Government of Karnataka

PARA MEDICAL BOARD

Revised Syllabus
of
II & III Year Diploma in Medical Laboratory Courses
(Previously first/second year certificate course / I year DMLT/II DMLT)

2017

Subject Details

II YEAR DIPLOMA

Paper	SUBJECT	SECTION	Question paper Code	MAX. MARKS	No. of Teaching Hour
Paper 1	Anatomy	Section A	**5101**	50	40
	Physiology	Section B	**5102**	50	40
	Anatomy Practical			50	30
	Physiology Practical			50	30
Paper 2	Biochemistry		**5103**	100	80
	Biochemistry Practical			100	60
Paper 3	Pathology		**5105**	100	80
	Pathology Practical			100	60
Paper 4	Microbiology		**5107**	100	80
	Microbiology Practical			100	60

III YEAR DIPLOMA

Paper	SUBJECT	Question paper Code	MAX. MARKS	No. of Teaching Hour
Paper 1	Biochemistry	**6101**	100	80
	Biochemistry Practical		100	60
Paper 2	Pathology	**6103**	100	80
	Pathology Practical		100	60
Paper 3	Microbiology	**6105**	100	80
	Microbiology Practical		100	60

Second Year Diploma in Medical Laboratory Technology

(DMLT II)

SUBJECT: ANATOMY **40 Hrs**

Section A **Q P Code : 5101**

Goal: Is to prepare the students with basic knowledge of structures with a co-relation to functions. At the end of course of six months, the paramedical students should be able to:

1. Identify the structures in the human body in their normal position.
2. Demonstrate the knowledge about each system with functional co-relation.
3. Develop the skills to use the knowledge of structures in the human body in their respective fields of function, with utmost care to the needs of the patients and with regards to the betterment of the health of the patients.
4. Develop and demonstrate the basic skills in microscopy of any given tissue, with an understanding of handling different types of microscopes independently → in the course of Laboratory technology.

Syllabus

General Anatomy:

I. **Introduction to Anatomy:**

a. Definition of Anatomy 11 Marks

b. Anatomical position

- Supine, prone, lithotomy → positions

c. Different parts of human body: Axial / Appendicular

→Head and neck, Thorax and abdomen, pelvis and perineum, upper and lower limbs.

d. Anatomical planes and sections: Median, sagittal, coronal, transverse, longitudinal, horizontal, oblique.

e. Anatomical terms:
Anterior, posterior, superior, inferior, medial, lateral, proximal, distal, superficial, deep, ventral, dorsal, cephalic, caudal, interior, exterior, invagination, evagination, ipsilateral, contralateral.

f. Terms for describing muscles:
Origin, insertion, Belly, tendon, aponeurosis, raphe.

g. Anatomical movements:
Flexion, extension, adduction, abduction, Medial rotation, lateral rotation, circumduction, pronation, supination, protraction, retraction, elevation, depression.

II. **Basic tissues:** Definitions of 3 Marks

Epithelium, connective tissue (including cartilage and bone), muscle, nerve.

III. **Skeletal System**: 10 Marks

Types and number of bones: Identification of each bone with its major features (ex: Femur with its upper end, lower end, shaft, trochanters, condyles, linea aspera etc)

Arthrology and Kinesiology in general:

Each joint to be understood under participating bones and movements.

IV. Systemic anatomy: 10Marks

The student should be able to identify and understand the anatomical components of each system with functional co-relation. (Diagrams, models, specimens from the dissected cadavers and colour photographs, 2D and 3D animation techniques can be used to teach.)

a. Parts of digestive system and associated glands and structures like liver, gall bladder, pancreas.
b. Cardiovascular System

→Location and chambers of heart, systemic circulation, pulmonary circulation. Detailed study of venous circulation.

Surface anatomy of superficial veins.

c. Respiratory system, its parts and respiratory passages, Trachea, lungs and their location, parts and differences between right and left lung.
d. Urinary system- parts and urinary passages → Kidney, ureter, urinary bladder and urethra.
e. Nervous system → parts, meninges, C.S.F and lumbar puncture.
f. Reproductive system → parts of male and female reproductive systems → in particular, Testis, prostate and seminal vesicle and structure of spermatozoon, uterus, ovary, Fallopian tube, cervix, vagina.
g. Lymphatic system → parts and functional co-relation regarding Thymus, lymph nodes, spleen and Tonsils.
h. Endocrine system → Location, parts and functions of each endocrine gland.

Histology **10 Marks**

1. Study of microscope including different types and using and handling of microscopes. The study of microscopes should include a thorough knowledge of both mechanical and optical parts. Usage of the microscope should include.

i. Taking care of microscope like cleaning and maintaining both mechanical & optical parts.

ii. Light adjustment with a thorough knowledge about the laws of physics applicable to optics – using low power, high power, and oil immersion objective lenses and also dark ground examination (advantages and disadvantages of each type of oil has to be learnt).

iii. A thorough knowledge about avoiding artefacts (dirts) in the microscope and the slides.

iv. Detailed study of magnification with knowledge about ocular and objective lenses, the focal length etc. A thorough description about practical problems during handling the microscope and histological techniques (Ex: Loose mirror, loose eye piece, dried oil, etc).

