routine analysis of Gastric Juice

Unit 2 Examination of Faeces and Sputum

2.1 Collection, Preservation of Specimen
2.2 Indication of Stool analysis

2.3 Routine Physical, Chemical & microscopic examination of Faeces
2.4 Concentration Techniques:
  2.4.1 Sedimentation Techniques
  2.4.2 Floatation Techniques
    a) Simple Floatation Technique
    b) Lane's Direct Centrifugal Floatation technique
    c) Zinc Sulphate Centrifugal Floatation technique
2.5 Collection and routine analysis of Sputum

Unit 3 Semen Analysis

3.1 Collection of Semen
3.2 Indications of Semen Analysis
3.3 Routine Physical, Chemical and Microscopic Examination
3.4 Automated Semen Analysis

Unit 4 Body Fluids and Sputum Analysis: Collection, Composition, Physical,Chemical and Microscopic examination and their Clinical Significance

4.1 Cerebrospinal Fluid
4.2 Synovial Fluid
4.3 Pleural Fluid
4.4 Peritoneal (Ascitic) Fluid
4.5 Pericardial Fluid

References:

- Chatterjee K.D. (2009). *Parastology: Protozoology and Helthminthology in Relation to Clinical Medicine,* 13th ed., CBC Publishers & Distributors Pvt Ltd
- John Bernard Henry. 2011, *Clinical Diagnosis and Management by Lab. Methods*, 22nd ed., W.B. Saunders Co.
- P.B. Godkar, 2014, *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing House, Mumbai, India.

MLT – 13: CLINICAL BIOCHEMISTRY AND ENZYMOLOGY

COURSE- MLT: 13	CLINICAL BIOCHEMISTRY AND ENZYMOLOGY	CREDIT- 02	2hrs/week

Unit 1 **Blood Sugar**

1.1 Regulation of blood glucose
1.2 Blood Sugar level and its significance
1.3 Glycosuria and its types
1.4 Diabetes mellitus: Stages, clinical types, causes and metabolic changes
1.5 GTT, Glycosylated Haemoglobin and its determination

Unit 2 **Plasma Lipids and Lipoproteins**

2.1 Plasma lipids and its separation methods
2.2 Factors influencing cholesterol level in blood
2.3 Pathological variations of serum cholesterol
2.4 Lipoproteins: Introduction, Classification and Metabolism
2.5 Clinical disorder of lipoprotein metabolism
2.6 Atherosclerosis

Unit 3 **Plasma Proteins**

3.1 Separation of Plasma Proteins
3.2 Bence- Jones' Proteins
3.3 Function of plasma proteins
3.4 Clinical significance of Total Protein, Albumin, Globulin and A:G ratio
3.5 Electrophoretic pattern of protein fractions in health and disease

Unit 4 **Clinical Enzymology**

4.1 Functional and non-functional enzymes
4.2 Serum Enzymes in Heart Diseases, Liver Diseases and Malignancies
4.3 Clinical Importance of Isoenzymes: LDH, CK, ALP
4.4 Enzymes as diagnostic reagents

References*:*

- Chatterjea M. N. and Shinde R. 2007. *Textbook of Medical Biochemistry*, 8th ed., Jaypee Brothers Publishers.

- P.B. Godkar, 2014, *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishering House, Mumbai, India.
- Vasudevan D. & Sreekumari S. 2005. *Textbook of Biochemistry*; 4th ed, Jaypee Publishers.

Additional References:

Harold Varley, 1990, Practical Clinical Biochemistry, Indian Edition, Anold Heinemann.
N.W. Tietz, Fundamental of Clinical Chemistry, 4ed. W.B. Saunders Co.
Clinical Chemistry, 3e, Kaplan & Psce, The C.V. Mosbey Co.
K.L.Mukherjee, 1997, Medical Laboratory Technology, Vol.I,II & III, Tata McGrawHill.
Keith Wilson & John Walker, Practical Biochemistry: Principles & Technique, 5ed, Cambridge University Press.
Tietz, Textbook of Clinical Chemistry, 3e, Bartis & Ashwood, W.B. Saunders Co.

