

**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.

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 Saturday's students shall work in hospitals in the respective speciality 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
Computer application	10 Hours

9. 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.

10. 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

- 05 papers in the 1st year
- 03 papers in the 2nd Year
- 03 papers in the 3rd Year.

Practical examination:

- There shall be no practical examination in the first year.
- Three practical examinations, at the end 2nd Year.
- 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	100	20	120
2	Physiology	3 Hours	100	20	120
3	Biochemistry	3 Hours	100	20	120
4	Pathology	3 Hours	100	20	120
5	Microbiology	3 Hours	100	20	120
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 Distribution of 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	100	20	120	80	20	100	220
II	Microbiology II	100	20	120	80	20	100	220
III	Pathology II	100	20	120	80	20	100	220

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	100	20	120	80	20	100	220
II	Microbiology III	100	20	120	80	20	100	220
III	Pathology III	100	20	120	80	20	100	220

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.

11. Pass criteria

11.1. 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 subject 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.

11.2. 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 subject 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.

12. Carry over benefit

12.1 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.

12.2. 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.

13. 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.

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)]

14. 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 12 months of rotational internship. On completion of 12 months of the internship with pass criteria in outgoing clinical assessment exams the candidate is then eligible for the award of degree.

15. Distribution of Type of Questions and Marks

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Subsidiary subjects)		
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

INTERNSHIP

Twelve-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. Hematology – 1 month
3. Clinical Biochemistry - 2 months
4. Clinical Microbiology – 1 months
5. Blood banking - 1 month
6. Phlebotomy – 1 month
7. Serology – 1 month
8. Histopathology – 1 month
9. Cytology – 1 month
10. Project work – 2 months

NOTE: - At the end of internship there will be a practical exam, conducted by one Internal and one External examiner.

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 his to pathological 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
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

PROJECT

Each student is encouraged to take up a research project in the area of his/her liking. The project should be original and should have considerable clinical relevance. The concerned faculty members guide the student in his/her project. After completing the project, each student has to submit a complete report of their respective projects

PROJECT GUIDELINES

All B.Sc MLT degree students enrolled in the Rajiv Gandhi University of Health Sciences should complete a scholarly project as partial fulfillment of requirements for the award of B.Sc MLT (MEDICAL LABORATORY TECHNOLOGY) degree.

What is a project?

A Project is a preliminary form of research. It is an independent investigation. It is very largely the student's own work and is to be pursued by them from the inception till completion. It involves the student in a hands-on project led by a research supervisor/ faculty advisor who will choose, develop and guide the project from its inception to completion.

Purpose of a project work

The purpose of the Project Work is to enable the student to gain practical experience. It enables the student to meet program objectives through development of an appreciation of the interrelations between theory research and practice. A project forms an introduction to scientific thinking and working.

Project suggestions

Prior to the practical work, students work out a concept with their supervisor that could include any of the following points:

- Scientific question
- Educational objectives (which methods have to be mastered and understood)
- Recent trends in the respective fields
- Case study
- Prospective studies
- Retrospective studies

This scholarly project provides the student with the opportunity to participate in a mentored research experience. The student will actively participate in a research project throughout all current applicable phases of the project such as the case study, problem statement development, review of the literature, hypotheses formation, proposal writing, study design, data collection, data analysis, and result reporting. This may be done as a group project.

Project supervision

The supervisor schedules the project work together with the student and provides an introduction to all laboratory skills that are needed. She or he is then the contact person for all questions and problems during the project. If required, she or he may also ask for a progress report and preliminary results while the project is still ongoing.

The eligibility academic qualification and teaching experience required for recognition as research supervisor and faculty advisor by the RGUHS are:

- a. Eligibility to be a research supervisor and faculty advisor
Shall be a full time teacher in the college or institution where he or she is working.
- b. Academic qualification and teaching/professional experience for each branch
 - Research supervisor (RS)- five years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by RGUHS
 - Faculty advisor (FA)- three years of teaching/ professional experience after the postgraduate qualification in a teaching institution or laboratory approved by RGUHS
- c. Age:
The age of the RS/ FA shall not exceed 65 years.

Assessment

Four copies of the project report should be submitted to the Principal along with a soft copy (CD), three months before the Internship Practical examinations. Projects are assessed with a written report and a seminar. The written report and the presentation, as well as the practical work in the laboratory are to be assessed during Internship Practical Examination.