2. Basic procedure of staining with Haematoxylin and eosin → The preparation of dyes, the process of staining with rationale, starting from tissue procurement to staining completely (Tissue processing, fixation, dehydration, clearing, embedding, using the microtome, staining using Haematoxylin and Eosin) and getting the slide ready for examination by the experts. It is desirable to know about improper staining.

   3 Marks

3. Biomedical waste management in Anatomy Laboratory- Do's and Dont's.

   3 marks

Lab Technology: Practicals 20 Hrs 50 Marks

The students should maintain practical records and submit the same to the HOD of Anatomy for scrutiny.

Gross Anatomy: Basic tissues to be demonstrated for identification.**25 Marks**

Limbs: i) Upper limb
ii) Lower limb

Identification of superficial and deep structures and surface anatomy of superficial vessels.

Thorax: Heart, Trachea and lungs, Mediastinum.

Abdomen: i) Location and identification of individual organs in GIT and its associated structures like liver and gall bladder, pancreas.

ii) Urinary system → Identification of parts and functional co-relation.

iii) Reproductive system → Identification of parts with functional co-relation.

Head and neck: i) Surface features in face and neck, oral cavity, Tongue, pharynx, nasal cavity → their location and importance.

ii) CNS → Meninges and parts of CNS → Identification with functional co-relation.

Histology: i) Introduction to Histology **25 Marks**

ii) Microscope and its parts, types of microscopes.

iii) Using microscope→ hands on training.

iv)Tissue processing, fixation, dehydration, clearing, embedding, using the microtome, staining using Haematoxylin and Eosin.

v) Practical problems with the handling of microscope and the staining process like artifacts, shrinkage, precipitate, Folds, Pinched tissue, Nick in knife, Autolysis, under and over staining.

REFERENCE BOOKS:

1. Singh (Inderbir) Text book of Histology J.P. Brothers, New Delhi
2. Difore Atlas of normal Histology Ed. 6 Lea & Febiger - 1989
3. Anatomy & Physiology for Nurses
Reference Books:
1. Human Anatomy -- Chaurasia Vol. I, II & III
2. Human Anatomy -- A.K. Dutta Vol. I, II & III
3. Cunningham's Manual of Practical Anatomy -- Vol. I, II & III

Second Year Diploma in Medical Laboratory Technology

(DMLT II)

SUB: PHYSIOLOGY **40 Hrs**

Section B Q P Code : 5102

GENERAL PHYSIOLOGY (Duration of Teaching - 3 Hrs)

Introduction:- **03 Marks**

Physiology - Homeostasis

Cell:-

Structure of a Cell, An overview of Intracellular Organelles, Cell Junctions, Stem Cells, Cell Aging & Death

Transport across cell membranes:-

Mechanisms of Transport across Cell Membrane

Body Fluids:-

An overview of Compartments of Body Fluid.

BLOOD (Duration of Teaching - 7 Hrs) **09 Marks**

Composition & Functions of Blood

Plasma:-

Composition and Functions of Plasma Proteins

Cellular Components of Blood:-

(RBC, WBC, PLATELETS) Morphology, Physiological Values, Functions, Overview of Haemopoeies, Life Span & Applied Aspects

Hemoglobin:-

Definition of Hemoglobin, Functions, Physiological Values, Fate of Hemoglobin, Applied Aspects

ESR, PCV, Blood Indices & Anemia, Polycythemia.

Blood Groups:-

ABO Blood Grouping, Rh Typing, Landsteiner's Law, Cross Matching, Storage of Blood, Indications and Contraindications of Blood Transfusion.

Hemostasis:-

Clotting Factors, Types off Clotting mechanisms, Anticoagulants, Applied Aspects, Bleeding time, Clotting time, Prothrombin time

NERVE PHYSIOLOGY (Duration of Teaching – 3 Hrs) 03 Marks

Nerve:-

Structure, Types of Neuralgia Cells, Functions Of Nerves

Receptors:-

Definition, Types of Sensory Receptors.

Reflex:-

Arc, Action & Reflexes.

Autonomic Nervous System:-

Organization and Functions

Synapse & Neuromuscular Junction

MUSCULOSKELETAL SYSTEM (Duration of Teaching - 2 Hrs) 03 Marks

Types of Muscle, Muscle Spindle, Physiology of Muscle Contraction. **Applied Aspects**

GASTROINTESTINAL PHYSIOLOGY (Duration of Teaching – 4 hrs)05 Marks

Structural Overview: of Gastrointestinal Tract

Movements of GIT

Salivary Glands- Its Secretions and Functions,

Hepatobillary System - Secretions and Its Functions

Pancreatic - Secretions and Its Functions

Intestinal- Secretions and functions

Applied Aspects In GIT.

Defecation

THE CARDIOVASCULAR SYSTEM (Duration of Teaching - 3 Hrs) 05 Marks

Overview of structure of Heart, Conducting System Of Heart, Systemic And Pulmonary Circulation, Over View -Heart Rate, Stroke Volume, Cardiac Output, Heat Sounds, Pulse, BP &Definition of ECG and Recording of ECG.

RESPIRATORY SYSTEM (Duration of Teaching - 3 Hrs) 03 Marks

An Overview of respiratory system: air way anatomy, muscles of ventilation, Functions of respiratory system, ventilation: exchange & transport of respiratory gases, compliance, surfactant.

Applied aspects:-

Artificial respiration, hypoxia, Definition of Apnea, Dyspnea, and Tachypnea.

