Ref.: AUTH/103/SA/BSc/MLT/249/2012-13

Date: 29/09/2012

NOTIFICATION

Sub: Approval of Revised Curriculum for B.Sc. MLT

Ref: 1) RGUHS Notification No. UA/AUTH/1 YEAR A.H.S./126/2007-08 dated 29.06.2007
2) Minutes of the meeting of Board of Studies in Allied Health Sciences held on 15.06.2012
3) Recommendations of Committee of Academic Council in its meeting held on 27.08.2012
4) Minutes of 100th meeting of Syndicate held on 28/08/2012.

In exercise of the powers conferred by Section 35(2) of RGUHS Act 1994, the Syndicate in its 100th meeting held on 28/08/2012 is pleased to notify the Revised Curriculum for B.Sc. MLT as shown in the annexure appended herewith.

The Ordinance shall come into force from the academic year 2012-13.

By Order,

[Signature]
(Dr. D. Prem Kumar)
Registrar

To:
The Principals of colleges affiliated to RGUHS conducting B.Sc. MLT course

Copy to:
1. The Principal Secretary to Governor, Governor’s Secretariat, Raj Bhavan, Bangalore – 560 001.
2. Principal Secretary to Government, Health & Family Welfare Department, (Medical Education), Vikasa Soudha, Bangalore – 560 001.
3. The Director, Department of Medical Education, Anand Rao Circle, Bangalore – 560 009.
4. PA to Vice-Chancellor / Registrar / Registrar (Eva.) / Finance Officer.
5. Director, Curriculum Development Cell.
Rajiv Gandhi University of Health Sciences, Karnataka

Revised Syllabus

B.Sc. MLT

2012-13
REVISED ORDINANCE GOVERNING

REGULATIONS & CURRICULUM FOR BACHELOR OF SCIENCE DEGREE

COURSES IN

ALLIED HEALTH SCIENCE FOR FIRST YEAR

B.Sc Medical Laboratory Technology

1. Title of the Courses offered in Allied Health Sciences:

1. Bachelor of Science in Medical Laboratory Technology [B.Sc. (M.L.T)]

2. Bachelor of Science in Operation Theatre Technology [B.Sc.O.T. Technology]

3. Bachelor of Science in Cardiac Care Technology [B.Sc Cardiac Care Technology]

4. Bachelor of Science in Perfusion Technology [B.Sc. Perfusion Technology]

5. Bachelor of Science in Neuro Science Technology [B.Sc. Neuro Science Technology]

6. Bachelor of Science in Renal Dialysis Technology [B.Sc. Renal Dialysis Technology]

7. Bachelor of Science in Respiratory Care Technology [B.Sc. Respiratory Care Technology]

8. Bachelor of Science in Anaesthesia Technology [B.Sc. Anaesthesia Technology]

9. Bachelor of Science in Imaging Technology [B.Sc. Imaging Technology]

10. Bachelor of Science in Radiotherapy Technology [B.Sc. Radiotherapy Technology]

2. Eligibility for admission:

A candidate seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences course from Sl.No. 1 to 10 shall have studied English as one of the principal subject during the tenure of the course and for those seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences courses from Sl.No. 1 to 8 mentioned above except for B.Sc. Imaging Technology and B.Sc. Radiotherapy Technology 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.
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 a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 shall have passed plus 12 [10+2] with Physics, Chemistry and Biology, as principal subjects or candidates with 3 years diploma from a recognized Government Board in a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned in Sl. No. 1 to 10 should have studied Physics, Biology and Chemistry as principal subjects during the tenure of the course.

6. Lateral entry to second year for allied health science courses 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.

7. In case of admission to B.Sc. Imaging Technology Or B.Sc.Radiotherapy Technology the candidate should have passed Pre-University or equivalent examination with Physics, Chemistry, Biology and Mathematics, as principal subjects of study.

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.

3. Duration of the course:

Duration shall be for a period of three and half years including six months of Internship.

4. Medium of instruction:

The medium of instruction and examination shall be in English.

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

6. 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.

7. 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.

8. 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

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Subject</th>
<th>Theory No. of Hours</th>
<th>Practical No. of Hours</th>
<th>Total No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human Anatomy</td>
<td>70</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>Physiology</td>
<td>70</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Biochemistry I</td>
<td>70</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>Pathology I (Clinical Pathology,</td>
<td>70</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Haematology &amp; Blood Banking)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Microbiology</td>
<td>70</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>350</td>
<td>100</td>
<td>450</td>
</tr>
</tbody>
</table>

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

Subsidiary Subjects

English 25 Hours
Kannada 25 Hours
Health-Care 40 Hours
Clinical/Lab posting − 470 hours (Friday 9am − 1pm and 2pm - 4-30 pm)
Saturday 9am - 1pm

Table - II Distribution of Teaching Hours in Second Year Subjects

Main Subjects

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Subject</th>
<th>Theory No. of Hours</th>
<th>Practical No. of Hours</th>
<th>Clinical Postings</th>
<th>Total No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biochemistry II</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>2</td>
<td>Microbiology II</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>3</td>
<td>Pathology II</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>300</td>
<td>240</td>
<td>510</td>
<td>1050</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Subjects</th>
<th>Theory No. of Hours</th>
<th>Practical No. of Hours</th>
<th>Clinical Posting</th>
<th>Total No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biochemistry III</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>2</td>
<td>Microbiology III</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>3</td>
<td>Pathology III</td>
<td>100</td>
<td>80</td>
<td>170</td>
<td>350</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>300</td>
<td>240</td>
<td>510</td>
<td>1050</td>
</tr>
</tbody>
</table>

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
03 papers in the 2nd Year

03 papers in the 3rd Year.