MLT – 14: HAEMATOLOGY

COURSE- MLT: 14	HAEMATOLOGY	CREDIT- 02	2hrs/week

Unit 1 **Introduction to Haematology**

1.1 Introduction, Collection, Processing, Storage, preservation and function of blood
1.2 Stages of development in : Erytropoiesis, Leucopoiesis and Thrombopoiesis
1.3 Morphology, functions and abnormalities of RBC, WBC and platelets
1.4 Haemoglobin: Structure, Types of normal and abnormal Haemoglobins
1.5 Haemoglobins Derivatives and variants

Unit 2 **Routine Haematological tests**

2.1 Estimation of Haemoglobin:
a) Sahli's Method
b) Cyanmethhaemoglobin Method
c) Specific gravity method
2.2 Total Blood cell count: RBC, WBC and Platelet count
2.3 Differential Leucocyte count
2.4 Determination of Haematocrit and RBC Indices
2.5 Determination of ESR by Westergren Method

Unit 3 **Special Haematological tests**

3.1 Screening for Sickle cell Anaemia: Slide, Tube & NESTROF Test
3.2 Determination of Fetal Haemoglobin
3.3 Determination of Osmotic Fragility of RBC
3.4 Detection of G_6PD Deficiency
3.5 Haemoglobin Electrophoresis and Electrophoretic pattern of Normal Haemoglobin, Sickle cell Anaemia and Thalassemia
3.6 Morphological Classification of Anaemia and Leukemia
3.7 Reticulocyte count and Absolute Eosinophil Count

Unit 4 **Test for coagulation functions**

4.1 Mechanism of Blood Coagulation and Coagulation Cascade
4.2 Test for Coagulations functions: Bleeding Time, Clotting Time, Clot retraction and Lysis time
4.3 Determination of Prothrombin time
4.4 Determination of Activated Partial Prothrombin Time
4.5 Determination of Fibrinogen
4.6 Determination of Plasma Recalcification

References*:*

- P.B. Godkar, 2014, *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishering House, Mumbai, India.
  Ochei J. & Kolhatkar A. 2000, *Medical Laboratory Science: Theory & Practice,* Tata McGraw Hill Pub.
- John Bernard Henry. 2011, *Clinical Diagnosis and Management by Lab. Methods*, 22nd ed., W.B. Saunders Co.

Additional References:

- Bharucha, Meyerm Moody, Carman, Vellore., Hand Book of Medical Laboratory Technology
- A. Dacie & S. M. Lewis ,Practical Haematology, The English Language book Society, 8 ed, ELBS.
- Hoffman , 1995, Haematology, 2nd ed, NMS Hematology US Edition
- M.M. Wintrobe, Clinical Haematology, Kothari's Indian Edition

MLT – 15: CLINICAL LABORATORY INSTRUMENTATION

COURSE- MLT: 15	CLINICAL LABORATORY INSTRUMENTATION	CREDIT- 02	2hrs/week

Unit 1 **Photometric instruments**

1.1 Introduction : Beers – Lamberts law
1.2 Colorimeter : Principle, Types, Basic components and Operation and uses
1.3 Spectrophotometer : Types, Principle, basic components and their functions, operation, uses,
1.4 Flame Photometer : Principle, Types, Components and Use
1.5 Fluorimeter : Principle, Types, Components and Use
1.6 Turbidometer

Unit 2 **Chromatography**

2.1 Introduction and Types
2.2 Paper Chromatography and Thin Layer Chromatography
2.3 Ion Exchange Chromatography
2.4 HPTLC
2.5 Affinity Chromatography
2.6 Gel Filtration Chromatography

Unit 3 **Electrophoresis**

3.1 Introduction, Principle and components of Electrophoresis
3.2 Supporting medium : Agarose gel, polyacrylamide
3.3 Electrophoretic techniques: SDS PAGE, Native PAGE, 2 D Gel electrophoresis, IEF, Gradient gel and Agarose gel Electrophoresis.