RENAL SYSTEM (Duration of Teaching - 3 Hrs) 05 Marks

Overview of Anatomy of kidneys, renal blood flow, structure of Nephrons.

Renal and non renal functions of kidney

General principles of formation of urine, GFR, estimation of GFR

Normal constituents of Urine.

Renal function tests (RFT).

ENDOCRINE SYSTEM (Duration of Teaching - 3 Hrs) 03 Marks

Over view of endocrine system; hypothalamic hormones, Functions and applied aspects, hormonal regulation by positive and negative feedback mechanism of Anterior & Posterior Pituitary Hormones, Thyroid Hormones, Parathyroid Hormones, Pancreatic Hormones, Adrenal Cortical Hormones.

REPRODUCTIVE SYSTEM (Duration of Teaching - 3 Hrs) 05 Marks

Over view:-

Male and Female Reproductive System Functions of Male and Female Gonads, Menstrual Cycle

Oogenesis and Spermatogenesis, Fertilization, Implantation and Parturition,

Male Reproductive Hormones It Functions & Cryptorchidism

Female Reproductive Hormones and Its Functions,

Pregnancy Tests and Contraceptive Methods in Male and Females, Lactation.

SKIN (Duration of Teaching - 2 Hrs) 03 Marks

Functions of skin

Vitamin D synthesis

Temperature regulation

CNS & SPECIAL SENSES (Duration of Teaching - 4 Hrs) 03 Marks

Functional Organization of Brain, Spinal Cord & Its Functions, Cranial and Spinal Nerves.

CSF Composition and Functions.

Vision: -

Structure and Functions of Eye Ball, Errors of Refraction and Correction.

Hearing:-

Structure and Function of Ear. Audiometry.

Taste: -

Taste Buds, Primary Taste sensation

Smell:

Olfactory pathway

REFERENCE BOOKS:

1. Fundamentals of Physiology - A text book for Nursing students by R.L. Bijalani -- Jay Pee Brothers Publications

Human Physiology and Biochemistry by Prof. A.J.Jain, Arya Publications

PRACTICALS (Duration of Teaching - 20 Hrs) 50 Marks

Microscope:-

Handling of microscope, parts of microscopes and maintenance

Collection of blood samples and anticoagulants and preparation

Study of drop of blood

Estimation of hemoglobin percentage

Determination of RBC, WBC, PLATELET, AEC count.

Differential leucocytes count

ESR, PCV (Demonstrate)

Blood grouping and RH typing

Recording of Pulse and BP.

II DMLT

Subject: BIOCHEMISTRY Q P CODE : 5103 80 Hrs

TOPICS	MARKS
Basic of Laboratory Equipment and Basic Chemistry **Unit I : General information of Laboratory** • General knowledge about laboratory basic information and skills. Laboratory safety, Laboratory laws and regulations, Laboratory quality, Laboratory mathematics. **Unit II : Specimen Collection** • General approach to Patient identification, Phlebotomy and specimen collection, Storage, transport and disposal. • Anticoagulants- E.D.T.A, Dipotassium salts of EDTA, Double oxalate, single oxalate, sodium citrate, Sodium Fluoride, heparin. **Unit III : Introduction to Laboratory Apparatus** • Pipettes- different types (Graduated, volumetric, Pasteur, Automatic etc.), Calibration of glass pipettes, Burettes, Beakers, Petri dishes, depression plates. • Flasks –different types- Volumetric, round bottomed, Erlenmeyer conical etc. • Funnels – different types, use. • Bottles: Reagent bottles – graduated and common, Wash bottles – different types, Specimen bottles etc. • Measuring cylinders, • Porcelain dish, Tubes – Test tubes, centrifuge tubes, test tube draining rack • Tripod stand, Wire gauze, Bunsen burner. • Cuvettes, types, significance of cuvettes in colorimeter, cuvettes for visible and UV range, Cuvette holders • Racks – Bottle, Test tube, Pipette, • Desiccators, Stop watch, timers, scissors, Dispensers – reagent and sample. • *Any other apparatus which is important and may have been missed should also be covered*	50

Unit IV : Maintenance of Lab Glassware and Apparatus

- Glass and plastic ware in Laboratory, use of glass: significance of boro-silicate glassware and cleaning of glassware, different cleaning solutions of glassware and cleaning of plasticware, different cleaning solutions.

Unit V : Instruments (Theory and demonstration *& Diagrams to be drawn***)**

- Water bath: Use, care and maintenance,
- Oven & Incubators: Use, care and maintenance.
- Water Distillation plant and water deionizers. Use, care and maintenance,
- Refrigerators, cold box, deep freezers – Use, care and maintenance.
- Reflux condenser: Use, care and maintenance.
- Centrifuges.
  Definition, Principle, Svedberg unit, centrifugal force, centrifugal field, rpm. Different types of centrifuges, Use care and maintenance of a centrifuge.
- Laboratory balances. Manual balances: Single pan, double pan, direct read out electrical balances. Use care and maintenance. Guideline to be followed and precautions to be taken while weighing. Weighing different types of chemicals, liquids. Hygroscopic compounds etc.
- Colorimeter and spectrophotometer.
  Parts, diagram. Use, care and maintenance.
- pH meter and electrodes, Use, care and maintenance. Guidelines to be followed and precautions to be taken while using pH meter.