**Practical examination:**

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

**TABLE-IV**

<table>
<thead>
<tr>
<th>A</th>
<th>Main Subjects*</th>
<th>Written Paper</th>
<th>IA Theory</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Duration</td>
<td>Marks</td>
<td>Marks</td>
</tr>
<tr>
<td>1</td>
<td>Basic Anatomy (Including Histology)</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Physiology</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Biochemistry</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Pathology</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Microbiology</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Subsidiary Subject**</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>

|   | English        | 3 Hours | 80 | 20 | 100 |
|   | Kannada        | 3 Hours | 80 | 20 | 100 |
|   | Health Care    | 3 Hours | 80 | 20 | 100 |

Note: IA = 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**

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Theory</th>
<th>Practicals</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Univ. exam</td>
<td>IA</td>
<td>Sub Total</td>
</tr>
<tr>
<td>I</td>
<td>Biochemistry II</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>II</td>
<td>Microbiology II</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>III</td>
<td>Pathology II</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>B</th>
<th>Subsidiary Subject**</th>
<th>Duration</th>
<th>Marks</th>
<th>IA Theory Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sociology</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Paper</td>
<td>Subject</td>
<td>Univ. exam</td>
<td>IA</td>
<td>Sub Total</td>
<td>Univ Prac</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>------------</td>
<td>----</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>I</td>
<td>Biochemistry III</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>II</td>
<td>Microbiology III</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>III</td>
<td>Pathology III</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
</tr>
</tbody>
</table>

**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**

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

<table>
<thead>
<tr>
<th>B</th>
<th>Subsidiary Subject**</th>
<th>Duration</th>
<th>Marks</th>
<th>IA Theory Marks</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ethics, Database Management</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Research &amp; Biostatistics</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Computer Application</td>
<td>3 Hours</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

**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. Failed candidate shall be permitted to appear in the failed subject in the following university examination along with the second year subjects.

12.2 Second year examination:

A candidate who fails in any one subject can carry over that subject to the third year. Failed candidate shall be permitted to appear in the failed subject in the following university examination along with the third year subjects. However he or she shall clear all failed subjects in the third year to be awarded the degree.

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.

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

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

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 six months of rotational internship. On completion of six months of the internship the candidate is then eligible for the award of degree.

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

THEORY
### SUBJECTS HAVING MAXIMUM MARKS= 100

<table>
<thead>
<tr>
<th>Type of Questions</th>
<th>No. of Questions</th>
<th>Marks for Each Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay Type</td>
<td>3 (2 x 10)</td>
<td>10</td>
</tr>
<tr>
<td>Short Essay Type</td>
<td>12 (10 x 5)</td>
<td>05</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>12 (10 x 3)</td>
<td>03</td>
</tr>
</tbody>
</table>

### SUBJECTS HAVING MAXIMUM MARKS= 80 (for first year B.Sc)

<table>
<thead>
<tr>
<th>Type of Questions</th>
<th>NO. of questions</th>
<th>Marks for Each Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Essay Type</td>
<td>10 (8 x 5)</td>
<td>40</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>12 (10 x 3)</td>
<td>30</td>
</tr>
<tr>
<td>To The Point Answer</td>
<td>07 (5 x 2)</td>
<td>10</td>
</tr>
</tbody>
</table>

### SUBJECTS HAVING MAXIMUM MARKS= 80 (for second and third year B.Sc)

<table>
<thead>
<tr>
<th>Type of Questions</th>
<th>No. of Questions</th>
<th>Marks for Each Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay Type</td>
<td>3 (2 x 10)</td>
<td>10</td>
</tr>
<tr>
<td>Short Essay Type</td>
<td>8 (6 x 5)</td>
<td>05</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>12 (10 x 3)</td>
<td>03</td>
</tr>
</tbody>
</table>

### SUBJECTS HAVING MAXIMUM MARKS= 60

<table>
<thead>
<tr>
<th>Type of Questions</th>
<th>No. of Questions</th>
<th>Marks for Each Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay Type</td>
<td>3 (2 x 10)</td>
<td>10</td>
</tr>
<tr>
<td>Short Essay Type</td>
<td>7 (5 x 5)</td>
<td>05</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>7 (5 x 3)</td>
<td>03</td>
</tr>
</tbody>
</table>

### SUBJECTS HAVING MAXIMUM MARKS= 50

<table>
<thead>
<tr>
<th>Type of Questions</th>
<th>No. of Questions</th>
<th>Marks for Each Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay Type</td>
<td>3 (2 x 10)</td>
<td>10</td>
</tr>
<tr>
<td>Short Essay Type</td>
<td>5 (3 x 5)</td>
<td>05</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>7 (5 x 3)</td>
<td>03</td>
</tr>
</tbody>
</table>

### INTERNSHIP

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

1. Clinical Pathology - 1 month
2. Clinical Biochemistry - 2 months
3. Clinical Microbiology - 2 months
4. Blood banking - 1 month
Requirements for internship in the department of Clinical pathology and Blood banking:

Haematology-

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

Histopathology

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

Cytology

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

Blood bank

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

Requirements for internship in the department of Clinical Biochemistry:

1. A medium sized lab performing tests on 100 samples per day or a hospital comprising of 100 beds with a lab performing tests on 100 samples.
2. Tests performed should include- routine tests and higher chemistry
   a. Glucose
   b. Calcium
   c. Phosphorus
   d. Uric acid
   e. Electrolytes
   f. Amylase
g. Lipase  
h. Ig  
i. Microalbumin  
j. RFT  
k. LFT  
l. Lipid profile  
m. Cardiac marker  
n. Diabetic profile including HbA1C  
o. Hypertension profile  
p. Tumor markers  
q. Hormones- LH, FSH, testosterone, prolactin  
r. Thyroid profile  
s. 24hrs urine protein  
t. 24hrs urine creatinine  
u. 24 hrs urine/ creatinine ratio

The lab should include equipments as per mentioned below-

a. Chemiluminescence/ drug hormone analyser/ ELFA  
b. HPLC (optional)  
c. Arterial blood gas analysis (optional)  
d. ISE electrolyte analyser/ flame photometry  
e. Electrophoresis / chromatography  
f. Fully automated analyser  
g. Semi automated analyser  
h. Spectrophotometer/ colorimeter  
i. pH meter  
j. hot air oven  
k. distillation unit

- should have facility for performing calibrations for smaller equipments/ pipettes  
- should run quality control materials  
- should have proper guidelines for total quality management

Requirements for internship in the department of Microbiology-

Should learn collection and appropriate processing of various specimens.

