

**Revised Ordinance Governing Regulations and
Curriculum**

of

**BACHELOR OF MEDICAL LABORATORY
TECHNOLOGY COURSE - 2019**



**Rajiv Gandhi University of Health
Sciences,
Karnataka, Bangalore**

The Emblem



The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts Amrutha Kalasham of Dhanvanthri the father of all Health Sciences. The wings above it depicts Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp at the bottom depicts human energy (kundalini). The script "Devahitham Yadayahu" inside the lamp is taken from Upanishath Shanth i Manthram (Bhadram Karnebh i Shrunuyanadev...), which says "May we live the full span of our lives allotted by God in perfect health" which is the motto of the Rajiv Gandhi University of Health Sciences.



ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು

RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA, BENGALURU
4th T Block, Jayanagar, Bengaluru – 560 041

Ref: ACA/DCD/AHS/B.Sc.MLT/367/2019-20

Date: 28/08/2019

NOTIFICATION

Sub: Revised Ordinance pertaining to Regulation and Curriculum of Bachelor of Medical Laboratory Technology.

Ref: 1) Minutes of BOS Allied Health Sciences held on 13/05/2019
2) Proceedings of Faculty meeting held on 15/05/2019
3) Proceedings of AC meeting held on 17/06/2019
4) Proceedings of Syndicate meeting held on 29/06/2019

In exercise of the powers vested under Section 35(2) of RGUHS Act, 1994, the Revised Ordinance pertaining to Regulation and the curriculum of Bachelor of Medical Laboratory Technology is notified herewith as per Annexure.

The above Regulation shall be applicable to the students admitted to the said course from the academic year 2019-20 onwards.

By Order,

Sd/-

REGISTRAR

To

The Principals of all affiliated Allied Health Sciences Course colleges of RGUHS, Bangalore.

Copy to :

1. The Principal Secretary to Governor, Raj Bhavan, Bangalore - 560001
2. The Principal Secretary Medical Education, Health & Family Welfare Dept., M S Building, Dr.B.R. Ambedkar Veedhi, Bangalore – 01
3. PA to Vice – Chancellor/PA to Registrar/Registrar (Eva.)/Finance Officer, Rajiv Gandhi University Health Sciences, Bangalore

4. All Officers of the University Examination Branch/ Academic Section.
5. Guard File / Office copy.

REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF BACHELOR OF MEDICAL LABORATORY TECHNOLOGY - 2019

1. Eligibility for admission:

A candidate seeking admission to the BSc. MLT shall have studied English as one of the principal subject during the tenure of the course and shall have passed:

1. Two year Pre-University examination or equivalent as recognized by Rajiv Gandhi University of Health Sciences with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by RGUHS, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Rajiv Gandhi University of Health Sciences, Bangalore for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in MLT shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in MLT should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc.MLT for candidates who have passed diploma program from the Government Boards and recognized by RGUHS, fulfilling the conditions specified

above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level from the academic year 2008-09 vide RGUHS Notification no. AUTH/AHS/317/2008-09 dated:01.08.2008.

Note:

- a. The candidate shall have passed individually in each of the subjects.
- b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

2. Duration of the course:

Duration shall be for a period of four years including one year of Internship.

3. Medium of instruction:

The medium of instruction and examination shall be in English.

4. Scheme of examination:

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

5. Attendance

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

6. Internal Assessment (IA):

1st Year B.Sc. MLT

Theory - 20 marks

Practicals - 10 marks*. [Lab work- 06 marks and Record-04 marks]

2nd & 3rd year B.Sc. MLT

Theory – 20 Marks

Practicals – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges with in a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

* There shall be no University Practical Examination in First year.

7. Subject and hours of teaching for Theory and Practicals

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

Table - I Distribution of Teaching Hours in First Year Subjects

Main subjects

Sl. no	Subject	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	Human Anatomy	70	20	90
2	Physiology	70	20	90
3	Biochemistry I	70	20	90
4	Pathology I (Clinical Pathology, Haematology & Blood Banking)	70	20	90
5	Microbiology	70	20	90
	Total	350	100	450

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturdays students shall work in hospitals in the respective specialty or department chosen by them

Subsidiary Subjects

English 25 Hours

Kannada 25 Hours

Health-Care 40 Hours

Clinical/Lab posting –470 hours(Friday 9am – 1pm and 2pm - 4-30 pm

Saturday 9am - 1pm)

Table - II Distribution of Teaching Hours in Second Year Subjects

Main Subjects

Sl. no	Subject	Theory No. of Hours	Practical No. of Hours	Clinical Postings	Total No. of Hours
1	Biochemistry II	100	80	170	350
2	Microbiology II	100	80	170	350
3	Pathology II	100	80	170	350
	Total	300	240	510	1050

Subsidiary Subjects:

Sociology 20 Hours

Constitution of India 10 Hours

Environmental Science & Health 10 Hours

Table - III Distribution of Teaching Hours in Third Year Subjects

Main Subjects

Sl. no	Subjects	Theory No. of Hours	Practical No. of Hours	Clinical Posting	Total No. of Hours
1	Biochemistry III	100	80	170	350
2	Microbiology III	100	80	170	350
3	Pathology III	100	80	170	350
	Total	300	240	510	1050

Subsidiary Subjects:

Ethics, Database Management 50 Hours

Research & Biostatistics 20 Hours

8. Schedule of Examination:

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

9. Scheme of Examination

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, Second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

First year examination:

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

Second & Third year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

03 papers in the 2nd Year

03 papers in the 3rd Year.

Practical examination:

Three practical examinations, at the end 2nd Year and three practical examinations at the end of the 3rd year.

TABLE-IV**Distribution of Subjects and marks for First Year University theory Examination**

A	Main Subjects*	Written Paper		I A Theory	Total
		Duration	Marks	Marks	Marks
1	Basic Anatomy (Including Histology)	3 Hours	80	20	100
2	Physiology	3 Hours	80	20	100
3	Biochemistry	3 Hours	80	20	100
4	Pathology	3 Hours	80	20	100
5	Microbiology	3 Hours	80	20	100

	Subsidiary Subject**				
1	English	3 Hours	80	20	100
2	Kannada	3 Hours	80	20	100
3	Health Care	3 Hours	80	20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

TABLE – V

Distribution of Subjects and marks for Second Year Examination of B.Sc. MLT

Paper	Subject	Theory			Practicals			Grand Total
		Univ. exam	IA	Sub Total	Univ Prac	IA	Sub Total	
I	Biochemistry II	80	20	100	80	20	100	200
II	Microbiology II	80	20	100	80	20	100	200
III	Pathology II	80	20	100	80	20	100	200

Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. MLT

B	Subsidiary Subject**	Duration	Marks	I A Theory Marks	Total Marks
1	Sociology	3 Hours	80	20	100
2	Constitution of India	3 Hours	80	20	100
3	Environmental Science & Health	3 Hours	80	20	100

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges

TABLE – VI

Distribution of Subjects and marks for Third Year Examination of B.Sc MLT

Paper	Subject	Theory			Practicals			Grand Total
		Univ. exam	IA	Sub Total	Univ Prac	IA	Sub Total	
I	Biochemistry III	80	20	100	80	20	100	200
II	Microbiology III	80	20	100	80	20	100	200
III	Pathology III	80	20	100	80	20	100	200

Distribution of Subsidiary Subjects and marks for Third Year Examination of

B.Sc. MLT

B	Subsidiary Subject**	Duration	Marks	I A Theory Marks	Total Marks
1	Ethics, Database Management	3 Hours	80	20	100
2	Research & Biostatistics	3 Hours	80	20	100
3	Computer Application	3 Hours	80	20	100

** Subsidiary subjects : Examination for subsidiary subjects shall be conducted by respective colleges

10. Pass criteria

10.1. First year examination

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures 50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subjects shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

10.2. Second and Third year Examination

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subjects shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

11. Carry over benefit

11.1 First year examination:

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/she must pass the carry over subjects before appearing for second year examination.

11.2. Second year examination:

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third year examination.

12. Declaration of Class

a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than 60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

e. The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

13. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory six months of rotational internship. On completion of six months of the internship the candidate is then eligible for the award of degree.