Unit VI : Solutions and Dilutions

- **Preparation of solution:** Normal solution, Buffer solution, Percent solution, Molar solution.
- ***Diluting solutions:*** e.g. Preparation of 0.1N NaCl from 1N NaCl from 2N HCl etc., preparing working standard from stock standard, Body fluid dilutions, Reagent dilution techniques. Calculating the dilution of a solution, body fluid reagent etc., Saturated and

supersaturated solutions. • **Standard solutions:** Technique for preparation of standard solutions e.g. Glucose, urea, etc., • Significance of volumetric flask in preparing standard solutions. Volumetric flasks of different sizes, Preparation of standard solutions of deliquescent compounds (CaCl2, potassium carbonate, sodium hydroxide etc.,) • Conventional and SI Units: Preparation of standards using conventional and SI units. Methods of measuring liquids, weighting solids.	
Basic Clinical Biochemistry **Unit VII :** • ***Acids, bases, salts and indicators: Acids and Bases*** – Definition, physical and chemical properties with examples. Arrhenius concept of acids and bases, Lowry – Bronsted theory of acids and bases classification of acids and bases. Difference between bases and alkali, acidity and basicity, monoprotonic and polyprotonic acids and bases. Concepts of acid base reaction, hydrogen ion concentration, Ionisation of water, buffer, pH value of a solution, preparation of buffer solutions using pH meter. • ***Salts*** – Definition, classification, water of crystallization – definition and different types, deliquescent and hygroscopic salts. • ***Acid-base indicators:*** (Theory and Practical) Definition, concept, mechanism of dissociation of an indicator, colour change of an indicator in acidic and basic conditions, use if standard buffer solution and indicators for pH determinations, preparation and its application, list of commonly used indicators, and their pH range, suitable pH indicators used in different titrations, universal indicators. **Unit VIII : Basic Biochemistry** • Carbohydrates: o Classification, Definition & properties of monosaccharides, disaccharides, and polysaccharides.	50

- Proteins:
  - Proteins – Definition, classification, properties.
  - **Amino acids -** Definition, classification, essential & non essential amino acids. Reactions of amino acids.
  - Plasma proteins – Definition, classification and reference values.
- Lipids
  - Definition, classification and properties of lipids and lipoproteins.
- Nucleic acid chemistry
  - Definitions of DNA, RNA, purines and pyramidines, nucleosides and nucleotides.
- Enzymes- Definition, classification and factors affecting enzyme activity. Isoenzymes – Definition, classification and significance.
- Vitamins and Minerals: in brief about reference values in blood.
- Normal and Abnormal Constituents of Urine.

Unit VI : Clinical Laboratory records.

Requisition forms, patient data registers, electronic records, Report forms, reference forms, equipment maintenance registers/ log books, Reagent stock books, quality control records, Laboratory statistics

PRACTICALS II YEAR DMLT **40 Hours**

PRACTICALS BIOCHEMISTRY

- Preparation of standard solutions.
- Preparation of Molar solutions
- Preparation of Normal solutions
- Preparation of Percent solutions
- Preparation of De ionized, distilled and double distilled water
- Reactions of carbohydrates Monosaccharide, Disaccharides and polysaccharide.
  - Glucose & Fructose, Lactose, Starch
- Reactions of Proteins
- Color reactions and precipitation reactions of albumin and casein.
- Analysis of normal and abnormal Urine
- Demonstration of Glucometer with strips.

PRACTICAL EXAMINATION- 100 MARKS:

1. Spotters	- 10 No -	20 marks
2.Preparation of normal, standard/molar percent solutions		10 marks
3.Reactions of carbohydrates Monosaccharide, Disaccharides and polysaccharide. Glucose & Fructose, Lactose, Starch		20 marks
4. Analysis of normal and abnormal Urine		20 marks
5. Color reactions and precipitation reactions of albumin and casein.		10 marks
6. Records	-	10 marks
7. Viva voce	-	10 marks
Total	**-**	**100 marks**

REFERENCE BOOKS:

Text Books:

1. Text book of Biochemistry for Dental Students– Pattabhiraman
2. Text book of Biochemistry for Dental Students, Harbans lal
3. Text book of Chemistry prescribed for II P.U.C. (students may need the basic knowledge of chemistry)

Practical Books:

1. Practical manual of Biochemistry – Dr. C V Yogaraje Gowda
2. Practical manual of Biochemistry – Rajagopal
3. Practical manual of Biochemistry – Shivananda Nayak
4. Practical manual of Biochemistry – Pattabhiraman

II DMLT

Subject: PATHOLOGY Q P CODE : 5105 80 Hrs

TOPICS	MARKS
I. Urine analysis / Examination – 1. Urine Formation 2. Collection 3. Composition 4. Preservation 5. Physical Exam 6. Chemical Exam 7. Microscopic Exam 8. Dipstick Method 9. Principal 10.Types of Dipstick 11. Interpretation 12.Quality Control	50
II. Stool Examination - • Composition • Collection • Physical Exam • Chemical • Microscope for ova Cyst • Occult blood III. Hematology • Introduction to clinical hematology • Instruments & Equipment used in hematology Lab • Anticoagulants – definition, anticoagulants used in different tests, Mechanism of action, Preparation, advantages, disadvantages. Use of Anticoagulants in different tests • Collection of Blood sample - Different methods of collection of Blood sample vacutainers • Cut off time for conducting various tests and storage of different samples. • Preparation of various diluting fluids (RBC, WBC, Platelet, AEC, Reticulocyte) stains & buffers used in hematology lab • Stains: Romanowskey stains: Leishman & Giemsa in Detail.Use of other Romanowskey stains – Wrights, JSB, Field stain • Development of Blood cells RBC, WBC, Platelets (Briefly)	