1. Routine culture and sensitivity including blood culture- minimum of 10 per day  
2. Serology by
   a. Latex agglutination- 20 per day  
   b. Rapid tests- 20 per day
c. ELISA- 5 per day

3. Mycology-
   a. Wet mount- 10 per day
   b. Culture- 5 per month

4. Parasitology-
   a. Wet mount- 20 per month
   b. Peripheral smear for malaria and filaria- 10 per day
   c. Quantitative buffy coat- 5 per day

5. Microscopy- minimum 10 per day
   a. Grams stain
   b. ZN stain
   c. Urine wet mount
   d. CSF India ink preparation

The lab should have the following instruments-

1. Autoclave
2. Hot air oven
3. Incubator
4. Centrifuge
5. Water distillation unit
6. Physical balance
7. Digital balance
8. Refrigerator
9. Microscope- monocular, binocular, fluorescent microscope
10. ELISA reader
11. Micropipettes
12. Laminar air flow
13. Water bath
14. VDRL shaker

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

- Preparation of media
- Sterilization
- Preparation of reagents
- Handling instruments
- Waste disposal
- Maintenance of microscopes
- Calibration of instruments
SYLLABUS FOR ALLIED HEALTH SCIENCE COURSES

I year - B.Sc. Allied Health Sciences
ANATOMY

Theory: 70hrs
Practicals: 20hrs

I. INTRODUCTION: HUMAN BODY AS A WHOLE
   THEORY:
   Definition of anatomy and its divisions
   Terms of location, positions and planes
   Cell and its organelles
   Epithelium — definition, classification, describe with examples, functions
   Glands — classification, describe serous and mucous glands with examples
   Basic tissues — classification with examples
   PRACTICALS:
   Histology of types of epithelium
   Histology of serous, mucous and mixed salivary gland

II. LOCOMOTION AND SUPPORT
   THEORY:
   Cartilage — types with examples and histology
   Bone — classification, names of bone cells, parts of long bone, microscopy of
   Compact bone, names of all bones, vertebral column, intervertebral disc,
   Fontanelles of fetal skull
   Joints — classification of joints with examples, synovial joint (in detail for radiology)
   Muscular system — classification of muscular tissue and histology
   Names of muscles of the body
   PRACTICALS:
   Histology of 3 types of cartilages
   Demo of all bones showing parts, radiographs of normal bones and joints
Histology of compact bone (TS and LS)
Demonstration of all muscles of the body
Histology of skeletal, smooth and cardiac muscle (TS and LS)

III. CARDIOVASCULAR SYSTEM

THEORY:
Heart – size, location, chambers, exterior and interior
Blood supply of heart
Systemic and pulmonary circulation
Branches of aorta, common carotid artery, subclavian artery,
Axillary artery, brachial artery, superficial palmar arch, femoral artery,
Internal iliac artery
Peripheral pulse
Inferior venacava, portal vein, portosystemic anastomosis
Great saphenous vein
Dural venous sinuses
Lymphatic system – cisterna chyli and thoracic duct
Histology of lymphatic tissues
Names of regional lymphatics, axillary and inguinal lymph nodes in brief

PRACTICALS:
Demonstration of heart and vessels in the body
Histology of large artery, medium sized artery and vein, large vein
Microscopic appearance of large artery, medium sized artery and vein,
Large vein pericardium
Histology of lymph node, spleen, tonsil and thymus
Normal chest radiograph showing heart shadows
Normal angiograms

IV. 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,
Radiographs of abdomen

V. RESPIRATORY SYSTEM

Parts of RS – nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments
Histology of trachea, lungs and pleura
Names of paranasal air sinuses

PRACTICALS:
Demonstration of parts of respiratory system
Normal radiographs of chest
Histology of lung and trachea

VI. PERITONEUM

THEORY:
Description in brief
PRACTICAL:
Demonstrations of reflections

VII. URINARY SYSTEM
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

VIII. REPRODUCTIVE SYSTEM
THEORY:
Parts of male reproductive system, testis, vas deferens, epididymis,
Prostate (gross and histology)
Parts of female reproductive system, uterus, fallopian tubes,
Ovaries (gross and histology)
Mammary gland – gross
PRACTICAL:
Demonstration of section of male and female pelvis with organs in situ
Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes,
Ovaries
Radiographs of pelvis – Hysterosalpingogram

IX. ENDOCRINE GLANDS
THEORY:
Names of all endocrine glands, in detail on pituitary gland, thyroid gland,
Parathyroid gland, suprarenal gland (gross and histology)
PRACTICAL:
Demonstration of the glands
Histology of pituitary, thyroid, parathyroid, suprarenal glands

X. NERVOUS SYSTEM
THEORY:
Neuron
Classification of NS
Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord
With spinal nerve (gross and histology)
Meninges, ventricles and cerebrospinal fluid
Names of basal nuclei
Blood supply of the brain
Cranial nerves
Sympathetic trunk and names of parasympathetic ganglia
PRACTICAL:
Histology of peripheral nerve and optic nerve
Demonstration of all plexuses and nerves in the body
Demonstration of all parts of brain
Histology of cerebrum, cerebellum, spinal cord

XII. SENSORY ORGANS

THEORY:
Skin – histology, appendages of skin
Eye – parts of eye and lacrimal apparatus
Extra-ocular muscles and 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 and retina