GUIDELINES FOR THE PREPARATION OF PROJECT REPORTS

1. The project report should be typed in Times New Roman. The size of the titles should be 14 and Bold and the size of the subtitles should be 12 and bold.
2. The matter should have double spacing except for long quotations, footnotes and endnotes, which are single spaced. The left-hand margin must be 1.5", other margins should be 1.0".
3. The project report should be hardbound.
4. The project report should be organized in the following subdivisions:
 - a. Title page
 - b. Certificate
 - c. Acknowledgement
 - d. List of abbreviations used
 - e. Table of contents
 - f. Introduction
 - g. Main project
 - h. Summary of the project work
 - i. List of references
 - j. Annexures

a. Title page

<-----Title----->
<-----Subtitle----->

by
Name of the Candidate
Project Report

In partial fulfillment
of the requirements for the degree of
Degree Name
in
Subject Name
Under the guidance of
Name of the RS and FA
Name of the Department
Name of the College
Place
Year

b. Certificate

CERTIFICATE BY THE RESEARCH SUPERVISOR

This is to certify that the project report entitled "<-----Title----->" is a bonafide research work done by Name of the Candidate in partial fulfillment of the requirement for the degree of Degree Name.

Signature of the Research Supervisor

Name
Designation & Department

Date:

Place:

ENDORSEMENT BY THE HOD, PRINCIPAL/HEAD OF THE INSTITUTION

This is to certify that the project report entitled "<-----Title----->" is a bonafide research work done by Name of the Candidate under the guidance of Name & designation of the Guide.

Seal & Signature of the HOD

Seal & Signature of the Principal

Name

Name

Date:

Place:

c. Acknowledgement

The inclusion of a paper of Acknowledgment is a traditional practice in the write up of the Project Work. This permits the candidate to write a brief perface and acknowledge the help received from persons and organizations.

d. List of abbreviations used

e. Table of Contents

f. Introduction

This section includes a brief write up about the topic, its scope and importance as well as relation to any previous studies done in the particular topic. It should also mention any present developments.

g. The main project

The main project should be divided into various sections as per the demand of the topic.

h. Summary of the project work

i. List of References (Vancouver Style)

References should be numbered consecutively in the order in which they are first mentioned in the text; they should not be listed alphabetically by author or title or put in date order.

j. Annexures

POINTS TO KEEP IN MIND

- The project work should be an original document and, candidates should maintain the originality.
- The candidate should not copy or reproduce anyone else's published or unpublished project.
- Any arguments that are put forward in the project should be supported with appropriate data.
- Proper documentation of the information is very important.
- The methodology to be used should be very clearly stated in the beginning of the work.
- Plagiarism should be avoided.

CLINICAL POSTING:

A student after having successfully completed the final year university examination is qualified to commence the Compulsory Rotatory ONE year Internship. The completion of Internship is mandatory to enable a student to obtain the B.Sc MLT degree.

GUIDELINES

- Interns should complete postings in all specialities as decided by the department
- The interns should conduct themselves in a manner befitting the profession.
- The intern should dress appropriately in the clinical areas
- It is mandatory for the intern to wear the white apron with nametag while attending clinics
- Each intern should maintain a logbook wherever he/she is posted. The intern has to get signature from the supervising staff at the end of each posting
- Log book should be submitted to the Head of the department at the end of each posting of internship after the period of posting
- Assignments/presentations given during the period of internship has to be duly undertaken and performed.
- Internship completion certificate will be issued from the College office only after passing in the Internship Practical Examination.
- The intern in the parent institute will get a monthly stipend.
- The intern will be allowed to attend the National Conference, leave will be granted only for the days of conference and travel days. Any other leave declared by the University for the students will not apply to the interns

I YEAR B.Sc. MLT

ANATOMY

Theory: 70hrs

Practicals: 20hrs

Chapter 1: Introduction:

Theory:

- Definition of anatomy and its divisions
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

Practical:

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

Chapter 2: Connective tissue:

Theory:

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)
- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

Practical:

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

Chapter 3: Cardiovascular system:

Theory:

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

Practical:

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

Chapter 4: Gastro-intestinal system

Theory:

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

Practical:

- Demonstration of parts of GIT
- Radiographs of abdomen

Chapter 5: Respiratory system

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

Chapter 6: Urinary system

Theory:

- Kidney, ureter, urinary bladder, male and female urethra
- 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

Chapter 7: Reproductive system

Theory:

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & 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, ovary
- Radiographs of pelvis – hysterosalpingogram

Chapter 8: Endocrine glands

Theory:

- Names of all endocrine glands in detail on pituitary gland, thyroid gland & suprarenal gland –(gross & histology)

Practical:

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

Chapter 9: Nervous system

Theory:

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

Practical:

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

Chapter 10: Sensory organs

Theory:

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

Practical:

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

Chapter 11: Embryology:

Theory:

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

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 100 marks.

Distribution of type of questions and marks for Anatomy shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks
- Total= 100**

Distribution of Marks for University Theory and Practical Exam

Theory			Practicals			Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	*			120

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

1. General Physiology

Introduction to cell physiology, transport across cell membrane Homeostasis, Body Fluid compartment & measurement.

2. Blood

Introduction- composition and function of blood Plasma. proteins, types and functions

Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.

Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice-types Anaemia,-types

ESR, PCV, osmotic fragility & blood indices

WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)

Platelets- origin, morphology, normal count, function-Platelet plug ,bleeding disorder Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.

Blood group-ABO & Rh system, Rh incompatibility blood typing ,cross matching, hazards of mismatched blood transfusion

RES, spleen and lymph.

3. Nerve-Muscle

Neuron structure, types, neuroglia-types, nerve fibre classification, properties of nerve fibres, RMP,action potential, wallerian degeneration

NMJ, blockers, Myasthenia gravis

Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins Excitation contraction coupling, mechanism of muscle contraction, types of contraction

Motor unit, fatigue, rigor mortis Smooth muscle.

4. Respiratory system

Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space

Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease

Lung volumes and capacities

Respiratory membrane , transport of O₂ & CO₂

Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclimatization, Dysbarism. Artificial respiration

Definition-Periodic breathing, dyspnoea, apnoea, asphyxia,, cyanosis.

5. Cardiovascular system

Introduction to CVS & general principles of circulation Properties of Cardiac muscle

Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate

BP-factors, measurement, Short term regulation Intermediate and long term regulation of BP

ECG uses and significance, .normal waveform, heart block Coronary circulation, Cutaneous circulation-Triple response Shock

Effects of exercise on CVS and Respiratory system.

6. Renal system, Skin and body temperature

Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non- excretory functions of kidney

Glomerular filtration rate (GFR)- Definition ,normal value, factors affecting GFR Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption Tubular

secretion- sites, substance secreted, mechanisms of reabsorption

Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics

Artificial kidney, renal function tests-clearance tests

Skin -structure and function, body temperature measurement, physiological variation,

Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus Hypothermia and fever.

7. Digestive system

Physiological anatomy, Enteric nervous system & functions of GIT Saliva- composition, regulation, disorder.

Deglutition- stages & disorders

Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex.

Pancreas- function, composition and regulation of pancreatic juice

Liver & gall bladder-functions, bile- composition, secretion and regulation Small

intestine- Succus entericus-composition, functions & movements Large intestine- functions, movements and defecation reflex

Digestion & absorption of Carbohydrates, fats and proteins.

8. Endocrine system

Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.

Anterior pituitary hormones- secretion, functions , disorders Posterior pituitary

hormones- secretion , functions , disorders Thyroid hormones- secretion, functions,

Disorders Parathyroid hormones- secretion, functions, disorders Calcium homeostasis &

disorders Pancreatic hormones, -Insulin and Glucagon- . secretion, functions, disorders

Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions,

disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

9. Reproductive system

Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis

Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual cycle

Physiological changes during pregnancy, pregnancy tests, parturition & lactation Male & Female contraceptive methods.

10. Central nervous system

Introduction to CNS, Sensory receptors classification, properties Synapse– classification, properties

Sensory pathways: Anterior spino thalamic tract and Posterior column pathway

Lateral spino thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

Classification of reflexes, Monosynaptic reflex- Stretch reflex , muscle spindle ,inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex

Motor pathways : Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)-functions, Medulla and Pons-functions Cerebellum –functions, disorders

Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture

Sleep, EEG,

Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

11. Special senses

Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision

Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway,

deafness Olfaction –modalities, receptor, function, abnormalities

Gustation-modalities, receptor, function, taste pathway, abnormalities.