Unit 4 **Radiochemical Techniques**

4.1 Types of radiation emission and Radioactive substances
4.2 Gamma counter
4.3 Types of Scintillation counter
4.4 Biochemical application of radioisotopes

References:

- P. Ashokan, *Analytical Biochemistry*: *(Biochemical Technique)*, Chinnaa Pub., Nelvisharani, Vellor.
- Wilson and Walker, 2005, *Principles and Techniques of Biochemistry and Molecular Biology*, 6th ed., Cambridge University Press.

MLT – 16: LABORATORY MANAGEMENT

COURSE- MLT: 16	LABORATORY MANAGEMENT	CREDIT- 02	2hrs/week

Unit 1 **Organization and Management of Clinical Laboratory**

1.1 Laboratory Facilities and Organization
- 1.1.1 Functional Consideration in Lab Design
- 1.1.2 Spatial Consideration in Lab Design
- 1.1.3 Specific Consideration in Lab Design

1.2 Stages in Laboratory design and building
1.3 Purchasing
1.4 Personnel management

Unit 2 **Fiscal and Information Management**

2.1 Factors influencing fiscal decisions
2.2 Cost Finding
2.3 Budgeting
2.4 Communication
2.5 Requisitioning and Reporting
2.6 Use of Computers in Clinical Laboratory

Unit 3 **Total Quality Management**

3.1 Quality Laboratory Processes
3.2 Quality Assurance
3.3 Quality Assessment
3.4 Quality Control and various ways of maintaining QC
3.5 Formulating Quality control charts: LJ chart and Cusum Chart
3.6 Importance of reference range
3.7 Westguard multirule charts

Unit 4 **Accreditation of Medical Laboratory: NABL**

4.1 Introduction and scope
4.2 Aims and objectives
4.3 Description and types of laboratory
4.4 Qualification norms
4.5 General technical requirements

References*:*

- P.B. Godkar, 2014, *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishering House, Mumbai, India.
- John Bernard Henry. 2011, *Clinical Diagnosis and Management by Lab. Methods*, 17th ed., W.B. Saunders Co.
- https://www.nabl-india.org>2019/02

Additional References:

- K.L. Mukherjee, Medical laboratory Technology, Vol.I,II & III, Tata McaGraw Hill, Latest Edition.
- Burtis, C. A and Ashwood E. R., 1999, *Tietz Textbook of Clinical Chemistry,* 3rd ed., W.B Saunders Company.

MADICAL LABORATORY TECHNOLOGY

T. Y. B. Sc. Semester V Practical

1. Collection, handling and transport of clinical specimens for bacteriological analysis
2. Diagnostic problems in Bacterial Diseases
3. Antimicrobial susceptibility test and determination of MIC
4. Urine analysis – Physical, Chemical, Microscopic
5. Chemical Examination of urine by Reagent strip method
6. Stool analysis - Physical, Chemical, Microscopic, Microbiologic & Concentration Technique
7. CSF analysis – Physical, Chemical, Microscopic
8. Sputum analysis – Physical & Microscopic
9. Semen analysis – Physical, Chemical, Microscopic
10. Body fluid – Pleural, Peritoneal, Pericardial & Synovial – Physical, Chemical, Microscopic
11. Estimation of blood sugar
12. Glucose Tolerance Test.
13. Serum Total Proteins and Albumin
14. Serum Urea and Blood Urea Nitrogen (BUN)
15. Serum Creatinine
16. Serum Uric acid
17. Serum Cholesterol and HDL Cholesterol, Triacylglyceride (TG) and Lipoproteins
18. Serum Iron and TIBC (Total Iron Binding Capacity)
19. Serum Total Bilirubin and Direct bilirubin
20. Serum Enzymes: Alanine transaminase, Aspartate transaminase, Alkaline Phosphatase,Acid Phosphatase, Amylase
21. Haemoglobin estimation by Sahli's and by Cyanmethaemoglobin method
22. Complete blood cell count
23. Peripheral smear study
24. E.S.R. and packed cell volume
25. Sickling test
26. Reticulocyte count
27. Absolute eosinophil count
28. G_6PD deficiency test
29. Test for bleeding and clotting time (Demonstration)
30. Test for Prothrombin Time (Demonstration)
31. Test for determination of Activated Partial Thromboplastin Time