XII. EMBRYOLOGY

THEORY:
Spermatogenesis and 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
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</table>
REFERENCE BOOKS:
1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaurisia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied)- Saunders & C P Prism Publishers, Bangalore
5. ESTER. M. Griscimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia

PHYSIOLOGY
Theory 70 hours
Practical 20hours

Introduction
Composition and function of blood
Red blood cells – Erythropoiesis, stages of differentiation function, count physiological Variation.
Haemoglobin –structure, function, concentration physiological variation, Methods of Estimation of Hb
White blood cells – Production, function, life span, count, differential count
Platelets – Origin, normal count, morphology functions.
Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen,
Prothrombin functions.
Haemostasis & Blood coagulation
Haemostasis – Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors.
Blood Bank
Blood groups – ABO system, Rh system
Blood grouping & typing
Crossmatching
Rh system – Rh factor, Rh incompatibility.
Blood transfusion – Indication, universal donor and recipient concept.
Selection criteria of a blood donor. Transfusion reactions
Anticoagulants – Classification, examples and uses
Anaemias : Classification – morphological and etiological. Effects of anemia on body
Blood indices – Colour index, MCH, MCV, MCHC
Erythrocyte sedimentation Rate (ESR) and Paced cell volume
Normal values, Definition. Determination
Blood Volume -Normal value, determination of blood volume and regulation of blood volume Body fluid
– pH, normal value, regulation and variation
Lymph – lymphoid tissue formation, circulation, composition and function of lymph

Cardiovascular system
Heart – Physiological Anatomy, Nerve supply
Properties of Cardiac muscle
Cardiac cycle-systole, diastole.
Intraventricular pressure curves.
Cardiac Output – only definition
Heart sounds- Normal heart sounds Areas of auscultation.
Blood Pressure – Definition, normal value, clinical measurement of blood pressure. Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension. Pulse – Jugular, radial pulse, Triple response
Heart sounds – Normal heart sounds, cause characteristics and signification. Heart rate
Electrocardiogram (ECG) –significance.

**Digestive System** - Physiological anatomy of Gastrointestinal tract
Functions of digestive system.
Salivary glands - Structure and functions.
Deglutination –stages and regulation
Stomach – structure and functions.
Gastric secretion – Composition function regulation of gastric juice secretion.
Pancreas – structure, function, composition, regulation of pancreatic juice
Liver – functions of liver.
Bile secretion, composition, function, regulation of bile secretion. Bilirubin metabolism, types of bilirubin, Vandernberg reaction, Jaundice- types, significance.
Gall bladder – functions.
Intestine – small intestine and large intestine.
Small intestine –Functions- Digestion, absorption, movements.
Large intestine – Functions, Digestion and absorption of Carbohydrates, Proteins, Fats, Lipids. Defecation

**Respiratory system**
Functions of Respiratory system, Physiological Anatomy of Respiratory system, Respiratory tract, Respiratory Muscles, Respiratory organ-lungs, Alveoli, Respiratory membrane, stages of respiration.

Mechanism of normal and rigorous respiration. Forces opposing and favouring expansion of the lungs. Intra pulmonary pleural pressure, surface tension, recoil tendency of the wall.


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

**Endocrine System** –
Definition, Classification of Endocrine glands & their Hormones Properties of Hormones.

Thyroid gland hormone – Physiological, Anatomy, Hormone secreted, Physiological function, regulation of secretion. Disorders – hypo and hyper secretion of hormone

Adrenal gland, Adrenal cortex physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones – functions and regulation Adrenal medulla – Hormones, regulation and secretion. Functions of Adrenaline and nor adrenaline

Pituitary hormones – Anterior and posterior pituitary hormones, secretion, function.

Diabetes mellitus – Regulation of blood glucose level.

Parathyroid gland – function, action, regulation of secretion of parathyroid hormone.

Calcitonin – function and action

**Special senses**

Vision – structure of eye. Function of different parts.

Structure of retina.

Hearing structure and function of can mechanism of hearing

Taste – Taste buds functions.

Smell physiology, Receptors.

**Nervous system**


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

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

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

**Excretory System**

Excretory organs


H + Cl aminoacids etc. TMG, Tubular lead, Renal threshold % of reabsorption of different substances, selective e secretion.

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


**Reproductive system**

Function of Reproductive system, Puberty

Male reproductive system- Functions of testes, spermatogenesis site, stages, factors, influencing semen.

Endocrine functions of testes

Androgens – Testosterone structure and functions.

Female reproductive system. Ovulation, menstrual cycle. Physiological changes during pregnancy, pregnancy test.
Lactation: Composition of milk factors controlling lactation.

**Muscle nerve physiology**

**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.

**Practicals**
Haemoglobinometry
White Blood Cell count
Red Blood Cell count
Determination of Blood Groups
Leishman’s staining and Differential WBC count
Determination of packed cell Volume
Erythrocyte sedimentation rate [ESR]
Calculation of Blood indices
Determination of Clotting Time, Bleeding Time
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 Practical need not be sent to the university.

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

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REFERENCE BOOKS:
2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency
3. Choudhary (Sujith K) Concise Medical Physiology Latest Ed. New Central Book

BIOCHEMISTRY I

No. Theory classes: 70 hours
No. Practical classes: 20 hours

I. Clinical Laboratory
- Responsibilities of health care personnel
- Laboratory hazards- Physical, Chemical and Biological. Laboratory safety measures- Safety regulations and first aid in laboratory

II. Laboratory apparatus: Different types, use, care and maintenance (Where appropriate, diagrams to be drawn in practical record)
- 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

III. Instruments: Use, care and maintenance (Where appropriate, pictures/diagrams and schematic diagrams to be drawn in practical record)
- 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)
IV. Units of measurement
- Metric system. Common laboratory measurements, Prefixes in metric system
- International system of units- SI units- definition, classification, Conversion of conventional and SI Units

V. Introduction to general Bio-molecules:
- Chemistry of carbohydrates: Classification (structures for monosaccharides*), Functions of carbohydrates
- Chemistry of amino acids*: Classification–based on structure and nutritional requirement, Occurrence. Functions of amino acids.
- Chemistry of lipids: Classification of lipids and fatty acids. Functions of lipids

* Structures mandatory

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

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

  Blood pH. Fluid buffers.