Practicals

Blood pressure Recording

Auscultation for Heart Sounds

Artificial Respiration

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 100 marks.
Distribution of type of questions and marks for Physiology shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

- | | |
|---|-------------------|
| 1. Long essay- 2 Questions (second question choice) | 2x10= 20 marks |
| 2. Short essay- 10 Questions (Questions no 5 &10 choice) | 10x5= 50 marks |
| 3. Short answer- 10 Questions (Questions no 15 & 20 choice) | 10x3= 30 marks |
| | Total= 100 |

Distribution of Marks for University Theory and Practical Exam

Theory			Practicals			Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	*			120

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

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 [5 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)
- Glycogen metabolism and gluconeogenesis.

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 [5 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 [3 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 regulating their levels.

12. Nutrition [6 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, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients)
- 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).
- Malnutrition

13. Renal Function Tests [2 hours]

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

14. Radioactive Isotopes [1 hour]

- Definition, clinical applications
- Biological effects of radiations

15. 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
- Serum Electrolytes

16. Fundamental Chemistry (1 hour)

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

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

ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

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

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 100 marks.

Distribution of type of questions and marks for Biochemistry I shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks
- Total= 100**

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals		Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	*			120

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions.

PATHOLOGY I

(Clinical Pathology, Hematology and Blood Banking)

Theory-70 hours

Practicals-20 hours

I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection , transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

II. Hematology – Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

III. Blood Bank- Theory

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

IV General Pathology:

1. Cell injury:

- a. Definition, causes.
- b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
- c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
- d. Necrosis – Definition and patterns of tissue necrosis.
- e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
- f. Pathologic calcification – Types and examples.

2. Inflammation:

- a. Definition and signs of inflammation.
- b. Types – Acute and chronic inflammation.
- c. Acute inflammation – Causes, morphological patterns and outcome.
- d. Chronic inflammation – Causes, morphology and examples.
- e. Regeneration and repair – Mechanism of cutaneous wound healing.
- f. Factors affecting wound healing.

3. Hemodynamic disorders:

- a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
- b. Difference between transudate and exudate.
- c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
- d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
- e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism.
- f. Infarction – Definition and examples.

4. Immune system:

- a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
- b. Systemic lupus erythematosus – Manifestations and diagnosis.

5. Neoplasia:

- a. Definition and nomenclature of tumors.
- b. Differences between benign and malignant neoplasms.
- c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.

- d. Modes of spread of tumors.
- e. Clinical aspects of neoplasia.
- f. Grading and staging of cancers.
- g. Laboratory diagnosis of cancer.

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.

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 100 marks. Distribution of type of questions and marks for Pathology I shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks
- Total= 100**

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals		Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	*			120

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
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996.

Microbiology I

Theory: 70 Hours

Practicals: 20 Hours

1. Introduction (6 hrs)

History of Microbiology - Louis Pasteur, Antony Van Leeuwenhoek, Robert Koch, Edward Jenner, Alexander Fleming.

Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.

Morphology of bacterial cell

2. Growth and Nutrition (6 hrs.)

Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

3. Sterilization and disinfection (8 hrs.)

Principles and use of equipments of sterilization, chemicals used in disinfection, testing of disinfectants.

4. Biomedical waste management principle and practice

5. Immunology (5hrs.)

Immunity - mechanism of immunity, classification, types

Vaccines

Immunization schedule

Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)

Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

6. Infection (5 hrs.)

Definition, types and mode of transmission

Hospital acquired infection - causative agents, mode of transmission and prophylaxis.

Antimicrobial sensitivity testing

7. Systematic bacteriology (15 hrs.)

Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, EITor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)
(no need of classification, antigenic structure, virulence mechanism)

8. Parasitology (10 hrs.)

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lambliia, T.solium, T.saginata)

Laboratory diagnosis of parasitic infection (No need of including life cycles)

9. Virology (10 hrs.)

Introduction to virology

List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses)

Cultivation of viruses and laboratory diagnosis of viral infections

10. Mycology (5 hrs.)

Introduction to Mycology

Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis)

Laboratory diagnosis of fungal infections.