References *:*

- Ranjan Chawla, Practical Clinical Biochemistry: Methods and Interpretation, 2e, Jaypee Brothers.
- Chitra Bharucha, Carmann, Mody 1987, Handbook of Medical Laboratory Technology, A.H. Press, Vellore.
- Dacie & Lewis, Practical Haematology, 8e The English Language Book Society, o ELBS
- Chakraborty & Bhattacharya, Handbook of Clinical Pathology, Academic Publisher.
- WHO, 1991, Basic Laboratory Methods in Medical Parasitology
- Dacie & S.M. Lewis, Practical Haematology, J. A., The English Language Book Society, 8th ed., ELBS.
- Ramphael, Lynch's Medical laboratory Technology, 3e, W.B. Saunders Co.
- J Ochei & A. Kolhatkar, Medical Laboratory Science: Theory & Practice, Tata McGraw Hill Pub.

SEMESTER - 6

MLT - 17 Parasitology and Mycology

COURSE- MLT: 17	Parasitology and Mycology	CREDIT- 02	2hrs/week

Unit - 1 Mycological diseases: Causative agent, Clinical features and Laboratory diagnosis

1.1 Superficial Mycosis
1.2 Cutaneous Mycosis: Dermatophytosis
1.3 Subcutaneous Mycosis: Mycetoma, Chromomycosis & Rhinosporidiosis
1.4 Systemic Mycosis: Blastomycosis & Histoplasmosis
1.5 Opportunistic Mycosis: Aspergillosis, Penicillosis, Candidosis & Zygomycosis
1.6 Specimen collection and microscopic examination

Unit - 2 Protozoology: Morphology, Life cycle and Laboratory diagnosis

2.1 Terminologies: Parasite, Host, Symbiosis, Comensalism, Parasitism, Protozoa & Helminths
2.2 Class of parasites & Hosts
2.3 Entamoeba histolytica
2.4 Giardia lamblia
2.5 Opporrtunistic Protozoa: *Naegleria fowleri & Acanthamoeba* species
2.6 Leishmania donovani
2.7 Plasmodium falciparum & *Plasmodium vivax*
2.8 Toxoplasma gondii

Unit - 3 Helminthology - 1: Morphology, Life cycle and Laboratory diagnosis

3.1 Cestodes
- *3.1.1 Taenia saginata*
- *3.1.2 Taenia solium*
- *3.1.3 Echinococcus granulosus*

3.2 Trematodes
- *3.2.1 Schistosoma haematobium*
- *3.2.2 Schistosoma mansoni*
- *3.2.3 Schistosoma japonicum*

Unit - 4 Helminthology – 2 (Nematodes): Morphology, Life cycle and Laboratory diagnosis

4.1 *Trichuris trichiura*
4.2 *Strongiloides stercoralis*
4.3 *Anchylostoma duodenale*
4.4 *Enterobius vermicularis*
4.5 *Ascaris lumbricoides*
4.6 *Wuchereris bancrofti*

4.7 *Dracanculus medinensis*

References *:*

1) Ananthanarayan & Paniker's *Textbook of Microbiology*, (2013). 9th ed., Universities Press.
2) Chatterjee K.D. (2009). *Parastology: Protozoology and Helthminthology in Relation to Clinical Medicine,* 13th ed., CBC Publishers & Distributors Pvt Ltd
3) Arora D.R. and Arora B. (2004). *Medical Parasitology*, 2nd ed., CBC Publishers & Distributors Pvt Ltd.
4) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.

Additional References:

1) Greenwood D., Slack R. C. B., Peutherer J. F. (2002). *Medical Microbiology; A guide toMicrobial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control,* 16th ed., ELST with Churchill Livingstone.
2) Konemam E. W, *Color Atlas and Textbook of Diagnostic Microbiology*, 5th ed., Lippincott
3) Murray, Baron, Pfaller, Tenover, Yolken, *Mannual of Clinical Microbiology*, 6th ed., American Society for Microbiology.