• Morphology of normal & abnormal RBC & WBC's • Hemoglobin – Introduction Mention all methods Sahlis & Drabkins method in detail including merits & demerits. • RBC Count – Equipment,Principle, Procedure, Importance • WBC count – Equipment,Principle, Procedure, Importance • Absolute eosinophil count – Equipment,Principle , Procedure, Importance • Reticulocye count – Equipment,Principle, Procedure, Importance • Packed cell volume – (PCV) Introduction Equipment,Principle , Procedure, Importance, and Automation • Preparation & Staining of peripheral Blood smear (Leishman stain), Preparation of Spreader and Ideal Smear • Blood Indices – MCV, MCH, MCHC – Calculation & Importance • Automation in hematology – in each & every test • Quality Control in hematology(With respect to each test) • Blood groups – Introduction, types.	
IV. <u>Clinical Pathology</u> • Sputum Examination o Definition o Collection o Physical Examination o Chemical Examination o Microscopy - Preparation & staining of smear o Preservation and Transport • CSF Examination – <u>stat specimen</u> o Definition o Collection o Physical Examination o Chemical Examination o Microscopy - Preparation & staining of smear o Cell count and Cell Type o Preservation and Transport • Examination of other body fluids o Definition o Collection o Physical Examination o Chemical Examination o Microscopy - Preparation & staining of smear o Cell count and Cell Type	50

- Preservation and Transport

- Semen Analysis
  - Definition
  - Collection
  - Physical Examination
  - Chemical Examination
  - Microscopy - Sperm count, Preparation & staining of smear
  - & Sperm Morphology
  - Preservation and Transport

V. <u>Cytopathology</u>

- Introduction

a. Methods of collection of samples, Processing, Making smears & methods of fixation.

b. Urine, body fluids, CSF bronchial washings, Synovial fluid and Pap smears.

c. Advantages of Dry and Wet Smears

- Fixatives: Different Types of Fixatives.
- Stains used in cytopathology: Preparation of stains staining cytopathology smears
- Stains PAP – Detail – Preparation & staining, Advantages, Drying Artifacts. Mention – Use of ZN, H&E, Shorr stain
- Demonstration of Barr Bodies – (Buccal smear, Peripheral Smear).
- Quality control in Cytology

VI. <u>Histopathology</u>

- Introduction
- Planning of Histopathology Lab: Infrastructure, Equipements, Man power and Master Register.
- Collection of specimen, numbering & giving tissue bits (Grossing)
- Fixatives used in histopathology, preparation, advantages & disadvantages
- Stains & dyes – Introduction Composition of commonly used stains, mention types of stains.
- Decalcification of Tissues like bones & teeth or other calcified tissues : Decalcifying Methods, Reagents Used and End point methods of Decalcification.

Practical's (SECOND Year DMLT, SUB: PATHOLOGY)

(Approximately 60 hrs)

1. Instruments & Glassware in Pathology Lab (Including slides & Coverslips)

2. Urine Examination:

a. Physical Examination –

Volume
Colour
Ph – Reaction
Sp Gravity
Odour

b. Chemical Examination

i. Albumin – Heat coagulation test
SSA
Nitric acid (Hellers)
Dipstick method

ii. Sugar -*Benedicts Test
*Dipstick Method

iii. Ketonebodies -
*Rotheras Test
*Dipstick Method

iv. Blood -
* Benedicts test
* Dipstick Method

v. Bile salts & Pigments : Heys test, Fouchets test, Dipstick Method

vi. Microscopic Exam :- Crystals, Casts, Cells

- Study of Blood Tests:
- Study of Neubauer chamber
- Haemoglobin estimation – Sahils & Drabkins
- Red Blood Cell (RBC) Count
- Total White Blood (TWBC) Count
- Absolute Eosinophil (AEC) Count
- Platelet Count
- Reticulocyte count
- Packed Cell Volume (PCV)
- Erythrocyte Sedimentation Rate (ESR) - Westergrens , Wintrobe
- Blood indices
- Use of cell counter (Automated)
- To make charts

3. Preparation Blood Smears

- Selection of slide - including preparation of new slides & old or used slides for making blood smears preparation of spreader slide
- * Good & bad smear ideal smears

Removal of mucks, Destaining & Restaining.

4. Staining of Peripheral Blood smear – Leishman stain

* Care & maintenance of equipment used in Lab

5. Identification of Optimum decalcification-

6. Preparation of cytology smear & fixation of cytology smears-

7. Staining of cytopathology Smears

PRACTICAL EXAMINATION-100 MARKS

I DMLT **[3 hrs duration]**

1. Spotters - 10 No. -		20 marks
2. Urine Exam -		20 marks
3. Hb exam Sahli's / Drapkins/ Automation		10 marks
4. Peripheral Blood seamier preparation & stain	-	20 marks
5. RBC / WBC / AEC count	-	10 marks
6. Records	-	10 marks
7. Viva voce	-	10 marks
Total	-	100 marks

* Records - Students should maintain this as work done

Take the signature of practical-incharge on a record- Demonstrator or Tutor and counter signed by Concerned H.O.D.