Practicals (20 hrs.)

Compound microscope (Demonstration)

Demonstration of sterilization equipments

Demonstration of culture media and culture methods

Demonstration of antibiotic sensitivity testing

Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA

Demonstration of gram stain and ZN staining

Demonstration of Helminthic ova

Grams stain, Acid fast staining

Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practicals need not be sent to the university.

INTERNAL ASSESSMENT

Theory-average of 2 exams conducted	20
Practicals: record and lab work*	10

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Microbiology I shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks
- Total= 100**

Distribution of Marks for University Theory and Practical Exam

Theory			Practicals			Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	*			120

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

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
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

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

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
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

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

II YEAR B.Sc. MLT

BIOCHEMISTRY II

No. Theory classes: 100 hours No.

Practical classes: 80 hours

THEORY SYLLABUS

1. Clinical Laboratory [02 hours]

- Responsibilities of health care personnel
- Laboratory hazards – physical, chemical and biological, laboratory safety measures– safety regulations and first aid in laboratory

2. 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

3. 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**)

4. Units of measurement [1 hour]

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

5. Fundamental Chemistry[2 hours]

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

6. 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.

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 ; [6 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; [6 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; [6 hours]

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

11. Metabolism of lipids [3 hours]

- Ketogenesis, ketone bodies utilization, ketosis, Rothera's test and it's importance.

12. Metabolism of amino acids; [7hours]

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

13. 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.

14. Urine analysis; [4 hours]

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

15. 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
- Electrophoresis – agarose and SDS-PAGE

ASSIGNMENT TOPIC;

- Oral glucose tolerance test
- Glycated HbA1c
- Microalbuminuria

PRACTICALS

I. PRACTICAL APPROACH TO BASIC LABORATORY PRACTICES

1. Pipetting techniques

2. Operation 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, Lactose, Maltose
- NPN- Urea, creatinine, Uric acid
- Albumin, Casein

2. Precipitation reactions

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

3. Identification of unknown carbohydrate

4. Identification of unknown protein

5. 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 Glucose oxidase – peroxidase method**
- Blood urea by DAM method
- Serum & urine creatinine by Jaffe's method. Determination of creatinine clearance
- Serum uric acid by commercially available kit method

PRACTICAL DEMONSTRATION;

1. Paper chromatography of amino acids
2. Dipsticks for urine analysis

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 100 marks.

Distribution of type of questions and marks for Biochemistry II shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (No choice) 10x3= 30 marks
- Total= 100**

SCHEME OF EXAMINATION – PRACTICALS

The scheme of examination for Biochemistry II Practical shall be as follows: 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			Grand Total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani

Textbook of Biochemistry (For Medical Students)-5th Edition by DM Vasudevan & Sreekumari S

- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions
- Clinical Chemistry, Theory, Analysis, Correlation-4th edition by Lawrence A Kaplan
- Tietz Textbook of Clinical Chemistry 3rd edition by Burtis, Ashwood and Bruns
- Clinical Chemistry-Principles, procedures, correlations- 5th edition by Michael L. Bishop, Edward P. Fody and Larry Schoeff.
- Practical Clinical Biochemistry, methods and interpretation -2nd edition by Ranjna Chawla.

MICORBIOLOGY II

(SYSTEMATIC BACTERIOLOGY AND PARASITOLOGY)

No. of Theory hours - 100 hrs.

No. of Practical hours- 80 hrs

I SYSTEMATIC BACTERIOLOGY (60hrs)

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
- Actinomycetes

Gram negative bacteria:

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

Spirochetes and others:

- Treponemes, Leptospira & Borrelia

Applied Bacteriology:

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

Bacteriology of water, milk and air

II PARASITOLOGY (40 hrs.)

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:

Stainings

1. Gram staining, ZN stain, Albert stain
2. Hanging drop preparation
3. Culture methods
4. Introduction to biochemical reactions
5. Identifications of pure 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 100 marks.

Distribution of type of questions and marks for Microbiology II shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (No choice) 10x3= 30 marks
- Total= 100**

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	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

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.