MLT – 18 IMMUNOLOGY

COURSE- MLT: 18	IMMUNOLOGY	CREDIT- 02	2hrs/week

Unit - 1 Innate Immunity

1.1 Introduction
1.2 Physical and mechanical barrier
1.3 Chemical mediators
1.4 Cells & organs of Immune system
1.5 Phagocytosis
1.6 Inflammation

Unit - 2 Adaptive Immunity

2.1 Antigen, Hapten & Adjuvant
2.2 Immunoglobulin: Structure & Types
2.3 Types of Acquired immunity: Active & Passive
2.4 T cell & B cell biology
2.5 Monoclonal antibody production & its use
2.6 Clonal selection theory
2.7 Vaccination schedule in India

Unit - 3 Antigen - Antibody reaction

3.1 General factors of antigen – antibody reactions
3.2 Precipitation reaction
3.3 Agglutination reaction
3.4 EIA
3.5 ELISA
3.6 CLIA

Unit - 4 Immunological disorders

4.1 Hypersensitivity reactions
  4.1.1 Classification of Hypersensitivity
  4.1.2 Anaphylaxis
  4.1.3 Cytolytic and cytotoxic
  4.1.4 Immune complex diseases
  4.1.5 Delayed Hypersensitivity
4.2 Mechanism of autoimmunization and Auto Immune Hemolytic Anemia
4.3 Immunodeficiency disorder

References *:*

1) Willey J. M., Sherwood L. M. and Woolverton C. J. (2014). *Prescott's Microbiology*, 9th ed., Mc Graw Hill Education.
2) Ananthanarayan & Paniker's *Textbook of Microbiology*, (2013). 9th ed., Universities Press.

Additional references*:*

1) Kindt T. J., Goldsby R. A. and Oarbara B. A. (2007). *Kuby Immunology*, 6th ed., W. h. Freeman and Company, New York.
2) Dasgupta A. (2007). *Immunology*, 1st ed., Jaypeee
3) Tizard I. R. (1995). *Immunology*, 4th ed., Thomson.

MLT - 19 Histology & Cytology

COURSE- MLT: 19	Histology & Cytology	CREDIT- 02	2hrs/week

Unit – 1 Introduction to Histopathology

1.1 General outline of procedure of tissue examination
1.2 Types of specimen preparation
1.3 Fixation : Types, Advantages & Disadvantages
1.4 Decalcification

Unit – 2 Tissue Processing

2.1 Introduction
2.2 Selection of tissue blocks for sectioning
2.3 Dehydration
2.4 Clearing
2.5 Wax Impregnation
2.6 Embedding
2.7 Automatic tissue processing

Unit – 3 Section Cutting & Staining

3.1 Types of Microtomes
3.2 Microtome knives
3.3 Sharpening of microtome knives
3.4 Frozen sections
3.5 Principle & procedure of H & E staining

Unit – 4 Diagnostic Cytopathology

4.1 Introduction
4.2 Role and Branches of Diagnostic Cytology
4.3 Techniques for Exfoliative cytology
4.4 Interventional cytology
    4.4.1 FNAC
    4.4.2 Imprint cytology
    4.4.3 Crush smear cytology
    4.4.4 Biopsy cytology

References*:*

1) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.
2) Mohan H. (2005). *Textbook of Pathology*, 5th ed., Jaypee Brothers Medical publishers (P) LTD.
3) Ochei J. and Kolhatkar A. (2000). *Medical Laboratory Science: Theory and Practice*, Mc Graw Hill Education (India) Private Limited, New Delhi.

MLT - 20 Pathophysiology

COURSE- MLT: 20	Pathophysiology	CREDIT- 02	2hrs/week

Unit – 1 Renal Function Tests

1.1 Introduction : Functions of Kidney & Classification of RFT
1.2 Tests based on Glomerular filtration
1.3 Tests to measure Renal plasma flow
1.4 Tests based on Tubular function

Unit – 2 Liver Function Tests

2.1 Introduction : Functions of Liver & Classification of LFT
2.2 Tests based on Abnormalities of Metabolism : Bile pigment, Carbohydrates & Drug
2.3 Tests based on changes in Plasma Proteins & Lipids
2.4 Tests based on Detoxification function & Excretory function
2.5 Tests for Amino acid catabolism & Formation of Prothrombin
2.6 Serum enzymes in liver diseases