REFERENCE BOOKS:

1. Medical laboratory Science - Theory and Practicals by J. OCHEI, A. KOLHATKAR Tata McGraw Hill Publishing Company Ltd.
2. Practical Haematology - SIR JOHN V. DACE, S.M. LEWIS, ELBS
3. Clinical Diagnosis Management by laboratory methods. Latest (19th) Edition. (Toff Sanford D Anderson) John Bernard Henry, W.B. Saunder Company, Prism Book Pvt. Ltd.
4. Theory and Practice of Histological Technique by John D Bancraft, Alan Stevens, Churchill livingstone Publishers.
5. Hand book of Medical laboratory technology, 2nd edition by Robert H Carman, Christian Medical Association of India (publishers)
6. Ramnik sood, Text book of laboratory medicine. Text book of laboratory medicine by V.H. Talib

Subject: Microbiology **Q P CODE : 5107** **80 Hrs**

TOPICS	MARKS
1. Introduction to microbiology including history of microbiology	10
2. Microscopy & different types of microscope	10
3. General bacteriology a. Morphology & Physiology of bacteria b. Classification of bacteria c. Common staining techniques in bacteriology d. Sterilization & disinfection e. Culture media & culture methods f. Basic concepts in identification of bacteria	30
4. Washing & packing of materials used in microbiology	10
5. Preparation of stains & buffers	10
6. Immunity, Antigen, Antibodies	10
7. Antigen & antibody reactions	5
8. Hypersensitivity	5
9. Infection prevention and control	10

II DMLT MICROBIOLOGY PRACTICALS **50 hours**

- Microscopy – types of microscopes, focusing, care & handling of microscopes
- Usage of sterilization equipments
- Media preparation & pouring
- Washing & packing
- Preparation of smears & stains
- Simple stain, Gram stain
- Inoculation techniques

PRACTICALS EXAMINATION – 100 MARKS

1. Spotters	-	20
2. Media preparation	-	20
3. Packing & sterilization techniques	-	25
4. Gram stain	-	20
5. Record	-	10
Total		**100**

REFERENCE BOOKS:

1. Bacteriology by Ananthanarayanan
2. Bacteriology by Rajesh Bhatia
3. Parasitology by Chatterjee
4. Parasitology by Jayaram and Panicker
5. Hand book of laboratory technology by Scott
6. Hand book of laboratory technology, C.M.C. Vellore - 2 copies.

III YEAR DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III-DMLT

SUB: BIOCHEMISTRY **Q P Code : 6101** **80 Hrs**	**MARKS**
Unit I. Photometry Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry–colorimetry, spectrophotometry, flame photometry, fluorimetry, choice of appropriate filter, measurements of solution, calculation of formula, applications. **Unit II. Liver Functions & their Assessment** Tests for 1) Carbohydrate metabolism 2) Protein metabolism 3) Lipid metabolism 4) Measurements of serum enzyme levels, Bile pigment metabolism, Jaundice, its types and their biochemical findings. **Unit III.** Different methods of Glucose Estimation- Principle advantage and disadvantage of different methods **Unit IV. Renal Function Tests-** Various Tests, GFR & Clearance Tests **Unit V. Cardiac Profile -** In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases Different methods of Cholesterol Estimation- Principle, advantage and disadvantage of different methods. Lipid profile. **Unit VI.** Electrophoresis Principle, Types & Applications. **Unit VII.** Immunodiffusion Techniques, Radioimmunoassay & ELISA. Principles & Applications.	**50**

Unit VII. Automation of Laboratory Services, Organization and Management Automation in clinical chemistry: Principle & Applications Instrumentation, types of analysers, benefits of automation. **Unit VII. Electrolytes, Blood Gases and pH** pH Regulation, Disturbance in acid Base Balance, Metabolic acidosis & alkalosis, Respiratory acidosis & alkalosis. Basic Principles and estimation of Blood Gases and pH, Basic principles and estimation of Electrolytes **Unit VIII. Quality control: Internal & External** Principles of quality Assurance and Standards for clinical chemistry Pre-analytical factors, analytical and post-analytical factors important in clinical chemistry Accuracy, Precision, Specificity, Sensitivity. Limits of error allowable in laboratory, Percentage error. Reference values and Interpretations,	**50**

PRACTICALS III YEAR DMLT (50 Hours)

1. Blood urea estimation
2. Serum creatinine estimation
3. Serum uric acid estimation
4. Serum total protein & A:G ratio
7. Serum glucose estimation
8. Total cholesterol estimation
9. HDL cholesterol (direct) estimation.
10. LDL cholesterol (direct) estimation
11. Triglyceride estimation
12. Estimation Serum of Direct & Total Bilirubin.
13. Estimation of serum Phosphate
14. Serum amylase estimation
15. Serum GOT (AST) estimation
16. Serum GPT (ALT) estimation
17. Alkaline phosphatase estimation
18. Acid phosphatase estimation
19. Serum sodium estimation
20. Serum potassium estimation

21. Serum chloride estimation
22. Estimation of serum calcium
22. Estimation of CK-NAC & CK MB
23. Analysis of CSF
24. Lactate dehydrogenase