14. Distribution of Type of Questions and Marks for Various Subjects

THEORY

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	12 (10 x 5)	05
Short Answer Type	12 (10 x 3)	03

SUBJECTS HAVING MAXIMUM MARKS= 80 (for first year B.Sc)		
Type of Questions	NO. of questions	Marks for Each Questions
Short Essay Type	10 (8 x 5)	40
Short Answer Type	12 (10 x 3)	30
To The Point Answer	07 (5 x 2)	10

SUBJECTS HAVING MAXIMUM MARKS= 80 (for second and third year B.Sc)		
Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

SUBJECTS HAVING MAXIMUM MARKS= 60		
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Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	7 (5 x 5)	05
Short Answer Type	7 (5 x 3)	03

SUBJECTS HAVING MAXIMUM MARKS= 50		
Type of Questions	No. of Questions	Marks for Each Questions
Essay Type	3 (2 x 10)	10
Short Essay Type	5 (3 x 5)	05
Short Answer Type	7 (5 x 3)	03

INTERNSHIP

Six month compulsory rotational postings during which students have to work under the supervision of experienced staff in the following areas:

1. Clinical Pathology - 1 month
2. Clinical Biochemistry - 2 months
3. Clinical Microbiology - 2 months
4. Blood banking - 1 month

Requirements for internship in the department of Clinical pathology and Blood banking-

Haematology-

1. A minimum of 50 haemograms or more per day
2. Bone marrow examination and reporting
3. All special tests for leukemias
4. Immunohistochemistry
5. One MD pathologist should be present

Histopathology

1. All histopathological techniques should be done, both manual or/and automated- 10 specimens per day minimum.
2. All special stains should be done.
3. Immunohistochemistry in histopathology

Cytology

1. Minimum 10 specimens per day
2. All cytological techniques including staining technique- manual and automated should be done.
3. Cytopathologist should be there.

Blood bank

1. Minimum 10 blood collections per day
2. All facilities for testing eg. Automated cell counter, ELISA reader should be there
3. Facilities for component separation and storage should be there eg. Plasma and / or platelet pheresis machine, cooling centrifuge, blood bag refrigerator, deep freezer, platelet agitator etc.

Requirements for internship in the department of Clinical Biochemistry-

1. A medium sized lab performing tests on 100 samples per day or a hospital comprising of 100 beds with a lab performing tests on 100 samples.
2. Tests performed should include- routine tests and higher chemistry
 - a. Glucose
 - b. Calcium
 - c. Phosphorus
 - d. Uric acid
 - e. Electrolytes
 - f. Amylase
 - g. Lipase
 - h. Ig
 - i. Microalbumin
 - j. RFT
 - k. LFT
 - l. Lipid profile
 - m. Cardiac marker

- n. Diabetic profile including HbA1C
- o. Hypertension profile
- p. Tumor markers
- q. Hormones- LH, FSH, testosterone, prolactin
- r. Thyroid profile
- s. 24hrs urine protein
- t. 24hrs urine creatinine
- u. 24 hrs urine/ creatinine ratio

The lab should include equipments as per mentioned below-

- a. Chemiluminescence/ drug hormone analyser/ ELFA
 - b. HPLC (optional)
 - c. Arterial blood gas analysis (optional)
 - d. ISE electrolyte analyser/ flame photometry
 - e. Electrophoresis / chromatography
 - f. Fully automated analyser
 - g. Semi automated analyser
 - h. Spectrophotometer/ colorimeter
 - i. pH meter
 - j. hot air oven
 - k. distillation unit
-
- should have facility for performing calibrations for smaller equipments/ pipettes
 - should run quality control materials
 - should have proper guidelines for total quality management

Requirements for internship in the department of Microbiology-

Should learn collection and appropriate processing of various specimens.

1. Routine culture and sensitivity including blood culture- minimum of 10 per day
2. Serology by
 - a. Latex agglutination- 20 per day
 - b. Rapid tests- 20 per day
 - c. ELISA- 5 per day
3. Mycology-
 - a. Wet mount- 10 per day
 - b. Culture- 5 per month
4. Parasitology-
 - a. Wet mount- 20 per month
 - b. Peripheral smear for malaria and filaria- 10 per day
 - c. Quantitative buffy coat- 5 per day
5. Microscopy- minimum 10 per day
 - a. Grams stain
 - b. ZN stain
 - c. Urine wet mount
 - d. CSF India ink preparation

The lab should have the following instruments-

1. Autoclave
2. Hot air oven
3. Incubator
4. Centrifuge
5. Water distillation unit
6. Physical balance
7. Digital balance
8. Refrigerator

9. Microscope- monocular, binocular, fluorescent microscope
10. ELISA reader
11. Micropipettes
12. Laminar air flow
13. Water bath
14. VDRL shaker

The responsibilities that the students should learn during their internship in the department of microbiology-

- Preparation of media
- Sterilization
- Preparation of reagents
- Handling instruments
- Waste disposal
- Maintenance of microscopes
- Calibration of instruments

SYLLABUS FOR ALLIED HEALTH SCIENCE COURSES

I year - B.Sc. Allied Health Sciences

ANATOMY

Theory: 70hrs

Practicals: 20hrs

ANATOMY

Theory: 70hrs

Practicals: 20hrs

I. INTRODUCTION: HUMAN BODY AS A WHOLE

THEORY:

Definitions of anatomy and its divisions

Terms of location, positions and planes

Epithelium — definition, classification, describe with examples, functions
Glands — classification, describe serous and mucous glands with examples
Basic tissues — classification with examples

PRACTICALS:

Histology of types of epithelium

Histology of serous, mucous and mixed salivary gland

II. LOCOMOTION AND

SUPPORT THEORY:

Cartilage — types with examples and histology

Bone—

classification, names of bone cells, parts of long bone, microscopy of
Compact bone, names of all bones, vertebral column, intervertebral disc,

Joints — classification of joints with examples, synovial joint (in detail for radiology)
Muscular system - classification of muscular tissue and histology

Names of muscles of the body
PRACTICALS:

Histology of 3 types of cartilages

Demo of all bones showing parts, radiographs of normal bones and joints

Histology of compact bone (TS and LS)

Demonstration of all muscles of the body

Histology of skeletal, smooth and cardiac muscle (TS and LS)

III. CARDIOVASCULAR

SYSTEM THEORY:

Heart — size, location, chambers, exterior and interior
Blood supply of heart

Systemic and pulmonary circulation

Branches of aorta, common carotid artery, subclavian artery,

Axillary artery, brachial artery, superficial palmar arch, femoral artery,
Internal iliac artery

Peripheral pulse

Inferior vena cava, portal vein, portosystemic
anastomosis Great saphenous vein

Dural venous sinuses

Lymphatic system —
cisternae, chyli and thoracic duct
Histology of lymphatic tissues

Names of regional lymphatics, axillary and inguinal lymph nodes in brief

PRACTICALS:

Demonstration of heart and vessels in the body

Histology of large artery, medium sized artery and vein, large
vein

Microscopic appearance of large artery, medium sized artery and
vein,

Histology of lymph node, spleen, tonsil and thymus

Normal chest radiograph showing heart shadows
Normal angiograms

IV. GASTRO-INTESTINAL

SYSTEM THEORY:

PartsofGIT,oralcavity, tongue—withhistology,tonsil,dentition,pharynx,
Salivary glands, Waldeyer'sring

Oesophagus, stomach, small and large intestine, liver, gall bladder,
pancreas, Radiographs of abdomen

V. RESPIRATORYSYSTEM

Parts of RS — nose, nasal cavity, larynx, trachea, lungs (in detail including
bronchopulmonary segments)Histology of trachea, lungs

Namesofparanasalairsin
uses PRACTICALS:

Demonstration of parts of respiratory system
Normal radiographs of chest

Histology of lung and trachea

VI. PERITONEUM

THEORY:

Description in brief

PRACTICAL:

Demonstrations of reflections

VII. URINARYSYSTEM

Kidney,ureter,urinarybladder,maleandfemaleure
thra Histology of kidney, ureter and urinary
bladder PRACTICAL:

Demonstration of parts of urinary
system Histology of kidney, ureter,
urinary bladder

Radiographs of abdomen — IVP, retrograde cystogram

VIII. REPRODUCTIVE SYSTEM

THEORY:

Partsofmalereproductivesystem,testis,vasdeferens,epididy
mis, Prostate (gross andhistology)

Parts of female reproductive system, uterus, fallopian
tubes, Ovaries (gross and histology)

Mammary gland —
gross PRACTICAL:

Demonstration of section of male and female pelvis with organs in situ

Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes and ovaries

IX. ENDOCRINE

GLANDS

THEORY:

Names of all endocrine glands, in detail on pituitary gland, thyroid gland, Parathyroid gland, suprarenal gland (gross and histology)

PRACTICAL:

Histology of pituitary, thyroid, parathyroid, suprarenal glands

X. NERVOUS SYSTEM

THEORY:

Neuron

Classification
of NS

Cerebrum, cerebellum, midbrain, pons, medulla oblongata

Spinal cord with spinal nerves (gross)

Meninges, ventricles and cerebrospinal fluid

Names of basal nuclei

Blood supply of the
brain Cranial nerves

Sympathetic trunk in brief and names of parasympathetic ganglia

PRACTICAL:

Histology of peripheral nerve and optic nerve

Demonstration of important nerves in the body

Demonstration of all parts of brain

XI. SENSORY ORGANS

THEORY:

Skin - histology

Eye and lacrimal apparatus (in brief)

Extra-ocular muscles and nerve supply

Ear-partsofear-external and middleear

PRACTICAL:

Histology of thin and thick skin

Histology of cornea and retina

XII. EMBRYOLOGY

THEORY:

Spermatogenesis and Oogenesis Ovulation, fertilization and Placenta

Fetal

circulation

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Anatomy shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
To the point answer	07 (attempt 5)	5 x 2	10
GRAND TOTAL			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	

80	-	20	100	*			100
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REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurasia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunder's & C P Prism Publishers, Bangalore
5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

PHYSIOLOGY

Theory 70 hours

Practical 20hours

Introduction

Composition and function of blood

Red blood cells — Erythropoiesis, stages of differentiation function, count physiological Variation. Haemoglobin —structure, function, concentration physiological variation, White blood cells . types & functions & immunity.