IX. Biomedical waste management

ASSIGNMENT TOPICS:
- Radio active isotopes
- Arterial Blood gases

PRACTICAL DEMONSTRATION (Record book to be maintained )
- Laboratory apparatus - All glass ware and plastic ware (all appropriate diagrams in practical record)
- Water bath, Oven & Incubators, Water Distillation plant*, refrigerators, cold box, cool barns, reflux condensers.
- Preparation of solutions: 1N HCl, 1M NaOH. Standard solutions of glucose and albumin
- Centrifuges* - Technique of Centrifugation
- Analytical balance* - Weighing of chemicals to prepare standard and different types of solutions. Care while weighing acids, deliquescent and hygroscopic compounds.
- Colorimeter* - Absorbance readings of a colored solution and graphing
pH meter* - Checking pH of urine and buffer
Diagrams to be drawn

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

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

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

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Text Book References
- Biochemistry – 3rd revised edition by U Sathyarayana & 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.
- Varley’s Practical Clinical Biochemistry, 4th, 5th and 6th editions

PATHOLOGY I

Histopatohology, Clinical Pathology, Hematology and Blood Banking

Theory-70 hours
Practicals-20 hours

I. **Histopathology- Theory**
   - Introduction to Histopathology
   - Receiving specimens in the laboratory
   - Grossing techniques
   - Mounting techniques- various mountants
   - Maintenance of records and filing of slides
   - Use and care of Microscope
   - Various fixatives, mode of action, preparation and indications
   - Biomedical waste management
   - Section cutting
   - Tissue processing for routine paraffin sections
   - Decalcification of tissues
   - Staining of tissues-H & E Staining

II. **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

III. **Hematology – Theory**
   - Introduction to hematology
   - Normal constituents of Blood, their structure and functions
   - Collection of Blood samples
   - Various anticoagulants used in Hematology
   - Various Instruments and glass ware used in Hematology, preparation and usage of glass wares
   - Laboratory safety guidelines
   - SI units and conventional units in Hospital laboratory
   - Quality control of laboratory findings
   - 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

IV. **Blood Bank- Theory**
   - Introduction blood banking
   - Blood group system
   - Collection and processing of blood for transfusion
• Compatibility testing
• Blood transfusion reactions

Practicals

1. Urine analysis - Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation, packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time
5. Histopathology - section cutting and H & E Staining (for BSc MLT only)

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

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

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REFERENCE BOOKS:

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

Theory: 70 Hours
Practicals: 20 Hours

1. Introduction (6 hrs)

History of Microbiology, classification of microorganisms, use of microscope in the study of bacteria, Morphology of bacterial cell

2. Growth and nutrition (6 hrs)

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

3. Sterilization and disinfection (8 hrs)

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

4. Biomedical waste management principle and practice

5. Immunology (5 hrs)

Immunity, vaccines
Immunization schedule
Definition of Antigen, antibody, list of antigen antibody reactions.

5. Infection (5hrs)

Definition, types and mode of transmission
Hospital infections – causative agents, mode of transmission and prophylaxis
Antimicrobial susceptibility testing

6. Systematic bacteriology (15 hrs)
Disease caused and lab diagnosis of medically important bacteria (Staphylococcus, Streptococcus, Gonococcus, Echerichia coli, Salmonella, Shigella, Vibrio, Mycobacteria, Treponema, Leptospira)

(No need of classification, antigenic structure, virulence mechanism)

7. Parasitology (10hrs)

Introduction to Parasitology

List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma)

Lab diagnosis of parasitic infections

8. Virology (10hrs)

Introduction to virology

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

Lab diagnosis of viral infections

9. Mycology (5hrs)

Introduction to Mycology

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

Lab diagnosis of fungal infections

PRACTICALS (20hrs)

Compound Microscope

Demonstration and sterilization of equipments

Demonstration of commonly used culture media and media with growth

Antibiotic susceptibility test

Demonstration of common serological tests—widal, VDRL,

Grams stain, Acid fast staining

Stool exam for Helminthic ova
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 Practical need not be sent to the university.

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

<table>
<thead>
<tr>
<th>TYPE OF QUESTION</th>
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<tr>
<td>Short answer type</td>
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Distribution of Marks for University Theory and Practical Exam

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</tbody>
</table>

Reference Books-
1. Ananthanarayana & Panikar Medical Microbiology- University Press
2. Robert Cruckshank- 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
No Practical or Viva voce examination
This is a subsidiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

REFERENCE
2. Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
5. Journalism Made Simple D Wainwright
6. Writers Basic Bookself Series, Writers Digest series
7. Interviewing by Joan Clayton Platkon
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

Scheme of Examination
Written (Theory): Maximum Marks: -80 marks.
No Practical or Viva voce examination
This is a subsiary subject, examination to be conducted by respective colleges. Marks required for a pass is 35%

SYLLABUS FOR II B.Sc. MLT COURSES

BIOCHEMISTRY II

No. Theory classes: 100 hours

No. Practical classes: 80 hours
I. Basic Laboratory Practices

Preparation of solutions and reagents

- Basic requirements – types / grades of chemicals, solvents, types of water and other requirements
- Various types of solutions and reagents – Normal, Molar, percent, buffer solutions and substrates, indicators, standards

Measurements in Clinical Laboratory

- Quantitative estimations- Selecting a method, linearity of a method, endpoint and rate reaction methods. Checking accuracy and precision
- Calibration: Preparation of calibration curve, importance of a calibration curve, straight line calibration and non-linear calibration graph; Technique of preparing a calibration curve using stock standard solutions. Graphic representation of calibration.