Unit – 3 Cardiac Function Tests & Thyroid Function Tests

3.1 List of Cardiac profile test
3.2 Cardiac injury panel test
3.3 Cardiac markers
3.4 Cardiac enzymes
3.5 Introduction and classification of Thyroid function test
3.6 Tests based on primary function of thyroid
3.7 Tests for measurement of thyroid hormone
3.8 Tests based on metabolic effect of thyroid hormone

Unit – 4 Acid – Base Balance & Imbalance

4.1 Introduction
4.2 Acid – Base balance in normal health
4.3 Mechanism of regulation of pH
    4.3.1 Role of different buffer system
    4.3.2 Role of Respiration
    4.3.3 Role of Kidney
4.4 Acid – Base imbalances: Acidosis & Alkalosis

References *:*

1) Chatterjae M. N. and Shinde R. (2012). *Textbook of Medical Biochemistry,* 8th ed., Jaypee Brothers Publishers.
2) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.

Additional References*:*

1) Burtis C. A. and Ashwood E. R. (1998). *Tietz Textbook of Clinical Chemistry*. 3rd ed., Harcourt Brace & Company ASIA PTE LTD.
2) Alex Kaplan, Lavernfl Szabo, Lee & Febiger *Clinical Chemistry Interpretation and Results*.

MLT - 21 Blood Banking

COURSE- MLT: 21	Blood Banking	CREDIT- 02	2hrs/week

Unit – 1 Blood Group System

1.1 ABO blood group system & its detection methods
1.2 Rh blood group system & its detection methods
1.3 Bombay blood group system & its detection methods
1.4 Other blood group system

Unit – 2 Blood Donation

2.1 Donors selection & rejection criteria
2.2 Anticoagulants
2.3 Tapping of Donor
2.4 Reaction during & after donation
2.5 Pre-transfusion tests
2.6 Types of Blood transfusion : Allogenic, Directed & Autologous

Unit – 3 Compatibility Testing & Transfusion Reactions

3.1 Compatibility testing
  3.1.1 Major & Minor cross matching
  3.1.2 Emergency cross matching
  3.1.3 Automation group matching
3.2 Mechanism & Investigation of Hemolytic disease of New born
3.3 Transfusion reaction
  3.3.1 Types of transfusion reaction

3.3.2 Investigation of suspected transfusion reaction

Unit – 4 Blood Components: Preparation, Storage & Use

4.1 Red cell concentrate
4.2 Platelet concentration
4.3 Leucocyte concentrate
4.4 Fresh frozen plasma
4.5 Factor VIII concentrate & Factor IX concentrate
4.6 Basic concepts of : Hemapheresis, Plasmapheresis, Cytapheresis, Plateletpheresis, Leukapheresis

References*:*

1) Ochei J. and Kolhatkar A. (2000). *Medical Laboratory Science: Theory and Practice*, Mc Graw Hill Education (India) Private Limited, New Delhi.
2) John Bernard Henry, Todd, Sanford and Davidsohn, (2003). *Clinical Diagnosis and Management by Laboratory Methods*, 17th ed., All India Traveller Book Seller.
3) Makroo R. N. and Mitra J. *Compendium Transfusion Medicine.*
4) Bryant N. J., A. R. T, F. A. C. B. S, (1994). *An introduction to Immunohematology*, 3rd ed., W. B. Saunders Company.

Additional references:

1) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.
2) Bharucha, Meyerm Moody, Carman, Vellore., *Hand Book of Medical Laboratory Technology*

MLT - 22 Recent Advances in Diagnostic techniques

COURSE- MLT: 22	**Recent Advances in Diagnostic Techniques**	**CREDIT- 02**	**2hrs/week**