Platelets — Normal count, functions.

Plasma Proteins — Concentration, types, albumin, globulin, Fibrinogen, Prothrombin functions.

Haemostasis — Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.

Blood Bank

Blood groups — ABO system, Rh system Blood grouping & typing

Crossmatching

Rh system — Rh factor, Rh incompatibility.

Blood transfusion — Indication, universal donor and recipient concept.

Selection criteria of a blood donor. Transfusion reactions

Anticoagulants — Classification, examples and uses

Anaemias : Classification — morphological and etiological. Effects of anemia on body Blood indices — Colour index, MCH, MCV, MCHC

Erythrocyte sedimentation Rate (ESR) and Packed cell volume

Normal values, Definition. Determination

Lymph

Body fluid compartments, function of lymph

1. Cardiovascular system

Heart ~ Properties of Cardiac muscle

Cardiac cycle-systole, diastole

Cardiac Output — Definition & Normal value

Heart sounds- Normal heart sounds Areas of auscultation, Causes

Blood Pressure — Definition, normal value, Physiological variations, regulation of BP, cardiac shock, hypotension, hypertension. Triple response

Electrocardiogram (ECG) —significance.

2. Digestive System - Physiological anatomy of Gastro intestinal tract

Salivary glands - Functions

Deglutition —stages

Stomach — Functions

Gastric secretion – Composition, function,phases of gastric secretion.

Pancreas — Function, composition of pancreatic juice.

Liver — functions of liver.

Bile composition, bile salts function, Bilirubin metabolism, types of bilirubin, Vandernberg reaction, Jaundice- types, significance.

Gall bladder — functions.

Intestine — small intestine and large intestine.

Digestion and absorption of Carbohydrates, Proteins, Fats, Lipids.

3. Respiratory system

Functions of Respiratory system, Physiological Anatomy of Respiratory system, Respiratory tract,

Respiratory Muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane, stages of respiration.

Mechanism of normal intra pulmonary / pleural pressure, surfactant.

Transportation of Respiratory gases: Transportation of Oxygen: Direction, pressure gradient, Forms of transportation, Oxy-Hb dissociation curve.Quantity of Oxygen transported. CO2 transport forms, chloride shift.

Spirogram - Lung volumes and capacities. Regulation of respiration what? Why? How? Mechanisms of Regulation, nervous and chemical regulation. Respiratory centre.

Applied Physiology and Respiration : Hypoxia, Cyanosis, Asphyxia, Dyspnea, Dysbarism, Artificial Respiration, Apnoea.

4. Endocrine System —

Thyroid gland hormone — Physiological function, regulation of secretion. Disorders — hypo and hyper secretion of hormone with features.

Adrenal gland — Physiological functions of hormones secreted, hypo & hyper secretion of hormones with features.

Pituitary hormones — Anterior and posterior pituitary hormones, function.

Pancreas — Hormones of pancreas. Insulin — secretion, regulation, function and action. Diabetes mellitus — Regulation of blood glucose level.

Parathyroid gland — function, action, regulation of secretion of parathyroid hormone. Calcitonin — function and action

5. Special senses

Vision — structure of eye. Function of different parts.

Structure of retina, Optic pathway, Refractive errors of eye.

Hearing structure and mechanism of hearing

Functions of middle ear.

Taste — Taste buds functions.

Smell physiology, Receptors.

6. Nervous system

Functions of Nervous system, Neuron structure, classification & properties. Neuroglia, conduction of impulses continuous and salutatory and factors affecting. Synapse — structure, types, properties.

Receptors — Definition, enumerate properties. Reflex action — unconditioned

properties of reflex action. Spinal cord nerve tracts. Name of the pathway & its function, course not needed.

Pyramidal tracts — Extrapyramidal tracts. Functions of Hypothalamic, disorders. Cerebral cortex lobes and functions, Sensory cortex, Motor cortex, functions of Cerebellum. Basal ganglion- functions. EEG.

Cerebro Spinal Fluid(CSF) : formation, circulation, properties, composition and functions

lumbar puncture.

Autonomic Nervous System: Sympathetic and parasympathetic distribution and functions and comparison of functions.

7.Excretory System

Excretory organs

Kidneys: Functions of kidneys structural and functional unit nephron, vasarecta, cortical and juxtamedullary nephrons — Comparison, Juxta Glomerular Apparatus —Structure and function.

Mechanism of Urine formation: Define of GFR, Normal value, factors affecting GFR, Determination. Determination of GFR — sites & mechanism of reabsorption, Na⁺, H₂O, Glucose.

Properties and composition of normal urine, urine output. Abnormal constituents in urine. Mechanism of urine concentration — Current Mechanisms

Micturition, innervation of Bladder, Cystourethrogram. Diuretics : Water, Diuretics, osmotic diuretics, Artificial kidney, Renal function tests — plasma clearance.

8.Reproductive system

Function of Reproductive system, Puberty

Male reproductive system- Functions of testes, spermatogenesis site.

Androgens — Testosterone and functions.

Female reproductive system, Functions of estrogen & progesterone, Ovulation, menstrual cycle. pregnancy test.

9.Muscle nerve physiology

Classification of muscle, structure of skeletal muscle, Sarcomere contractile proteins, Neuromuscular junction. Transmission across, Neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction muscle tone, fatigue Rigour mortis.

10.Skin—Functions of skin

Body temperature measurement,Regulation of body Temperature by physical chemical and nervous mechanisms .Role of Hypothalamus, Hypothermia

PRACTICALS – ONLY DEMONSTRATION

- 1.Haemoglobinometry
- 2.White Blood Cell count
- 3.Red Blood Cell count
- 4.Determination of Blood Groups
- 5.Leishman's staining and Differential WBC count
- 6.Determination of packed cell Volume
- 7.Erythrocyte sedimentation rate [ESR]
- 8.Calculation of Blood indices

9.Determination of Clotting Time, Bleeding Time

10.Blood pressure Recording

11.Auscultation for Heart Sounds

12.Artificial Respiration

13.Determination of vital capacity

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Physiology shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
To the point answer	07 (attempt 5)	5 x 2	10
GRAND TOTAL			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book
4. Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton
5. A K Jain MLT Venkatesh Sudakar

BIOCHEMISTRY I

No. Theory classes: 70 hours

No. Practical classes: 20 hours

1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class) ,
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples) .
- Disaccharides (Sucrose/ lactose/ maltose and their composition)
- Polysaccharides : a. Homopolysaccharides (Structure of starch and glycogen) b. Heteropolysaccharides (Functions)

2. Lipid Chemistry; [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

3. Amino-acid and Protein Chemistry ; [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples)
- Functions of amino acids and Proteins

4. Nucleotide and Nucleic acid Chemistry; [3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA,

5. Enzymes; [5 hours]

- Definition & Classification of Enzymes with example
- Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin)

6. Digestion and Absorption [3 Hours] ;

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

7. Carbohydrate Metabolism; [7 Hours];

- Glycolysis ; Aerobic, Anaerobic, Definition , Site and subcellular site , Steps with all the enzymes and coenzymes at each step , mention the regulatory enzymes , Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes) , Site and subcellular site , Reactions with all the enzymes and coenzymes ,Regulatory enzymes , Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)

8. Lipid Metabolism [4 Hours];

- Introduction to lipid metabolism, Lipolysis,

- Beta oxidation of fatty acids ; Definition ,Site and subcellular site , Activation of palmitic acid , Transport of activated palmitic acid into mitochondria , Reactions , Energetics.
- Name the different ketone bodies . Note on ketosis

9. Amino acid and Protein Metabolism [3 Hours];

- Introduction, transamination, deamination, Fate of ammonia, transport of ammonia,
- Urea cycle.

10. Vitamins [13 Hours] ;

- Definition and classification .
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following water soluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat soluble vitamins; A and vitamin D

11. Mineral Metabolism [5 Hours];

- Name the macro/ microminerals
- Iron: Sources ,RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources ,RDA, functions, normal serum levels and hormones reulating their levels

12.Nutrition; [4 hours]

- Balanced diet (Definition)
- Caloric value ; Definition , Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)

- Basal metabolic rate(BMR) ; Definition , Magnitude of BMR in men and women c, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)

13.Carbohydrates, Proteins and fats in Nutrition:[4 hours]

- Carbohydrates ;. Daily dietary requirement. 2. Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins ;. Daily requirement , Biological value. a. Definition b. Protein used as a standard for this , Protein sources with high and low biological value , Mutual supplementation of proteins (Definition, examples).
- Fats ; Daily requirement , Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations) , Saturated and unsaturated fatty acids (Definition, sources, examples).