II. Chemistry of Carbohydrates

- Structural properties- Stereoisomerism, optical activity, cyclic structures, mutarotation, epimers.
- Monosaccharides of biological importance. Important chemical reactions – formation of furfural derivatives, enediols, osazones, sugar acids, sugar alcohols. Deoxy sugars Biomedical importance of amino sugars, glycosides.
- Polysaccharides: Properties of starch and glycogen. Biomedical importance of inulin. Mucopolysaccharides - Composition, tissue distribution and functions.

III. Chemistry of amino acids and proteins

- Proteins- Functions. Classification - Based on composition and solubility, functional and nutritional. Protein Structure-primary(insulin), secondary, tertiary and quaternary
- Precipitation reactions of proteins- salting out, iso-electric precipitation, precipitation by organic solvents, heavy metal ions, alkaloidal reagents. Denaturation of proteins. Heat coagulation. Preparation of protein free filtrates for quantitative estimations

IV. Enzymes

- Classification, properties, specificity, mechanism of enzyme action, factors affecting enzyme activity, enzyme inhibition. Coenzymes. Analytical and therapeutic role of enzymes. Immobilized enzymes

V. Chemistry of Nucleic acids

- Structure of DNA. Watson-Crick model, different forms of DNA
VI. Water soluble vitamins:

- Thiamine, riboflavin, niacin, pyridoxine, vitamin B12, folic acid and Vitamin C
- Chemistry, Sources, RDA, functions, deficiency and or toxicity. Antivitamins

VII. Metabolism of Carbohydrates

- Digestion and absorption of carbohydrates. Disorders
- Metabolic pathways, energetics, inhibitors and regulation, disorders - Glycolysis, TCA cycle, Glycogen metabolism.
- Diabetes mellitus - Diagnosis and management.
- Principles and procedures for the determination of plasma glucose levels-reductometric and enzymatic methods.
- Urinary glucose.

VIII. Metabolism of amino acids and nucleic acids

a. Non protein nitrogenous compounds:

- Formation of ammonia - transamination and deamination, Urea cycle and disorders, Blood urea/ Blood urea nitrogen - clinical importance.
- Biosynthesis of creatine, formation of creatinine, clinical importance of creatinine
- Degradation of purine nucleotides, formation of uric acid, Disorders - Gout, Lesch Nyhan syndrome.

Principles and procedures for the determination of Blood urea nitrogen, creatinine & uric acid - colorimetric and enzymatic methods.

b. Catabolism of Branched chain, Phenylalanine/Tyrosine catabolism:

- Pathway Disorders - Phenylketonuria, Alkaptonuria, Maple Syrup Urine Disease

IX. Overview of Body fluids

- Ascitic fluid, CSF, peritoneal, pleural, pericardial and synovial fluids. Quantitative analysis of constituents in different types of fluids.

X. Specimen collection: Technique, use of anticoagulants and preservatives where appropriate. Storage, time of collection, instructions to patients for timed sample collection.

Disposal

- Blood- venous and capillary puncture.
- Urine-random, timed & 24 hrs

XI. Normal constituents of urine: Physical characteristics. Chemical examination of urinary constituents.

XII. Renal function tests
• Glomerular and tubular function. Handling of different solutes by tubules. Reabsorption of water
• Abnormal constituents of urine - Physical characteristics. Chemical examination of urinary constituents.
• Clearance tests: Definition. Procedure for creatinine clearance test, reference values and significance
• Tests of tubular function: Concentration and dilution tests. Measurement of specific gravity and osmolality
• Urinary acidification: Ammonium chloride loading test

XIII. Techniques

• Spectrophotometry: Principle, components, operation, care and maintenance, relation between concentration and optical density, standardization of spectrophotometer.

• Chromatography: Principle. Partition chromatography-instrumentation and application in identification of amino acids
• Others- Principle and application
  Osmometry, Reflectance photometry, Turbidimetry, Nephelometry

• Glucometers: Principle, instrumentation and application

ASSIGNMENT TOPICS:

• Oral Glucose tolerance test
• Glycated HbA1c
• Microalbuminuria

PRACTICAL SYLLABUS

I. PRACTICAL APPROACH TO BASIC LABORATORY PRACTICES

a. Pipetting techniques

• Use of glass pipettes-graduated and volumetric pipets; Specimen and Reagent using fixed and variable pipettes

b. Operation of instruments

• Analytical Balance: Weighing chemicals, deliquescent, hygroscopic compounds and acids.
• pH meter: Checking pH of urine and buffers by electrometry.
• Centrifuges: concept of balancing, time and speed specifications
• Urinometer, Esbach’s albuminometer

c. Techniques of preparation of solutions and reagents

• Normal, molar, percent (Na₂CO₃, NaCl, NaOH, KCl, HCl, H₂SO₄, H₃PO₄, CH₃COOH, Sodium tungstate) Buffers (Phosphate buffer, citrate buffer), Indicators.
• Standard solutions – Creatinine, Total Protein etc.,

d. Dilution techniques
- Dilution of stock standards and reagents to working
- Dilution of acids
- Part dilution of body fluids

e. Determination of pH: using indicators, pH paper, universal indicator solutions

II. QUALITATIVE

a. Color reactions - known test solutions

- Carbohydrates: Glucose, Fructose, Xylose, Sucrose, Starch
- Amino acids in protein solution
- NPN- Urea, Creatinine and Uric acid
- Titrable acidity and ammonia in urine

b. Precipitation reactions

- Albumin
- Preparation of protein free filtrates for quantitative estimations - glucose, urea, creatinine uric acid estimation

c. Spot tests for

- Phenylketonuria, alkaptonuria, MSUD

d. Urine analysis

- Normal and Abnormal urine

III. QUANTITATIVE

a. Operation of Colorimeter / Spectrophotometer.