Unit - 1 Nucleic acid based methods

1.1 Polymerase chain reaction & its types
1.2 Southern Blotting technique

1.3 Northern Blotting technique
1.4 RFLP
1.5 Genotyping method

Unit - 2 Modern Pathology

2.1 Computer Assisted Imaging
2.2 FISH
2.3 Microarray
2.4 Karyotype analysis

Unit - 3 Immunological assay

3.1 RIA
3.2 ELISA & Enzyme multiplied immunoassaytechnique
3.3 Fluoroimmunoassay
3.4 Flow cytometry
3.5 Immunolotting

Unit - 4 Automation

4.1 Introduction
4.2 Automation in Biochemistry Laboratory
4.3 Automation in Haematology Laboratory (Cell counter: Coulter counter)
4.4 Automation in Microbiology Laboratory (BECTEK & VITEK SYSTEM)
4.5 Automation in Pathology Laboratory

References*:*

1) Watson J. D., Baker T. A., Bell S. P., Gann A., Levine M. and Losich R. (2010). Molecular Biology of the Gene, 5th ed., Pearson.
2) Burtis C. A. and Ashwood E. R. (1998). *Tietz Textbook of Clinical Chemistry*. 3rd ed., Harcourt Brace & Company ASIA PTE LTD.
3) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.
4) John Bernard Henry, Todd, Sanford and Davidsohn, (2003). *Clinical Diagnosis and Management by Laboratory Methods*, 17th ed., All India Traveller Book Seller.

Additional References:

1) Ochei J. and Kolhatkar A. (2000). *Medical Laboratory Science: Theory and Practice,* Mc Graw Hill Education (India) Private Limited, New Delhi.
2) Wilson K. and Walker J. (2005). *Principles and techniques of Biochemistry and Molecular Biology*, 6th ed., Cambridge University Press.

MADICAL LABORATORY TECHNOLOGY

T. Y. B. Sc. Semester VI Practical

1) Examination of fungi from clinical specimen by Lactophenol cotton blue & KOH method
2) Detection of malarial parasites by immunochromatographic test / Blood smear
3) Lab. Study of parasites present in
   (i) Stool: *Giardia lamblia, Entamoeba histolytica* & *Ascaris lumbricoides*
   (ii) Urine: *Trichomonas vaginalis, Enterobius vermicularis* & *Schistosoma haematobium*
   (iii) Blood: *Plasmodium spp., Microfilaria* & *Leishmania donovani*
4) Diagnosis of typhoid by Widal Slide test
5) Diagnosis of typhoid by Widal tube test
6) Rapid test for diagnosis of Typhoid
7) Rheumatoid Arthritis test
8) Pregnancy test
9) Diagnosis of syphilis by RPR/ VDRL tests
10) Rapid test for detection of HBsAg
11) Rapid test for detection of HAV
12) Rapid test for detection of HEV
13) Rapid test for detection of HCV
14) Rapid test for detection of Anti HIV antibodies
15) Test for CRP
16) ASO test
17) Rapid tests for Leptospirosis, Chikungunia, Dengue, NS_1Ag (Demonstraion)
18) FNAC Smear staining by PAP staining
19) Histological technique: Tissue processing
    Block preparation
    Microtomy
    Staining – Hematoxylen & Eosin Stain
20) ABO blood grouping: a) Forward grouping b) reverse grouping
21) Rh Typing: a) Direct method: Saline method
    b) Indirect method: (i) Albumin replacement method & (ii) AHG method
22) Direct Anti-Human globulin test
23) Determination of incomplete antibody by Indirect Anti-Human globulin test
24) Determination of Anti A titer by saline method
25) Determination of Anti B titer by saline method
26) Determination of Anti D titer: a) Albumin method & b) Indirect antiglobulin method
27) Cross matching
28) Blood component preparation (Demonstration)
29) Renal Function test
30) Liver function test
31) Cardiac function test
32) Measurement of T_3, T_4 & TSH (Demonstration)
33) Automation in Bacteriology by BACTEK & VITEK System (Demonstration)

References*:*

1) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., Bhalani Publishing house.
2) Ochei J. and Kolhatkar A. (2000). *Medical Laboratory Science: Theory and Practice*, Mc Graw Hill Education (India) Private Limited, New Delhi.
3) Chatterjee M. N. and Shinde R. (2012). *Textbook of Medical Biochemistry*, 8th ed., Jaypee Brothers Publishers.
4) Chatterjee K.D. (2009). *Parastology: Protozoology and Helthminthology in Relation to Clinical Medicine*, 13th ed., CBC Publishers & Distributors Pvt Ltd.
5) John Bernard Henry, Todd, Sanford and Davidsohn, (2003). *Clinical Diagnosis and Management by Laboratory Methods*, 17th ed., All India Traveller Book Seller.
6) Makroo R. N. and Mitra J. *Compendium Transfusion Medicine*.
7) Varley Harold, Practical Clinical Biochemistry, 4e, CBC Publishing.
8) Chawla Ranjan, Practical Clinical Biochemistry: Methods and Interpretation, 2nd ed. Jaypee Brothers.