14. Malnutrition : [1 hour]

- Protein energy malnutrition [PEM] (Definition, classification).
- Marasmus and kwashiorkor (Similarities and differences)

15.Renal Function Tests[2 hours]

- Name the different tests to asses the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

16. Radio active Isotopes [2 hours]

- Definition, clinical applications
- Biological effects of radiations

17.Clinical Biochemistry: [5 hours]

A. Definitions of acid, base, pH and pKa [1 hour]

B. **Buffers** • Definition [2 hours]

- Henderson Hasselbalch equation,

- principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis (Definition, classification, causes and biochemical findings)

C. Normal serum levels and condition where they are altered [2 hour]

- Glucose, Protein, urea, uric acid, and creatinine
- bilirubin, cholesterol
- SerumElectrolytes

ASSIGNMENT TOPICS;

1. Hazrads; physical, chemical, Biological ,
2. Arterial blood gas analysis
3. Responsibilities of Health care personnel
4. Biomedical waste management

Total theory hours; 70

PRACTICAL DEMONSTRATION ;20 hours.

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose folin wu And enzymatic method
- Estimation of Urea by dam method

Diagrams to be drawn

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry I shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
To the point answer	07 (attempt 5)	5 x 2	10
GRAND TOTAL			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Text Book References

- Biochemistry –by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry by D.M Vasudeva & Shrekumari.
- Textbook of Medical Biochemistry- by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology by Godkar and Godkar.
- Biochemistry- by Pankaja Naik
- Medical Laboratory technology by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students- by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry,

PATHOLOGY I

Histopathology, Clinical Pathology, Hematology and Blood Banking

Theory-70 hours

Practicals-20 hours

General pathology -33hrs

1) CELL INJURY-5HRS

Definition, examples & morphology of reversible injury(fatty liver, hyperplasia, hypertrophy,

metaplasia(1 hr)

**Definition & pathogenesis of irreversible injury(neurosis, apoptosis)-
2hrs**

Gangrene – Definition, morphology & differences(1hr)

Pathological calcification & pigments(1hr)

2) INFLAMMATION-(10hr)

Cells in acute & chronic inflammation(1hr)

Acute inflammation – signs, vascular events, cellular events(2hr)

Morphology of pattern of acute inflammation(1hr)

**Wound healing- primary & secondary healing, stages, factors and
complications- 2hrs**

Chronic inflammation – classification, & pathogenesis of TB(1hr)

Primary tuberculosis, 2^o tuberculosis, miliary TB(1hr)

**Leprosy, classification, laboratory diagnosis & morphology of
Tuberculoid leprosy &**

Lepromatous leprosy(1hr)

**Syphilis- stages, c/f, laboratory diagnosis of primary, secondary, tertiary
& congenital**

syphilis(1hr)

3) HAEMODYNAMIC DISORDERS(10hr)

Pathogenesis of thrombosis & fate of thrombosis(2hr)

Pathogenesis of edema(1hr)

Renal edema & cardiac edema(1hr)

- Difference between transudate and exudates-1hr**
- Classification embolism- sources of emboli, fat embolism(causes & c/f)(2hr)**
- Infarction- definition, classification & examples-2hr**
- Classification of shock & pathogenesis of cardiac shock(1hr)**
- 4) Classification of autoimmune disease & c/f & laboratory diagnosis of SLE(1hr)**

5) NEOPLASIA -7HRS

- Definition & naming of tumours(1hr)**
- Differences between benign & malignant neoplasm(1hr)**
- Metasis- pathways & examples (1hr)**
- Precancerous conditions-(1hr)**
- Clinical aspects of neoplasia(1hr)**
- Paraneoplastic syndrome & tumour markers (1hr)**
- Tumour staging & grading(1hr)**

Haematology-21HRS

- Haematopoieses(2hr)**
- Normal haemostasis including- coagulation pathway & fibrinolytic system(2hr)**
- Definitions & Classifications of anemia(2hr)**
- Definition & classification of leukemia(2hr)**
- Classification of bleeding disorders(1hr)**
- Normal constituents of Blood, their structure and functions-3hours**
- Collection of Blood samples and anticoagulants-2hrs**
- Hemoglobin estimation, different methods and normal values-2hrs**

- Packed cell volume-1hr**
- Erythrocyte sedimentation rate-1hr**
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time-3hrs**

BOOD BANKING-7HRS

- Blood group system(1hr)**
- Blood grouping(2hrs)**
- Blood components and their indications(2hrs)**
- Definition and Classification & transfusion reaction(2hr)**

Clinical Pathology- Theory-9hours

- Collection & transport of urine sample-1hr**
- Physical examination of urine -1hr**
- Chemical examination of urine.-2hr**
- microscopic examination of urine-1hr**
- Examination of Body fluids(pleural & peritoneal fluid)—1hr**
- Examination of Cerebrospinal fluid (CSF)-1hr**
- Sputum examination-1hr**
- Examination of feces-1hr**

Practicals

- 1. Urine analysis- Physical, Chemical, Microscopic**
- 2. Blood grouping and Rh typing**
- 3. Hb estimation , packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)**
- 4. Bleeding time and Clotting time**

5. Histopathology- section cutting and H & E Staining (for BSc MLT only

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology I shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
To the point answer	07 (attempt 5)	5 x 2	10
GRAND TOTAL			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology

5. Orell Cytopathology

6. Todd and Sanford- clinical diagnosis by Laboratory Medicine

7. Dacie and Lewis- Practical Hematology

8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi,

1996

Microbiology I

Theory: 70 Hours

Practicals: 20 Hours

1. Introduction (8hrs)

- Introduction to Microbiology 1
- History of Microbiology 1
- Classification of microorganisms 1
- Microscopy 2
- Morphology of bacterial cell 3

2. Growth and nutrition (3 hrs)

- Nutrition, growth and multiplication of bacteria, culture media and culture methods

3. Sterilization and disinfection (3hrs)

- Principles and use of equipments of sterilization, chemicals used in disinfection

4. Biomedical waste management principle and practice (2 hrs)

5. Immunology (20 hrs)

- Immunity 2
- Vaccines, Immunization schedule 1
- Antigen, antibody 3
 - Definition of antigen and antibody
 - List the types of antigens and antibodies
- Antigen antibody reactions 3
- Immune system 4

- Brief introduction of primary and secondary lymphoid organs
- Lymphocytes; T cell, B cell functions
- Phagocytic cells
- Hypersensitivity 3
 - Classification
 - Types with examples
- Autoimmunity 2
 - Mechanisms
 - Examples of autoimmune diseases
- Transplantation immunology 2
 - Classification of transplants
 - Types of grafts
 - Graft versus host reaction

6. Infection (5hrs)

- Definition, types and modes of transmission 2
- Hospital acquired infections 1
 - causative agents
 - modes of transmission
 - Prophylaxis
- Antibiotics 1
- Antimicrobial susceptibility testing 1

7. Systematic bacteriology (8hrs)

- General symptoms & causative agents of infections of the Respiratory tract, gastrointestinal tract, central nervous system, skin and soft tissue, urinary tract infections, blood borne diseases, STDs, PUO and their laboratory diagnosis.

8. Virology (8 hrs)

- Introduction to virology, morphology and classification, replication, viral culture.
- List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arboviral diseases) and their laboratory diagnosis.

9. Parasitology (8hrs)

- Introduction to Parasitology , Classification.
- Lab diagnosis of parasitic infections
- List of medically important parasites and diseases (E.histolytica, Giardia lamblia, Plasmodium, T. saginata, T. solium, Echinococcus granulosus, Ascaris, Ancylostoma, W.bancrofti, Leishmania donovani) and their laboratory diagnosis.

10. Mycology

(7hrs)

- Introduction to Mycology,classification
- List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis and Mucor mycosis) and their laboratory diagnosis.

Practicals:

20 Hours

1. Compound Microscope.
2. Demonstration and sterilization of equipments - Hot Air oven, Autoclave, Bacterial filters.
3. Demonstration of commonly used culture media- Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, MacConkey medium, LJ media, Robertson Cooked meat media, Potassium tellurite media; with growth, Mac with LF & NLF, NA with staphylococcus Antibiotic susceptibility test
4. Anaerobic culture methods.
5. Gram stain
6. Acid Fast staining
7. Demonstration of common serological tests - Widal, VRDL, ELISA.
8. Stool examination
9. Biomedical waste management.
10. Universal precautions

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practicals need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology I shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Short essay type	10 (attempt 8)	8 x 5	40
Short answer type	12 (attempt 10)	10 x 3	30
To the point answer	07 (attempt 5)	5 x 2	10
GRAND TOTAL			80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	*			100

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruickshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle
9. Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd

SUBSIDIARY SUBJECTS

ENGLISH

COURSE OUTLINE

COURSE DESCRIPTION: This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

BEHAVIOURAL OBJECTIVES:

The student at the end of training is able to

1. Read and comprehend English language
2. Speak and write grammatically correct English
3. Appreciates the value of English literature in personal and professional life.