PATHOLOGY II

No. Theory classes: 100 hours

No. Practical classes: 80 hours

Theory:-

Histopathology and Hematology Histopathology

Instrumentation:

- a) Automated tissue processor
- b) Microtomes, knives, knife, sharpner and ultra microtome
- c) Freezing microtome and Cryostat
- d) Automatic slide stainer

Techniques:

- Receiving specimens
- Grossing, fixation
- Tissue processing, Decalcification, Section cutting
- Haematoxylin & Eosin Staining
- Frozen section and Cryostat section studies

Staining techniques: Special stains for Carbohydrates, Connective tissue, Nervous tissue, Bone tissue, Collage 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 microscope
- Fluorescent microscope
- Museum technology
- Microphotography and its application
- Maintenance of records and filing of slides
- ICDS classification and coding
- Application of computers in pathology

HAEMATOLOGY

- Haemopoiesis, stem cells, formed elements and their functions
- Anticoagulants used in various haematological studies

Routine haematological tests and normal values :

- A) Determination of haemoglobin and Hematocrit
- B) Enumeration of RBC, WBC and platelets
- C) Absolute eosinophil count
- D) Reticulocyte
- E) Calculation of red cell indices
- F) Preparation and staining of blood film for morphology of red cells and differential count

Special haematological tests :

- A) Sickling test
- B) Osmotic fragility tests
- C) Determination of HbF and HbA2
- D) Haemoglobin electrophoresis
- E) Investigation of G6PD deficiency
- F) Plasma haptoglobin and demonstration of hemosiderin in urine
- G) Tests of autoimmune and 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
- C) Needle aspiration and surgical biopsy technique
- D) 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 Hemoglobin 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 100 marks.

Distribution of type of questions and marks for Pathology II shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

- | | |
|--|-------------------|
| 1. Long essay- 2 Questions (second question choice) | 2x10= 20 marks |
| 2. Short essay- 10 Questions (Questions no 5 &10 choice) | 10x5= 50 marks |
| 3. Short answer- 10 Questions (No choice) | 10x3= 30 marks |
| | Total= 100 |

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	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

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
9. Sathish Guptha , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, NewDelhi, 1996.

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 the various social factors affecting the family in rural and urban communities in India will be studied.

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 and rehabilitation 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

SUBJECTS HAVING MAXIMUM MARKS= 80 (for Second year)		
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

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.

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. MLT

Biochemistry III

No. Theory classes: 100 hours

No. Practical classes: 80 hours

THEORY SYLLABUS

1. Laboratory Management [6 hours]
 - **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 [14 hours]**
 - Atomic absorption spectrophotometry
 - Potentiometry, Ion selective electrodes
 - Agarose gel lectrophoresis
 - Immunochemical assays; RIA, ELISA, Chemiluminescence
 - Osmometry
 - Arterial Blood Gas analyzer
 - HPLC, Mass Spectrometry
 - Capillary Electrophoresis
3. **Clinical enzymology [4 hours]**
 - Sources of Plasma enzymes. Units of enzyme activity
 - Diagnostic importance of enzymes
 - Isoenzymes, cardiac troponins
4. **Plasma proteins [4 hours]**
 - Total proteins
 - Functions & clinical importance of- albumin , Globulins – accute phase proteins (CRP, Ceruloplasmin, AAT, Immunoglobulins) . Genetic deficiency & disorders
 - Electrophoretic separation of plasma proteins .-pattern, interpretation , reference intervals etc
5. **Metabolism of Carbohydrates; [8 hours]**
 - HMP shunt Pathway & its significance
 - Uronic acid pathway
 - Metabolism of Galactose & Fructose and associated disorders
 - Glycogen storage disorders
 - Sorbitol pathway
 - OGTT, OGCT, HbA1c

6. Lipid metabolism [6 hours]

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

7. Amino acid metabolism [6 hours]

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

8. Metabolism of nucleic acids [4 hours]

- Outline of Purine metabolism and associated disorders
- Outline of Pyrimidine metabolism and associated disorders

9. Molecular genetics [10 hours]

- Salient features of genetic code
- Protein biosynthesis – eukaryotic
- Semiconservative DNA replication, Transcription , Translation
- Mutations & cancer

10. Tumor markers [4 hours]

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

11. Acid base balance [6 hours]

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

12. Liver function tests [4 hours]

- 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.