PRACTICAL EXAMINATION-100 MARKS

1. Spotters	- 10 No -	20 marks
2.Estimation of blood urea/creatinine/uric acid		10 marks
3.Estimation of cholesterol/ HDL/LDL/Triglyceride And calculation		20 marks
4.Liver function tests- Any 2		10 marks
5.Electrolytes estimation/ chart		10 marks
6.CSF analysis		10 marks
7. Records	-	10 marks
8. Viva voce	-	10 marks
Total	**-**	**100 marks**

REFERENCE BOOKS:

iii) Biochemistry:

Text Books:

1. Text book of Biochemistry for Dental Students– Pattabhiraman
2. Text book of Biochemistry for Dental Students, Harbans lal
3. Text book of Chemistry prescribed for II P.U.C. (students may need the basic knowledge of chemistry)

Practical Books:

1. Practical manual of Biochemistry – Dr. C V Yogaraje Gowda
2. Practical manual of Biochemistry – Rajagopal
3. Practical manual of Biochemistry – Shivananda Nayak
4. Practical manual of Biochemistry - Pattabhiraman

III DMLT
Subject: PATHOLOGY

Q P Code : 6103 **80 Hrs**

TOPICS	MARKS
I. Hematology • Differential Luecocyte count - DC • Bone marrow examination - a. Introduction , b. Different sites of bone marrow aspiration, c. Different Types of Bone marrow needles. d. Types of bone marrow –-1. Aspiration 2. Bone Marrow Biopsy e. Materials Required for bone marrow exam – Slides, Watch glass, Anticoagulant for collecting Bone marrow particles f. Preparation of Bone Marrow smear for Examination g. Staining of Bone marrow slides (Leishman, Giemsa, Perls stain) h. Importance of Bone marrow exam • Osmotic fragility test: Definition, Preparation, Procedure and Importance • Blood coagulation – a. Introduction to normal haemostatic mechanism or coagulation mechanism b. Investigation of bleeding disorders : a. Bleeding time – BT b. Clotting time – CT 3. Clot retraction time – CRT 4. Prothrombin time - PT 5. Activated partial Thromboplastin time – APTT • BT, CT, CRT, PT, APTT – must know - normal values & importance • Thrombin Time – TT (Optional) • Automation in Coagulation Tests. • FDP & fibrinogen estimation – Desirable to know • Foetal Hb - Desirable to know • Introduction & importance of calibration & validation of clinical laboratory instruments in pathology • Introduction to laboratory information system(LIS) & Hospital information system(HIS)	50

Blood Bank

- Introduction – Blood bank & blood group, Organization of blood bank- Infrastrucutre : Building, Equipments, Human resources.

Use of various Registers and their importance.

- Blood grouping ABO & Rh, other Systems of Blood grouping (Mention)
- Forward & Reverse grouping and their Importance
- Cross matching – major / minor and Impoprtance
- Methods – Saline, Albumin, Coombs cross – matching
- Coombs test –Principle, Procedure and Importance of direct indirect Coomb's Test.
- Selection of Donor, Counselling
- Screening tests for donor
- Collection & Storage of Blood
- Infrastructure for Components : Space area, Equipments, manpower.
- Separation & uses of various Blood components (Packed cells, Fresh Frozen Plasma(FFP), Cryoppt

- Transfusion reaction – definition, importance and role of technician in transfusion reaction.
- Quality control, Quality assurance & SOP (Standard Operating procedure.
- Disposal of unused and expired Blood and Blood components, with special importance of disinfection
- Inventory Management in Blood Bank

6. Histopathology

- Tissue processing – Completion of Fixation, Dehydration, Clearing, Impregnation in molten wax.
- Instruments used for tissue processing -
  a. Manual method
  b. Automated (Histokinette)

- Embedding & Section cutting -
  a. Manual
  b. Automated
- Errors in section cutting & their correction
- Different types of haemotoxylins, Preparation of Harris Haematoxyllin and Eosin – routine H & E
- Staining technique including staining technique for rapid diagnosis – Frozen section

- Special stains – Introduction
  Names and their Importance

50

• Microwave tissue processing – Introduction, Principle, Procedure in brief and importance • Quality check or Quality control in Histopathology 7. Mounting of museum specimens : Various Mounting solutions used in mounting, Different types of mounting jars used. Biological Hospital waste disposal & universal Precautions	

III year DMLT PATHOLOGY Practical's **60hrs**

1. Differential WBC count (DC)

2. Staining of Bone marrow smears

3. Preparation of red cell suspension
4. Osmotic fragility test
5. Sickling Test
6. Determination of ABO blood grouping & Rh typing - methods
   Slide method .
   Tube method
   Micro titer plate method & gel method
7. Cross – matching – Major cross Match
   Minor cross match
8. Coomb's test - Direct, Indirect
9. Tissue processing
10. Blocking - Observation & Demonstration
11. Section cutting
12. Staining by H & E stain
13. Frozen section Cutting & staining - Demonstration (Desirable to know)
14. Semen analysis
15. Sputum Examination
16. CSF Examination
17. Other body fluids pleural Peritoneal
18. Bleeding Time & Clotting Time
19. Clot retraction Time Observation
21. Prothrombin time(PT)
22. Activated partial thromboplastin Time(APTT)
23. Mounting of museum specimens

Proposed: Pathology 3 days in a week Includes Lecture, Lecturer Demonstration, Practical & Hospital Posting

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PRACTICAL EXAMINATION: 100 MARKS [3hrs duration]

Pattern:

1. Spotters	- 10 No	-	20 marks
2. Blood group			10 marks
3. PAP smear staining			20 marks
4. H & E staining	-		20 marks
5. WBC – DC	-		10 marks
6. Records	-		10 marks
7. Viva voce	-		10 marks
Total	-		100 marks

* Take the signature of practical-incharge on a record- Demonstrator or Tutor and counter signed by Concerned H.O.D.