UNIT - I: INTRODUCTION:

Study Techniques

Organisation of effective note taking and logical processes of analysis and synthesis

Use of the dictionary

Enlargement of vocabulary

Effective diction

UNIT - II: APPLIED GRAMMAR:

Correct usage

The structure of sentences

The structure of paragraphs

Enlargements of Vocabulary

UNIT - III: WRITTEN COMPOSITION:

Precise writing and summarizing

Writing of bibliography

Enlargement of Vocabulary

UNIT - IV: READING AND COMPREHENSION:

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

Enlargement of Vocabulary.

UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

Paragraph, Essay, Letter, Summary, Practice in writing

UNIT - VI: VERBAL COMMUNICATION:

Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

REFERENCE

1. English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
3. Letters for all Occasions. A S Myers. Pub - Harper Perennial
4. Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
8. Penguin Book of Interviews.

HEALTH CARE

Teaching Hours : 40

Introduction to Health

Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.

National Health Policy

National Health Programmes (Briefly Objectives and scope)

Population of India and Family welfare programme in India

Introduction to Nursing

What is Nursing ? Nursing principles. Inter-Personnel relationships. Bandaging : Basic turns; Bandaging extremities; Triangular Bandages and their application.

Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

Lifting And Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. Transferring from bed to stretcher.

Bed Side Management: Giving and taking Bed pan, Urinal : Observation of stools, urine.

Observation of sputum, Understand use and care of catheters, enema giving.

Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion

Care of Rubber Goods

Recording of body temperature, respiration and pulse,

Simple aseptic technique, sterilization and disinfection.

Surgical Dressing: Observation of dressing procedures

First Aid :

Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

Reference Books:

1. Preventive and Social Medicine by J.Park
2. Text Book of P & SM by Park and Park
3. Counseling & Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

SYLLABUS FOR II B.Sc. MLT COURSES

BIOCHEMISTRY II

No. Theory classes: 100 hours

No. Practical classes: 80 hours

1.Laboratory apparatus :Different types, use, care and maintenance (Where appropriate, diagrams to be drawn in practical record) [10 hours]

- Glass ware in laboratory – Significance of boro silicate glass.
- Plastic ware in laboratory
- Cleaning of glass ware and plastic ware

- Pipettes - Glass and Automated
- Burettes, Beakers, Petri dishes, Porcelain dish
- Flasks - different types (volumetric, round bottomed, Erlenmeyer, conical etc.,)
- Funnels – different types (Conical, Buchner etc.,)
- Bottles – Reagent, Wash bottles
- Measuring cylinders, reagent dispensers
- Tubes – Test tube, Centrifuge tube, Folin-Wu tube
- Cuvettes and its use in measurements , cuvettes for visible and UV range
- Racks – Bottle, Test tube, Pipette and draining racks
- Tripod stand, Wire gauze, Bunsen burner, Dessicator, Stop watch, timers

2. Instruments: Use, care and maintenance (Where appropriate, pictures/diagrams and schematic diagrams to be drawn in practical record) [17hours]

- Water bath, Oven & Incubators, Distillation apparatus - water distillation plant and water deionisers, Reflux condenser, Cyclomixers , Magnetic stirrer, Shakers
- Refrigerators, Deep freezers, Cold box
- Centrifuges*: Principle, Svedberg unit, centrifugal force, centrifugal field, rpm, Conversion of G to rpm and vice versa) Components, working. Different types of centrifuges
- Laboratory balances*: Physical and analytical. Mono & double pan, Electronic balances. Weighing different types of chemicals, liquids, hygroscopic compounds etc. Precautionary measures while handling (Diagram)
- Photometry - Colorimeter*- Principle, limitations of Beer-lambert's law, components, working.
- pH meter*- Principle, components-pH measuring electrodes, Working, Precautions taken while handling. (Diagram of pH meter) **(*Diagrams mandatory)**

3. Units of measurement [2 hour]

- Metric system. Common laboratory measurements, Prefixes in metric system
- International system of units- SI units- definition, classification, Conversion of conventional and SI Units

4. Fundamental Chemistry[4 hours]

- Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

5. Solutions: Definition, use, classification where appropriate, preparation and storage

[7 hours]

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H₂SO₄, H₃PO₄, CH₃COOH etc..)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal , Molar and percent solutions. Preparing working standard from stock standard. Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

6. Overview of Chemistry of; carbohydrates, proteins, lipids, & Nucleic acids.[6 hour]

7. Chemistry of Carbohydrates; [5 hours]

- Structural properties- Stereoisomerism, optical activity, cyclic structures, mutarotation, epimers.
- Monosaccharide's of biological importance .Important chemical reactions – formation of furfural derivatives, enediols, osazones, sugar acids, sugar alcohols , Deoxy sugars, Biomedical importance of Amino sugars, glycosides.
- Disaccharides; Properties of Maltose, Lactose, Sucrose. Invert sugars. Biomedical importance of Lactose, sucrose.
- Polysaccharides; Properties of Starch & Glycogen . Biomedical importance of Inulin. Mucopolysaccharides – composition, tissue distribution and functions.

8. Chemistry of amino acids & Proteins ; [7 hours]

- Properties of amino acids- Isomerism, amphoteric nature, and isoelectric pH. Peptide bond formation, Peptides and functions. Color reactions of amino acids . Use of amino acids analysis in diagnosis of diseases.
- Proteins ; Functions, Structure of proteins- Primary, secondary, tertiary, and quaternary.
- Precipitation reactions of proteins.
- Denaturation of proteins.
- Preparation of protein free filtrate for quantitative analysis.

9. Enzymes; [9 hours]

- Definition, Classification, Properties, Mechanism of action , factors affecting enzyme activity , enzyme inhibition. Coenzymes
- Analytical & therapeutic role of enzymes
- Immobilized enzymes

10. Metabolism of carbohydrates; [8 hours]

- Gluconeogenesis
- Glycogen metabolism
- Diabetes mellitus; diagnosis & management
- Principles and procedures for the determination of plasma glucose levels; reductometric & enzymatic methods
- Urinary glucose

11. Metabolism of amino acids & Nucleic acids; [7hours]

- Urea cycle and disorders , Blood urea / blood urea nitrogen – clinical importance
- Biosynthesis of creatinine- formation, clinical importance
- Degradation of purine nucleotides – formation of uric acid , disorders
- Principles and procedures for the determination of Blood urea nitrogen, Creatinine, & uric acid ; Colorimetric & enzymatic methods.

12. Specimen Collection ; [4 hours]

- Capillary, Arterial , Venous blood collection techniques,
- Anticoagulants used
- Various types Urine sample collections (Random, times, 24 hrs etc)
- Preservatives used , storage of samples,
- Disposal

13. .Urine analysis; [4 hours]

- Physical characteristics,
- Chemical examination of urine
- Abnormal constituents of urine

14. Techniques ; [10 hours]

- Spectrophotometry-Principle, Instrumentation, Operation, Applications, care & maintenance, Standardization

- Reflectance photometry-Principle, Instrumentation, Applications
- Turbidimetry & Nephelometry-Principle, Instrumentation, Applications
- Glucometers-Principle, Instrumentation, Applications
- Chromatography – Paper & TLC- Principle, Instrumentation, Applications

ASSIGNMENT TOPIC;

- Oral glucose tolerance test
- Glycated HbA1c
- Microalbuminuria

PRACTICALS;

I.PRACTICAL APPROACH TO BASIC LABORATORY PRACTICES

1. Pipetting techniques

2. Opeartion of the instruments

- Analytical balance
- PH meter
- Centrifuges
- Urinometer, esbach' s albuminometer

3. Techniques of preparation of Solutions & reagents;

- Normal, Molar,
- Percent (Na_2CO_3 , NaCl , NaOH , KCl , HCl , H_2SO_4 , H_3PO_4 , CH_3COOH , sodium tungstate
- Buffers (Phosphate buffer, Citrate buffer)
- Standard solutions – Glucose, urea, creatinine, Total protein etc

4. Dilution Techniques;

- Dilution of stock standard ,
- Dilution of acids
- Part Dilution of the body fluids

5. Determination of pH ;

II. QUALITATIVE;

1. Color reactions – known test solution

- Carbohydrates; Glucose, Fructose , Sucrose, Starch .
- Amino acids in protein solutions
- NPN- Urea, creatinine, Uric acid
- Titrable acidity & ammonia in urine

2. Precipitation reactions

- Albumin
- Preparation of protein free filtrates for quantitative analysis of - Glucose, urea, creatinine, uric acid estimations

3. Urine Analysis; normal and Abnormal

III. QUANTITATIVE;

1. Operation of colorimeter / spectrophotometer;

2. Quantitative estimations by manual methods- Preparation of calibration curve, & estimation of unknown analyte concentration.