13. Pancreatic function tests [2 hours]

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

14. Thyroid function tests [2 hours]

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

15. Renal function tests & Renal Calculi [4 hours]

- 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.
- Microalbuminuria and its importance
- Formation & analysis of Renal calculi

16. Cardiac markers [2 hours]

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

17. Overview of Body Fluids ; [1 hour]

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

18. Measurements in clinical laboratory ; [6 hours]

- 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.

19. Specimen collection; [1 hour]

- Color Codes of vacutainer tubes and its uses
- Order of sample draw

ASSIGNMENT TOPIC; [6 hours]

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

PRACTICALS;

I. QUALITATIVE;

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

II. QUANTITATIVE;

- 1. Concept of preparation of buffered substrate, use of control serum**
 - 2. 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 IFCC kit method
- ALP by DEA kit method.
- Serum amylase by (CNP3) substrate method
- Serum calcium by kit method
- Phosphate in the serum by Fiske Subbarow method(care & cleaning of tubes before and after analysis)
- Serum Chloride by method of Schales & Schales

III. PRACTICAL DEMONSTRATION;

- ❖ Electrolyte & Arterial blood gas measurements
- ❖ Agarose gel electrophoresis for serum proteins
- ❖ Automated analyzers
- ❖ Semi automated and automated methods for
 - Lipid profile,
 - T3,T4,TSH
 - Troponin T or I, CK, Ck-MB

CASE REPORTS;

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

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 100 marks.

Distribution of type of questions and marks for Biochemistry III shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (No choice) 10x3= 30 marks
- Total= 100**

SCHEME OF EXAMINATION PRACTICAL

The scheme of examination for Biochemistry III 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

Split up of marks for experiments:

Qualitative:

Carrying out color reactions of the given solution + Bench viva

II yr B.Sc.,	8 mks + 2 mks
III yr B.Sc.,	15 mks + 5 mks

Quantitative:

- a. Writing principle & procedure before conducting the experiment

II yr B.Sc.,	3 mks
III yr B.Sc.,	5 mks

- b. Standardisation of expt & determining unknown concentration+ Bench viva

II yr B.Sc.,	25mks + 2 mks
III yr B.Sc.,	40 mks + 5 mks

Distribution of Marks for University Theory and Practical Exam

Theory			Practicals			Grand total
Theory	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

Text Book References

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani
- Textbook of Biochemistry (For Medical Students)-5th Edition by DM Vasudevan & reekumari S
- Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde
- Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.

- Practical Clinical Biochemistry, methods and interpretation –2nd edition by Ranjna Chawla
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6th editions
- Clinical Chemistry, Theory, Analysis, Correlation-4th edition by Lawrence A Kaplan
- Tietz Textbook of Clinical Chemistry 3rd edition by Burtis, Ashwood and Bruns
- Clinical Chemistry-Principles, procedures, correlations- 5th edition by Michael L. Bishop, Edward P. Fody and Larry Schoeff.
- Biophysical chemistry-Principles and Techniques by Upadhyay, Upadhyay and Nath
- Clinical Diagnosis and management by laboratory methods 20th edition by John Bernard Henry
- Mark's Basic Medical Biochemistry- A clinical approach 2nd Edition by Smith, Marks and Lieberma.

MICROBIOLOGY III

(Immunology, Virology and Mycology)

Theory - 100 hrs.

Practicals- 80hrs.

I Immunology (40 hrs)

1. Infection

2. Immunity

- ❖ Innate Immunity
- ❖ Acquired Immunity (adaptive)
- ❖ 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 and antibody
- ❖ Primary and secondary responses
- ❖ Theories of antibody productions
- ❖ Monoclonal antibodies(production and applications)

5. Antigens

- ❖ Antigen (definition, types, factors of antigenicity)

6. Antibodies

- ❖ Properties of antibodies(immunoglobulins)
- ❖ Structures of immunoglobulin

- ❖ Classes of immunoglobulins

7. Antigen-antibody reactions

- ❖ Precipitation
- ❖ Agglutination
- ❖ ELISA
- ❖ Immunofluorescence and miscellaneous tests

8. Complement system

- ❖ Classical pathway
- ❖ Alternative pathway
- ❖ Biological effects of complement
- ❖ Regulation of complement activation