Veer Narmad South Gujarat University, Surat

IDS for T. Y. B. Sc. Semester – V as per CBCS

Biostatistics and Bioinformatics

Unit - 1 Introduction to Biostatistics

1.1 Definition, Application & Role of Bioistatistics
1.2 Some definitions concerning statistics inference
1.3 Data, its collection and classification
1.4 Variables and Constant
1.5 Accuracy and Presition

Unit - 2 Mesures of Central Tendency

2.1 Introduction and characteristics of an ideal measure of Central Tendency
2.2 Arithmetic mean: Calculation, merits, demerits and use
2.3 Median: Calculation, merits, demerits and use
2.4 Mode: Calculation, merits, demerits and use
2.5 Empirical relation between mean, median & mode
2.6 Standard deviation: Calculation, merits, demerits and use
2.7 Variance and Coefficient of variation

Unit - 3 Introduction to Bioinformatics

3.1 Introduction to Bioinformatics
3.2 Branches of Bioinformatics: Genomics, Transcriptomics, Proteomics & Metabolomics
3.3 Aim of Bioinformatics
3.4 Research areas of Bioinformatics

Unit - 4 Data Analysis Tools

4.1 Biological Databases
4.2 Features of Biological Databases
4.3 Classification of Biological Database Based on Data Type
4.4 Classification Biological Database Based on Data Source
4.5 Biological Database Retrieval System

References *:*

1) Arora P. N. (2007). Biostatistics. Himalaya Publishing House
2) Ghosh Z. and Mallick B. (2009). *Bioinformatics: Principles and Applications*. Oxford University Press.

Additional References:

1) Xiong J. (2009). *Essential Bioinformatiocs*. Cambridge University Press.
2) Orpita Basu and Thukral S. K. (2008). *Bioinformatics: Databases, Tools and Algorithms*. Oxford University Press.
3) Sundar Rao, P. S. S. (2006). *Introduction to Biostatistics and Research Methods*. 4th ed., Prentice-Hall of India Private Limited, New Delhi.
4) Gurumani N. (2005). *An Introduction to Biostatistics*. 2nd ed., MJP Publishers, Chennai

Veer Narmad South Gujarat University, Surat

IDS for T. Y. B. Sc. Semester – VI as per CBCS

Toxicology and Cancer & Tumor Markers

Unit - 1 Cancer

1.1 Introduction, Definition and Characteristics of Cancer
1.2 Pathophysiology of cancer
1.3 Carcinogens
1.4 Oncogens and its mechanism of action
1.5 Characteristics of growing tumor cells

Unit - 2 Tumor Markers

2.1 Introduction
2.2 Tumor markers
2.3 Bladder cancer markers and antigens
2.4 Genetic markers
2.5 Biomarkers still in research

Unit - 3 Detection of cancer and tumor markers

3.1 Determination of Alphafetoprotein
3.2 Determination of Prostate specific antigen
3.3 Determination of Tumor markers by ELFA
3.4 Determination of CA 125 II

Unit - 4 Toxicology

4.1 Introduction to Toxicology
4.2 Metabolism and Excretion of drugs
4.3 Relation between Plasma concentration of Drugs and their cellular effects
4.4 Methods and Principle for determination of:
  4.4.1 Common antiepileptic and Valproic drugs
  4.4.2 Digoxine, Bronchodilators and Lithium
  4.4.3 Cyclosporin, Ethanol & Methanol

References *:*

1) Godkar P. B. (2014). *Textbook of Medical Laboratory Technology*, 3rd ed., BhalaniPublishing house.