- Blood glucose by reductometric method [folin wu method]
- Blood urea by DAM method
- Serum & urine creatinine by Jaffes method. Determination of creatinine clearance
- Serum uric acid by Caraways' method

PRACTICAL DEMONSTRATION;

1. Paper chromatography of amino acids

2. Dipsticks for urine analysis

3. Osazones of Lactose, Maltose, Galactose

Total theory hours; 100

Practical ; 80

SCHEME OF EXAMINATION THEORY;

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry II shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUBTOTAL
Long essay type	3 (attempt 2)	2x 10	20
Short essay type	8 (attempt 6)	6x5	30
Short answer	12 (attempt 10)	10x3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION PRACTICAL

The scheme of examination for Biochemistry II practical shall be as follow ;
Distribution of Marks

TYPE OF QUESTION	MARKS ALLOTTED
Quantitative estimation	30
Qualitative estimation	30
Urine examination	20
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals		
Theory	Viva Voce	IA	Sub total	Practicals	IA	Sub total
80	----	20	100	80	20	100

Text Book References

- Biochemistry –by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry by D.M Vasudeva & Sreekumari S
- Textbook of Medical Biochemistry- by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology by Godkar and Godkar.
- Biochemistry- by Pankaja Naik
- Medical Laboratory technology by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students- by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry
- Clinical chemistry ,theory, analysis, correlation , by Lawrence A Kaplan
- Tietz textbook of clinical chemistry by Burtis , Ashwood and Burns .

MICORBIOLOGY II

(Systematic Bacteriology + Parasitology)

I. Systematic Bacteriology

Biochemical reactions for identification of bacteria

Antimicrobial Susceptibility Testing

Normal flora of the human body

Gram Positive Bacteria: Systematic study of the following bacteria with special reference to morphology, cultural characteristics, pathogenicity, lab diagnosis and prophylaxis -

- Staphylococcus,
- Streptococcus,
- Pneumococcus
- Corynebacterium , Bacillus
- Mycobacterium

- Clostridium
- Actinomyces

Gram Negative Bacteria:

- Neisseria
- Haemophilus, Bordetella, Brucella
- Enterobacteriaceae, Salmonella & Shigella
- Vibrio, Campylobacter & Helicobacter
- Pseudomonas, Burkholderia & non fermenters
- Yersinia

Spirochaetes & Others:

- Treponemes, Leptospira & Borrelia
- Mycoplasma, Chlamydia & Rickettsia
- Non sporing anaerobes
- Gardnerella, Legionella & Listeria
- Miscellaneous Bacteria

Applied bacteriology

- UTI, Diarrhoeal diseases and food poisoning, Meningitis, Sexually transmitted diseases, pyogenic infections, Hospital infections and PUO
- Specimen collection for the above said infections.

Bacteriology of Water, Milk and Air

II. Parasitology

1. Protozoology

- Entamoeba, Balantidium coli,
- Trichomonas, Giardia, Leishmania, Trypanosoma
- Malaria, Toxoplasma
- Cryptosporidium, Microsporidium, Isospora, Cyclospora

2. Helminthology

- **Cestodes** – Taenia, Echinococcus, D. latum, H. nana,

- **Trematodes** – Schistosoma, Fasciola,
- **Nematodes** – Ascaris, Ancylostoma, Enterobius, Strongyloides, Trichuris, Trichinella, Dracunculus, Wuchereria and other Filarial worms.

Lab Diagnosis of Parasitic Infections

Arthropods of Medical Importance

Practicals:

Staining:

1. Gram Stain, Z N Stain, Albert stain
2. Hanging drop Preparation
3. Culture methods
4. Introduction to Biochemical reactions
5. Identifications of pure bacterial culture based on morphology, colony characteristics, motility, biochemical reaction and anti biogram
6. Antibiotic sensitivity testing -Kirby Bauer method
7. Stool examination
8. Saline mount
9. Iodine mount
10. Peripheral smear examination for malaria and filariasis

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

SCHEME OF EXAMINATION -THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology II shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Long essay	3 (attempt 2)	2 x 10	20
Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Microbiology II Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Spotters	20
ZN staining	10
Pure culture of the organism	25
Stool examination	15
Record	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

B.Sc Medical Laboratory Technology

2nd year

PATHOLOGY II

No. Theory classes: 100 hours

No. Practical classes: 80 hours

Theory:-

Histopathology and Hematology

Histopathology

- Instrumentation :**
- Automated Tissue Processor
 - Microtomes, Knives, Knife sharpnersand Ultramicrotome
 - Freezing microtome and Cryostat
 - Automatic slide stainer

Techniques : Receiving the specimen

Grossing, fixation

Tissue processing, decalcification, section cutting

Haematoxylin, H&E Staining

Frozen section and Cryostat section studies

Staining techniques: Special stains for Carbohydrates, Connective tissue, Nervous tissue, Bone tissue, Collagen fibers, Elastic Fibers, Lipids, Organisms, fungi, parasites, pigments and deposits in tissues

Mounting techniques: Various mounts and mounting techniques

Electron Microscope, Scanning electron microscope, Dark ground and

Florescent microscope

Museum technology

Microphotography and its applications

Maintenance of records and filing of slides

ICDS Classification and coding

Application of computers in Pathology

Hematology

Hemopoiesis, Stem cells, formed elements and their functions

Anticoagulants used in various hematological studies

Routine hematological tests and normal values:

(a) Determination of Hemoglobin and Hematocrit

(b) Enumeration of RBC, WBC & Platelets

(c) Absolute Eosinophil count

(d) Reticulocyte count

(e) Calculation of Red cell Indices

(f) Preparation of staining of blood film for morphology of red cells and differential count

Special Hematological tests:

(a) Sickling tests

(b) Osmotic fragility test

(c) Determination HbF and HbA₂

(d) Hemoglobin Electrophoresis

(e) Investigation of G6PD deficiency

(f) Plasma haptoglobin and demonstration of hemosiderin in urine

(g) Tests for Autoimmune hemolytic anemia

(h) Measurement of abnormal Hb pigments

Hemostasis and Coagulation

(a) Normal hemostasis, mechanism of blood coagulation and normal fibrinolytic system

(b) Collection of blood and anticoagulants used in coagulation studies

(c) Investigation of hemostatic mechanism-BT, CT, whole blood coagulation time test, PT, PTT

(d) Assay of clotting factors

(e) Tests for fibrinolytic activity- Euglobulin, clot lysis test and FDP

(f) Platelet function tests

Investigation of Megaloblastic anemia and Iron deficiency anemia

(a) B₁₂ and Folate assay and Schilling test

(b) Estimation of serum iron and iron binding capacity Bone marrow biopsy study

- (a) Needle aspiration and surgical biopsy technique
- (b) Preparation of smears and staining

Demonstration of LE cells

Cytochemistry

Administration in Hematology and Quality control

Practicals:

1. Paraffin section cutting
2. Staining by Hematoxylin & Eosin and other special stains
3. Determination of Hemaglobin and Hematocrit
4. Red blood cell count
5. Total white blood cell count
6. Platelet count
7. Differential count of white blood cells
8. Absolute Eosinophil count
9. Reticulocyte count
10. Calculation of red cell indices
11. Determination of ESR
12. Determination of BT, CT, Whole blood clotting time
13. Determination of PT and PTT
14. Blood smear preparation and staining
15. Osmotic fragility test
16. Sickling test
17. LE cell preparation

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

Scheme of examination: Theory

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology II shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB- TOTAL
LONG ESSAY (LE)	3 (to attempt 2)	2 x 10	20
SHORT ESSAY (SE)	8 (to attempt 6)	6 x 5	30
SHORT ANSWER (SA)	12 (to attempt 10)	10 x 3	30
GRAND TOTAL			80

Scheme of Examination: Practical

Distribution of marks

Type of Question	Marks allotted
Haematoxylin and eosin or a special stain	10
Haemoglobin or PCV	10
Total count	10

Differential count	10
ESR	10
PS preparation and staining	10
Record	10
Spotters	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

SUBSIDIARY SUBJECTS

SOCIOLOGY

Teaching Hours: 20

Course Description

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and thevarious social factors affecting the family in rural and urban communities in India will bestudied.

Introduction:

Meaning – Definition and scope of sociology

Its relation to Anthropology, Psychology, Social Psychology

Methods of Sociological investigations – Case study, social survey, questionnaire,interview and opinion poll methods.

Importance of its study with special reference to health care professionals

Social Factors in Health and Disease:

Meaning of social factors

Role of social factors in health and disease

Socialization:

Meaning and nature of socialization

Primary, Secondary and Anticipatory socialization

Agencies of socialization

Social Groups:

Concepts of social groups, influence of formal and informal groups on health and sickness. The role of primary groups and secondary groups in the hospital andrehabilitation setup.

Family:

The family, meaning and definitions

Functions of types of family

Changing family patterns

Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

Community:

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community – Meaning and features – Health hazards of urbanities

Culture and Health:

Concept of Health

Concept of culture

Culture and Health

Culture and Health Disorders

Social Change:

Meaning of social changes

Factors of social changes

Human adaptation and social change

Social change and stress

Social change and deviance

Social change and health programme

The role of social planning in the improvement of health and rehabilitation

Social Problems of disabled:

Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems

Population explosion

Poverty and unemployment

Beggary

Juvenile delinquency

Prostitution

Alcoholism

Problems of women in employment

Social Security:

Social Security and social legislation in relation to the disabled

Social Work:

Meaning of Social Work

The role of a Medical Social Worker

Reference Books:

1. Sachdeva & Vidyabhushan, Introduction to the study of sociology
2. Indrani T.K., Text book of sociology for graduates nurses and Physiotherapy students, JP Brothers, New Delhi 10

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

No Practical or Viva voce examination

This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

INDIAN CONSTITUTION

Prescribed for the First Year students of all degree classes

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

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

Unit-III: Fundamental Rights and Duties their content and significance.