- Colorimetric experiment to select a complementary filter.
- Concepts of use of blank, reagent blank
- Standardization of a colorimeter/ spectrophotometer using coloured solutions
- Graphing of Beer’s law- drawing calibration curves.
- Determination of unknown concentration of colored solution from calibration curve. Concept of one point calculation or calibration (T/S X concentration of standard)

b. Quantitative estimation by manual methods- Preparation of calibration curve & estimation of unknown analyte concentration

- Blood Glucose by reductometric method (Not to use O-toluidine method as it is a potent carcinogen)
- Blood urea by Diacetyl Monoxime method.
- Serum and urine creatinine by Jaffe’s reaction. Determination of Creatinine clearance rate.
- Serum uric acid by Caraway’s method
- CSF and urine protein by sulphosalicylic acid method
PRACTICAL DEMONSTRATION

- Paper chromatography of amino acids
- 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 80 marks. Distribution of type of questions and marks for Biochemistry II shall be as given under.

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SCHEME OF EXAMINATION – PRACTICALS

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<td>Urine examination</td>
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Distribution of Marks for University Theory and Practical Exam

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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.
- 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
MICROBIOLOGY II
(Systematic Bacteriology + Parasitology)

I. Systematic Bacteriology

Biochemical reactions for identification of bacteria

Antimicrobial Susceptibility Testing

Normal flora of the human body

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

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

Gram Negative Bacteria:

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

**Spirochaetes & Others:**
- Treponemes, Leptospira & Borrelia
- Mycoplasma, Chlamydia & Rickettsia
- Non sporing anaerobes
- Gardenerella, Legionella & Listeria
- Miscellaneous Bacteria

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

**Bacteriology of Water, Milk and Air**

**II. Parasitology**

1. **Protozoology**
   - Entamoeba, Balantidium coli,
   - Trichomonas, Giardia, Leishmania, Trypanasoma
   - Malaria, Toxoplasma
   - Cryptosporidium, Microsporidium, Isospora, Cyclospora

2. **Helminthology**
   - Cestodes – Taenia, Echinococcus, D. latum, H. nana,
   - Trematodes – Schistosoma, Fasciola,
   - Nematodes – Ascaris, Ancylostoma, Enterobius, Strongyloides, Trichuris, Trichinella, Dracunculus, Wuchereria and other Filarial worms.

**Lab Diagnosis of Parasitic Infections**

**Arthropods of Medical Importance**

**Practicals:**

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

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

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

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<tr>
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SCHEME OF EXAMINATION - PRACTICALS
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<td>ZN staining</td>
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<td>Pure culture of the organism</td>
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<tr>
<td>Stool examination</td>
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<td>Record</td>
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Distribution of Marks for University Theory and Practical Exam

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B.Sc Medical Laboratory Technology
2nd year
PATHOLOGY II

No. Theory classes: 100 hours
No. Practical classes: 80 hours

Theory:

Histopathology and Hematology

Histopathology
Instrumentation:
(a) Automated Tissue Processor
(b) Microtomes, Knives, Knife sharpeners and Ultramicrotome
(c) Freezing microtome and Cryostat
(d) Automatic slide stainer

Techniques:
(a) Routine paraffin section cutting
(b) 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 and Florescent microscope
Museum technology
Microphotography and its applications
Maintenance of records and filing of slides
ICDS Classification and coding
Application of computers in Pathology

Hematology
Hemopoiesis, Stem cells, formed elements and their functions
Anticoagulants used in various hematological studies
Routine hematological tests and normal values:
(a) Determination of Hemoglobin and Hematocrit
(b) Enumeration of RBC, WBC & Platelets
(c) Absolute Eosinophil count
(d) Reticulocyte count
(e) Calculation of Red cell Indices
(f) Preparation of staining of blood film for morphology of red cells and differential count

Special Hematological tests:
(a) Sickling tests
(b) Osmotic fragility test
(c) Determination HbF and HbA2
(d) Hemoglobin Electrophoresis
(e) Investigation of G6PD deficiency
(f) Plasma haptoglobin and demonstration of hemosiderin in urine
(g) Tests for Autoimmune hemolytic anemia
(h) Measurement of abnormal Hb pigments

Hemostasis and Coagulation
(a) Normal hemostasis, mechanism of blood coagulation and normal fibrinolytic system
(b) Collection of blood and anticoagulants used in coagulation studies
(c) Investigation of hemostatic mechanism-BT, CT, whole blood coagulation time test, PT, PTT
(d) Assay of clotting factors
(e) Tests for fibrinolytic activity- Euglobulin, clot lysis test and FDP
(f) Platelet function tests

Investigation of Megaloblastic anemia and Iron deficiency anemia
(a) B12 and Folate assay and Schilling test
(b) Estimation of serum iron and iron binding capacity Bone marrow biopsy study
(a) Needle aspiration and surgical biopsy technique
(b) Preparation of smears and staining

Demonstration of LE cells
Cytochemistry
Administration in Hematology and Quality control

Practicals:
1. Paraffin section cutting
2. Staining by Hematoxylin & Eosin and other special stains
3. Determination of 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 80 marks. Distribution of type of questions and marks for Pathology II shall be as given under.

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Scheme of Examination: Practical
Distribution of marks

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<tr>
<td>Haemoglobin or PCV</td>
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</tr>
<tr>
<td>Total count</td>
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</tr>
<tr>
<td>Differential count</td>
<td>10</td>
</tr>
<tr>
<td>ESR</td>
<td>10</td>
</tr>
<tr>
<td>PS preparation and staining</td>
<td>10</td>
</tr>
<tr>
<td>Record</td>
<td>10</td>
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<tr>
<td>Spotters</td>
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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
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-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 − 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.

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.