9. Hypersensitivity reactions

- ❖ Immediate and delayed type

10. Autoimmunity

11. Transplantation and malignancy Immunity

12. Immunodeficiency diseases

II. Virology (40 hrs)

1. General properties of virus, cultivation of viruses
2. Virus host interaction
3. Bacteriophage
4. Pox viruses
5. Herpes viruses (HSV, Varicella-Zoster, Cytomegalo virus, Epstein-Barr virus)
6. Adeno viruses
7. Picornaviruses
 - a. Enteroviruses (Polio virus, Echo viruses)
 - b. Rhinoviruses
- ❖ Orthomyxo viruses (Influenza virus)
- ❖ Paramyxo viruses (Parainfluenza virus, Mumps, Measles, RSV)
8. Arboviruses
 - a. Discuss in detail Chikungunya, Dengue, KFD
 - b. Enumerate remaining arbovirus with disease caused
9. Rhabdoviruses
10. Hepatitis viruses
11. HIV
12. Papova virus, Parvovirus, Corona virus
13. Rubivirus
14. Viruses causing gastroenteritis
 - Rotavirus, Norwalk virus, Astro Virus
15. Viral hemorrhagic fevers, SARS, Slow viruses
16. Oncogenic viruses

III Mycology (20 hrs)

1. Introduction to Mycology, Classification
2. Lab diagnosis of fungal infections

3. Mycoses
 - a. **Superficial Mycoses**
Malassezia furfur, T.nigra, T.piedra
 - b. **Dermatophytes**
 - c. **Subcutaneous mycoses**
Mycetoma, Rhinosporidiosis, Sporotrichosis, Chromomycosis
 - d. **Systemic mycoses**
Histoplasmosis, Blastomycosis, Coccidioidomycosis, Paracoccidioidomycosis
 - e. **Opportunistic fungi**
Aspergillosis, Penicillosis, Zygomycosis, Pneumocystis
 - f. **Candidiasis , Cryptococcosis**
4. Mycotoxins and antifungal agents

PRACTICALS **80 hrs.**

1. **Immunology:** Serological tests
Principle, procedure, normal values, significant titre, 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 (Tri dot/immune comb test)
3. **Mycology**
Slide culture technique
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 100 marks. Distribution of type of questions and marks for Microbiology III shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (second question choice) 2x10= 20 marks
 2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
 3. Short answer- 10 Questions (No choice) 10x3= 30 marks
- Total= 100**

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	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

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.

PATHOLOGY III

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

No. Theory classes: 100 hrs

Practical classes: 80 hrs.

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, 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,
(b) peripheral blood lymphocytes, solid tumors and skin fibroblasts Direct preparation from tumour 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 and 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 100 marks.

Distribution of type of questions and marks for Pathology III shall be as given under

SUBJECTS HAVING MAXIMUM MARKS= 100 (for Second and Third Year)		
Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

- | | |
|--|-------------------|
| 1. Long essay- 2 Questions (second question choice) | 2x10= 20 marks |
| 2. Short essay- 10 Questions (Questions no 5 &10 choice) | 10x5= 50 marks |
| 3. Short answer- 10 Questions (No choice) | 10x3= 30 marks |
| | Total= 100 |

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	IA	Sub Total	Practicals	IA	Sub Total	
100	20	120	80	20	100	220

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
9. Sathish Gupta , Short text book of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, NewDelhi, 1996.

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, commulative 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 SD

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 ratios 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

BMLT IV YEAR - INTERNSHIP

1. Project

Submission of a Project work is a compulsory requirement for the B Sc MLT –course. Each student can choose a topic for the project in any one of the subjects – Microbiology/Biochemistry/Pathology which would be approved by his/her supervising teacher. The topics for project shall be divided equally among total number of students from the three main subjects Microbiology/ Biochemistry/ Pathology.

The option for topics selection for the project will be based on the following criteria

- Total marks obtained in all the previous university examinations up to 3rd year.
- If total marks obtained equal for more than one student then marks obtained for the optional subject may be considered.

The supervising Teacher should have minimum 3 years full time teaching experience in the concerned subject. The student should be under the guidance of the supervising staff, carry out the work on the topic selected and prepare a project report including results and references. The project report duly certified by the supervising staff and head of the department of MLT Three months prior to fourth year university practical examination should be submitted to the Principal.

The project report evaluation will be conducted by the concerned subject internal and external examiners together in the Fourth year B.Sc MLT University practical examination.

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