Unit – IV: Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.

Unit – V: Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.

Unit-VI: Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India.

Unit – VII: The Election Commission and State Public Service commissions.

Unit – VIII: Method of amending the Constitution.

Unit – IX: Enforcing rights through Writs:

Unit – X: Constitution and Sustainable Development in India.

Reference Books: 1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.

2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.

3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

ENVIRONMENT SCIENCE AND HEALTH

Introduction to Environment and Health

Sources, health hazards and control of environmental pollution

Water

The concept of safe and wholesome water.

The requirements of sanitary sources of water.

Understanding the methods of purification of water on small scale and large scale.

Various biological standards, including WHO guidelines for third world countries.

Concept and methods for assessing quality of water.

Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issues related to their disposal.

Awareness of standards of housing and the effect of poor housing on health.

Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

Recommended Books.

1. Text Book of Environmental Studies for under graduate courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

III year - B.Sc., Medical Laboratory Technology

Biochemistry III

No. Theory classes: 100 hours

No. Practical classes: 80 hours

1.Laboratory Management

- Soft skills in patient handling
- Clinical automation- different types of automation
- Quality assurance in clinical laboratory- control of Pre analytical, analytical & post analytical variables
- General approach to quality control . Commonly used terms; accuracy, precision specificity, sensitivity, mean , standard deviation, co-efficient variation ,bias, errors etc
- Preparation of quality control sera, internal quality control, control charts & westgard rules
- External quality control
- Biological reference intervals

2. Techniques: Principle, instrumentation, application

- Flame photometry
- Atomic absorption spectrophotometry
- Ion selective electrodes
- Agarose gel electrophoresis
- Immunochemical assays; RIA, ELISA, Chemiluminescence
- Osmometry

3. Clinical enzymology

- Sources of Plasma enzymes. Units of enzyme activity
- Diagnostic importance of enzymes
- Isoenzymes, cardiac troponins

4. Plasma proteins

- Total proteins
- Functions & clinical importance of- albumin , Globulins – acute phase proteins (CRP, Ceruloplasmin, AAT, Immunoglobulins) . Genetic deficiency & disorders

- Electrophoretic separation of plasma proteins .-pattern, interpretation , reference intervals etc

5. Metabolism of Carbohydrates;

- HMP shunt Pathway & its significance
- Uronic acid pathway
- Metabolism of Galactose & Fructose,
- disorders

6. Lipid metabolism

- Cholesterol pool ; Body cholesterol & and cellular. Excretion of cholesterol.
- Lipoproteins; Classification based on separation and Electrophoretic mobility.
- Functions & Metabolism
- Hyperlipoproteinemias
- Lipid profile & coronary artery diseases

7. Amino acid metabolism

- Catabolism of Branched chain amino acids , Phenyl alanine / tyrosine metabolism .
- Pathway disorders; Phenyl ketonuria, Alkaptonuria, Maple syrup urine diseases

8. Molecular genetics

- Protein biosynthesis – eukaryotic
- Semiconservative DNA replication, Transcription , Translation
- Mutations & cancer

9. Tumor markers

- Definition, Classification, and clinical applications.
- Overview of specific tumor markers; AFP, CEA, CA-125, PSA, ALP, hCG

10. Acid base balance

- Regulation of pH
- Disorders
- Blood gases; symbols, reference intervals for arterial blood gasses, procedure for arterial blood collection , preanalytical variables

11. Liver

- Role of liver in metabolism , functions of liver
- Liver enzymes

- Formation of Bilirubin
- Jaundice
- Panel of Liver function tests in clinical laboratory
- Formation & analysis of gall stones.

12. Pancreatic function tests

- Functions of pancreas, Composition of Pancreatic juice
- Clinical utility of enzyme determination in pancreatitis.

13. Thyroid function tests

- Overview of Functions of Thyroid Hormones
- Clinical utility and methods for the measurement of Circulating thyroid hormones.

14. Renal function tests & Renal Calculi

- Glomerular function test ; Clearance tests (Urea, creatinine, Inulin clearance tests)
- Tests for tubular function ; Concentration and dilution tests, Measurement of specific gravity and osmolality
- Urinary acidification tests ; ammonium chloride loading test.
- Formation & analysis of Renal calculi

15. Cardiac markers

- Chemistry & overview of cardiac markers
- Diagnostic & prognostic use of cardiac markers
- Laboratory evaluation.

16. Overview of Body Fluids ;

- Quantitative analysis of different types of fluids; CSF, Synovial, peritoneal, Pleural, pericardial and Ascitic fluids.

17. Detoxification & biotransformation of Xenobiotics

18. Measurements in clinical laboratory ;

- Quantitative estimations; Selecting a method, linearity of a method, end point and rate reaction methods.
- Checking accuracy & precision.
- Calibration; Preparation of calibration curve, importance of calibration curve
- Techniques of preparation of calibration curve using stock standard solutions.
- Graphic representation of calibration.

ASSIGNMENT TOPIC;

- Laboratory design
- Laboratory safety & first aid in laboratory
- Point care of testing

PRACTICALS;

I. QUALITATIVE;

- 1. Renal calculi**
- 4. Gall stone analysis**
- 5. Urine Analysis; normal and Abnormal**
- 6. Spot test for; Phenyl ketonuria , Alkaptonuria, MSUD**

II. QUANTITATIVE;

- 3. Concept of preparation of buffered substrate , use of control serum etc.**
- 4. Quantitative estimations by manual methods- Preparation of calibration curve, & estimation of unknown analyte concentration.**

- Total protein& albumin by biuret method & calculation of A/G ratio
- Albumin by BCG (Bromo cresol green) method.
- Total & conjugated bilirubin by Malloy & Evelyn method
- AST and ALT by Bergmeyer method
- ALP by Kind & Kingmethod by using 4- Aminoantipyrine.
- Pancreatic amylase by Somogyi method
- Serum calcium by o- cresolphthalein and Phosphate in the serum by Fiske subbarao method(care & cleaning of tubes before and after analysis)
- Serum Cholride by method of Schales & Schales

III. PRACTICAL DEMONSTRATION;

1. Electrolyte & Arterial blood gas measurements
2. Agarose gel electrophoresis for serum proteins
3. Automated analyzers
4. Semi automated and automated methods for
 - Lipid profile,
 - T3,T4,TSH

- Troponin T or I , CK, Ck-MB

IV. CASE REPORTS;

- Inborn errors of Galactose, pentose, Fructose.
- OGTT curves
- Jaundice
- Acid base imbalances
- Electrophoretogram- normal, abnormal
- Cardiac markers
- Lipid disorders
- Tumor markers

Total theory hours; 100

Practical ; 80

SCHEME OF EXAMINATION THEORY;

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Biochemistry II shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUBTOTAL
Long essay type	3 (attempt 2)	2x 10	20
Short essay type	8 (attempt 6)	6x5	30
Short answer	12 (attempt 10)	10x3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION PRACTICAL

The scheme of examination for Biochemistry II practical shall be as follow ;

Distribution of Marks

TYPE OF QUESTION	MARKS ALLOTTED
Quantitative estimation	30
Renal calculi	20
Urine examination	20
Case reports	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals		
Theory	Viva Voce	IA	Sub total	Practicals	IA	Sub total
80	----	20	100	80	20	100

Text Book References

- Biochemistry –by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry by D.M Vasudeva & Sreekumari S
- Textbook of Medical Biochemistry- by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology by Godkar and Godkar.
- Biochemistry- by Pankaja Naik
- Medical Laboratory technology by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students- by Shivananda Nayak B
- Varley’s Practical Clinical Biochemistry
- Clinical chemistry ,theory, analysis, correlation , by Lawrence A Kaplan
- Tietz textbook of clinical chemistry by Burtis , Ashwood and Burns .

- Biophysical chemistry – principles & techniques by Uphadhay
- Clinical diagnosis and management by laboratory methods, Jhon Bernald Henry

MICROBIOLOGY III
(Immunology, Virology and Mycology)

THEORY: 100 HOURS

PRACTICALS: 80 HOURS

I. IMMUNOLOGY

1. Infection 2 hrs

2. Immunity 4 hrs

- Innate immunity
- Acquired immunity (adaptive immunity)
- Active and passive immunity

3. Immune system

- Cell development
- B lymphocytes (general knowledge of their role)
- T lymphocytes
- Natural killer cells

4. Immune responses

- Humoral Immunity, Cell mediated immunity
- Antigen & Antibody
- Primary and secondary responses
- Theories of antibody productions
- Monoclonal Antibodies (production and applications)

5. Antigens

6. Antibodies

- Properties of Antibodies (immunoglobulins)
- Classes of immunoglobulins

7. Antigen-antibody reactions

Precipitation, Agglutination, ELISA, Immunofluorescence and miscellaneous tests.