* Practicals examination training can be taught by objective structured practical examination pattern(OSPE)

REFERENCE BOOKS:

1. Medical laboratory Science - Theory and Practicals by J. OCHEI, A. KOLHATKAR Tata McGraw Hill Publishing Company Ltd.
2. Practical Haematology - SIR JOHN V. DACE, S.M. LEWIS, ELBS
3. Clinical Diagnosis Management by laboratory methods. Latest (19th) Edition. (Toff Sanford D Anderson) John Bernard Henry, W.B. Saunder Company, Prism Book Pvt. Ltd.
4. Theory and Practice of Histological Technique by John D Bancraft, Alan Stevens, Churchill livingstone Publishers.
5. Hand book of Medical laboratory technology, 2nd edition by Robert H Carman, Christian Medical Association of India (publishers)
6. Ramnik sood, Text book of laboratory medicine.
7. Text book of laboratory medicine by V.H. Talib

III DMLT

Subject: MICROBIOLOGY

Q P Code : 6105 **80 Hrs**

Topics	MARKS
I. Systematic Bacteriology Gram positive cocci – Staphylococci, Streptococci, Pneumococci Gram negative cocci – Neisseria meningitides & Gonococci Gram positive bacilli – C. diphtheria Cl. tetani Gram negative bacilli – Enterobactericae, V. cholerae, Pseudomonas, Mycobacteria	15
II. Isolation & identification of micro organisms from various clinical samples a).Collection and transport of various samples b).Preservation of samples c). Processing of various samples	25
III. Quality and Biomedical waste disposal Management System. **1.**Quality control measures 2. Universal precautions **3.** Bio Medical Waste disposal and Management	10
IV. Mycology – General features, lab Diagnosis of fungal infection (KOH mount, LPCB & SDA); Candida, Cryptococci, Aspergillus	10
V.Virology – General features, HIV, HBV HCV,	5
VI.Parasitology – Protozoology – Entamoeba histolytica, Trichomonas, Giardia, Malaria,	5
VII. Helminthology – Nematodes – Ascaris, Ankylostoma, Trichuris trichura, Enterobious, Vermicularis & Cestodes – Taenia & Echinococcus	5
VIII.Serology – Widal , Typhidot., VDRL, ASLO, RA, CRP, Brucella Agg test, ELISA , Antibiogram, Preparation of antibiotic discs, Antibiotic Resistance, Automation in Serology and Cultures	25

III YEAR DMLT MICROBIOLOGY PRACTICALS **50 hrs**

Albert's stain
Gram's stain
Z-N stain
Negative stain
Leishman's stain
JSB
Lactophenol cotton blue mount
Wet mounts & KOH mount

Serology, Widal, VDRL, RA, CRP, ASO, latex agglutination ELISA
Stool examination
Clinical sample with culture sensitivity

PRACTICALS EXAM – 100 Marks

1. Spotters	-	20
2. Serology	-	20
3. Stool examination	-	20
4. Z-N stain	-	20
5. Clinical sample with culture sensitivity (Charts can be used)	-	10
6. Record	-	10
		100 Marks

REFERENCE BOOKS:

1. Bacteriology by Ananthanarayanan
2. Bacteriology by Rajesh Bhatia
3. Parasitology by Chatterjee
4. Parasitology by Jayaram and Panicker
5. Hand book of laboratory technology by Scott
6. Hand book of laboratory technology, C.M.C. Vellore - 2 copies.

Students should know- In All 3 years * (not included in practical examination)

Basic computers and Information Science-Practical

Practical on fundamentals of computers -

1. Demonstration of basic hard ware of the computers and laptops
2. Learning to use MS office: MS word, MS PowerPoint, MS Excel.
3. To install different software.
4. Data entry efficiency

DMLT- Communication and Soft Skills, Spoken English-Practical

1. Précise writing and comprehension of simple passages from a prescribed text book. The passage should be atleast100 words and students should answer a few questions based on it.
2. To practice all forms of communication i.e. drafting reports, agendas, notes, précise writing, circulars, presentations, telephonic communication, along with practice on writing resumes and applications for employment.

DMLT- Medical Terminology, Record keeping (including anatomical terms) and Orientation to Medical Laboratory Science Technology (MLT)-Practical

1. General discussion/Sensitization on career opportunities and role of MLT in Hospital Care
2. Visit to Central Sterile Supply Department (CSSD)
3. Visit to incinerator complex
4. Visit to Immunization section

DMLT- Introduction to Quality and Patient safety (including Basic emergency care and life support skills) Practical

DMLT- Environmental Science-Practical

1. Any Activity related to public awareness about the environment:
   1.1. Preparation of Charts/Models
   1.2. Visit to any effluent treatment plant
2. Effects of environmental pollution on humans through poster presentation.
3. Any activity related to biomedical waste management in a hospital or clinical laboratory

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