8. Complement system

9. Hypersensitivity reactions

Immediate and delayed type

10. Autoimmunity

11. Transplantation and malignancy immunity

12. Immunodeficiency diseases

II. Virology

- General properties of virus, cultivation of viruses
- Pox viruses, Herpes viruses, Adenoviruses
- Picornaviruses, Orthomyxoviruses,
- Paramyxoviruses, Arboviruses, Rhabdoviruses
- Hepatitis viruses, Oncogenic viruses, HIV, Parvovirus
- Viral haemorrhagic fevers, SARS, Slow viruses
- Rotavirus, Norwalk virus, Astrovirus, Corona virus

III. Mycology

1. Introduction of Mycology, Classification
 2. Lab Diagnosis of Fungal Infections
 3. Mycoses
 - a. **Superficial Mycoses**
Malsezzia furfur, T. nigra, T. pidera
 - b. **Dermatophytes**
 - c. **Subcutaneous Mycoses**
Mycetoma, Rhinosporidium, Sporotrichosis, Chromomycosis
 - d. **Systemic Mycoses**
Histoplasmosis, Blastomycosis, Coccidioidosis, Paracoccidiosis
 - e. **Opportunistic fungi**
Aspergillosis, Penicillosis, Zygomycosis, Pneumocystis
 - f. **Candida, Cryptococcus**
3. Mycotoxins and antifungal agents.

Practicals

1. Immunology: Serological tests

Principle, procedure, normal values, significant titer, interpretation and limitation of the following tests

WIDAL, Brucella

VDRL, RPR

ASO, CRP, RF

ELISA for HbsAg, HIV

2. Virology

Demonstration of embryonated egg inoculation/ animals/inclusion bodies

Virology exercise

ELISA (HIV, HBV)

Western blot

Spot test (tridot/immuno comb test)

3. Mycology

Slide culture techniques

KOH mount

Identification of fungal culture

Macroscopic and microscopic examination of candida, Cryptococcus,

Dermatophytes, aspergillus, rhizopus, mucor, penicillium

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

SCHEME OF EXAMINATION -THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Microbiology III shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Long essay	3 (attempt 2)	2 x 10	20
Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Microbiology III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Virology exercise	10
Mycology 2 exercise	15
Serology(Widal/ Brucella)	15
Serology (ASO/ CRP RPR/ RF)	10
Spotters	20
Record	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

PATHOLOGY III

Cytology, Automation in cytology, Cytogenetics, Cytochemistry, Immunohaematology and Blood transfusion

No. Theory classes: 100 hours

No. Practical classes: 80 hours

Cytology

1. Normal cell structure, functions, cytologic criteria of malignancy
2. Types of specimens, methods of collection & preparation of cell block
3. Different fixatives and methods of fixation
4. Staining : (a) Papanicolaou's stain- principle , preparation and staining techniques
(b) May Grunwald Giemsa stain
(c) Shorr's stain
(d) Aceto orcin stain

Female Genital tract

1. Anatomy, Histology, Physiology & normal cytology
2. Techniques of collection of specimen for cervical cytology study
3. Hormonal cytology and cytological indices
4. Cervical cytology screening for malignant and nonmalignant conditions, Radiation changes & follow up
5. Cytology of Endometrium – normal, nonmalignant and in malignant conditions
6. Cytology in Ovarian cancers

Respiratory tract, Gastrointestinal tract and Urinary tract

1. Anatomy, Histology and Physiology
2. Collection of sample, preparation of smears and staining
3. Cytology of normal, nonmalignant & malignant conditions

C S F and Effusions

1. Cytology of CSF in inflammatory, nonmalignant & malignant conditions
2. Cytology of effusions in nonmalignant and malignant conditions

Glands – Breast, Thyroid, Salivary glands and Lymph nodes

1. Anatomy, Histology and Physiology
2. Fine needle aspiration cytology of glands and other soft tissue mass
3. Cytologic features in nonmalignant and malignant conditions of different glands and nipple discharges

Automation in Cytology

1. Flow cytometry
2. Image Analysis
3. Principles, Equipments, procedures & Evaluation

Tissue culture and Immunohistochemistry

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

Cytogenetics

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

Immunocytochemistry

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

Immunohematology and Blood transfusion

1. ABO Blood group and Rh system
2. Subgroups of A and B, Other blood groups and Bombay group
3. HLA antigens and their significance
4. Principles of Blood transfusion:
 - (a) Blood donor selection
 - (b) Methods of bleeding donors
 - (c) Blood containers, anticoagulants and storage of blood
 - (d) Coomb's test and its significance
 - (e) Screening of blood for infective material
 - (f) Blood components, preparation & component therapy
 - (g) Autologous transfusion
 - (h) Transfusion reactions and work up
 - (i) Blood bank organization, standards, procedures, techniques and quality control

Practicals

Preparation of various cytology smears and fixation

1. Papanicolaou's and May Grunwald Geimsa staining
2. Hormonal cytology study
3. Blood grouping and Rh typing
4. Cross matching techniques
5. Screening of Donor's blood for infective agents
6. Transfusion reaction work up
7. Preparation of blood components

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted 20

Practicals: record and lab work* 20

SCHEME OF EXAMINATION -THEORY

There shall be one theory paper of three hours duration carrying 80 marks. Distribution of type of questions and marks for Pathology III shall be as given under.

TYPE OF QUESTION	NUMBER OF QUESTIONS	MARKS	SUB-TOTAL
Long essay	3 (attempt 2)	2 x 10	20
Short essay	8 (attempt 6)	6 x 5	30
Short answer	12 (attempt 10)	10 x 3	30
GRAND TOTAL			80

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Pathology III Practical shall be as follows: Distribution of marks

Type of Question	Marks allotted
Pap stain	20
Blood grouping and typing	10
Cross matching	15
Coomb's test	15
Spotters	10
Record	10
Total	80

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
80	-	20	100	80	20	100	200

SUBSIDIARY SUBJECTS

BIO STATISTICS

Time Allotted: 20 Hours

Course Description:

Introduction to basic statistical concepts: methods of statistical analysis; and interpretation of data

Behavioral Objectives:

Understands statistical terms.

Possesses knowledge and skill in the use of basic statistical and research methodology.

Unit – I : Introduction

Meaning, definition, characteristics of statistics.

Importance of the study of statistics.

Branches of statistics.

Statistics and health science including nursing.

Parameters and estimates.

Descriptive and inferential statistics.

Variables and their types.

Measurement scales

Unit – II : Tabulation of Data

Raw data, the array, frequency distribution.

Basic principles of graphical representation.

Types of diagrams - histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, ogive.

Normal probability curve.

Unit - III : Measure of Central Tendency

Need for measures of central tendency

Definition and calculation of mean - ungrouped and grouped

Meaning, interpretation and calculation of median ungrouped and grouped.

Meaning and calculation of mode.

Comparison of the mean, and mode.

Guidelines for the use of various measures of central tendency.

Unit - IV : Measure of Variability

Need for measure of dispersion.

The range, the average deviation.

The variance and standard deviation.

Calculation of variance and standard deviation ungrouped and grouped.

Properties and uses of variance and SO

Unit -V : Probability and Standard Distributions.

Meaning of probability of standard distribution.

The Binominal distribution.

The normal distribution.

Divergence from normality - skewness, kurtosis.

Unit - VI : Sampling Techniques

Need for sampling - Criteria for good samples.

Application of sampling in Community.

Procedures of sampling and sampling designs errors.

Sampling variation and tests of significance.

Unit - VII : Health Indicator

Importance of health Indicator.

Indicators of population, morbidity, mortality, health services.

Calculation of rates and rations of health.

Recommended Books.

B.K. Mahajan & M. Gupta (1995) Text Book of Preventive & Social Medicine, 2002,17th Edition Jaypee Brothers.

BASICS IN COMPUTER APPLICATIONS

Time allotted: 20 hours

The course enables the students to understand the fundamentals of computer and its applications.

Introduction to Data processing :

Features of computers, Advantages of using computers. Getting data into / out of computers. Role of computers. What is Data processing? Application areas of computers involved in Data processing. Common activities in processing. Types of Data processing, Characteristics of information. What are Hardware and Software?

Hardware Concepts :

Architecture of computers, Classification of computers, Concept of damage. Types of storage devices. Characteristics of disks, tapes, Terminals, Printers, Network. Applications of networking concept of PC System care, Floppy care, Data care.

Concept of Software.

Classification of software : System software. Application of software. Operating system. Computer system. Computer virus. Precautions against viruses. Dealing with viruses. Computers in medical electronics
Basic Anatomy of Computers

Principles of programming

Computer application - principles in scientific research ; work processing, medicine, libraries, museum , education, information system.

Data processing

Computers in physical therapy - principles in EMG, Exercise testing equipment, Laser.

No Practical or Viva voce examination