III year - B.Sc., Medical Laboratory Technology

Biochemistry III

No. Theory classes: 100 hours

No. Practical classes: 80 hours

THEORY SYLLABUS

I. Laboratory management
• Soft skills in patient handling
• Clinical automation, different types of automation
• Quality assurance in clinical laboratory- control of pre-analytical, analytical and post-analytical variables
• Biological reference intervals.
• General approach to quality control. Commonly used terms in quality control - accuracy, precision, specificity, sensitivity, mean, standard deviation, co-efficient of variation etc.,
• Use of controls, Preparation of Levey-Jennings’ control charts, Westgard rules

II. Clinical Enzymology

• Sources of plasma enzymes. Units of enzyme activity. Diagnostic importance of enzymes. Isoenzymes. Cardiac troponins

III. Plasma proteins

• Total proteins.
• Functions and clinical importance. - Albumin and globulins-acute phase proteins (CRP, ceruloplasmin, AAT, Immunoglobulins). Genetic deficiencies and disorders
• Electrophoretic separation of plasma proteins. Electrophoretic patterns. Reference intervals and interpretation

IV. Fat soluble vitamins: A, D, E and K

• Chemistry, Sources, RDA, absorption, functions, deficiency and or toxicity.
• Antivitamins

V. Metabolism of Carbohydrates

• HMP pathway, Uronic acid pathway, Metabolism of galactose and fructose
• Disorders

VI. Lipid metabolism

• Digestion and absorption of lipids, β-oxidation of fatty acids-pathway and energetics (palmitic acid). Formation of Ketone bodies
• Cholesterol Pool: Body cholesterol and cellular. Excretion of cholesterol.
• Classification of lipoproteins based on separation and electrophoretic mobility. Metabolism. Frederickson’s classification of hyperlipoproteinemias.
• Lipid profile. Coronary Artery Disease

VII. Molecular genetics

Protein biosynthesis-eukaryotic

• Semiconservative DNA replication, Transcription and Translation , Mutations and cancer.

VIII. Tumour markers

• Definition, classification and clinical applications
• Over view of specific tumour markers-AFP, CEA, CA-125, PSA, hCG, ALP
IX. Acid-base balance

- Regulation of pH
- Disorders

X. Liver

- Role of liver in metabolism, functions of liver. Liver enzymes
- Formation of Bilirubin
- Jaundice
- Panel for Liver function in Clinical laboratory

XI. Pancreatic function tests:

- Functions of pancreas, composition of pancreatic juice.
- Clinical utility of enzyme determinations in pancreatitis.

XII. Thyroid function tests

- Overview of function of thyroid hormones.
- Clinical utility and methods for the measurement of circulating thyroid hormones.

XIII. Cardiac markers- Chemistry and overview of cardiac markers. Diagnostic and prognostic use of cardiac markers. Laboratory evaluation

XIV. Techniques- Principle, instrumentation and application

- Flame photometry
- Atomic Absorption Spectrophotometry
- Ion Selective Electrodes
- Agarose gel electrophoresis for separation of plasma proteins
- Immunochemical assays—RIA, ELISA, Chemiluminiscence

XV. Calculi

- Renal and gall. Theory of formation and analysis.

XVI. Mineral metabolism and clinical conditions

- Metabolism of Calcium, Phosphorus and Iron.
- Serum and urine electrolytes-Sodium, Potassium and chloride

XVII. Nutrition

- Nutrition and energy supply
- Utilization of energy in man
- Nutritional importance of carbohydrates, lipids, proteins, vitamins and minerals
- RDA, Balanced diet, fiber in nutrition
- Nutritional disorders
XVIII. Detoxification and biotransformation of xenobiotics

ASSIGNMENT TOPICS:

- Laboratory design
- Preparation of in-house quality control serum. Establishing mean and cutoff limits
- Point-of-Care-Testing

PRACTICAL SYLLABUS

I. QUALITATIVE

- Qualitative tests of lipids, tests for unsaturation, qualitative tests for glycerol and cholesterol.
- Renal calculi
- Gall stones

II. QUANTITATIVE

Basic approach: Concepts of preparation of buffered substrate, use of control serum in enzymatic estimations, enzyme calculations


- Total protein by Biuret method
- Albumin by Bromo Cresol Green method, Calculation of A/G ratio
- Total and conjugated Bilirubin by Malloy and Evelyn method
- Aspartate Transaminase (AST) and Alanine Transaminase (ALT) by Bergmeyer
- Alkaline phosphatase (ALP) by Kind and King method using 4-aminoantipyrine.
- Pancreatic amylase by Somogyi method
- Calcium in serum and urine by o-cresolphthalein complexone method and Phosphate in serum and urine by Fisk & Subbarow method. (Care and cleaning of tubes before and after the analysis)
- Serum Chloride by method of Schales and Schales

III. PRACTICAL DEMONSTRATION

- Oszones of Galactose, Lactose and Fructose.
- Electrolyte and Arterial Blood Gas measurements
- Agarose gel electrophoresis for Serum proteins
- Automated analyzer
- Semi automated or automated method for following analytes.
  a. Lipid profile – Cholesterol, HDL, LDL, Triglycerides
  b. T3, T4, TSH
  c. Troponin T or I, CK, CK-MB

IV. CASE REPORTS
• Inborn errors of Galactose, Pentose and Fructose
• Multiple myeloma, polyclonal gammopathy
• OGTT curves
• Jaundice – different types
• Electrophoretograms; normal and abnormal
• Thyroid disorders
• Cardiac markers
• Lipid disorders
• Tumour 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 80 marks. Distribution of type of questions and marks for Biochemistry III shall be as given under.

<table>
<thead>
<tr>
<th>TYPE OF QUESTION</th>
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<td>30</td>
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<tr>
<td>Short answer</td>
<td>12 (attempt 10)</td>
<td>10 x 3</td>
<td>30</td>
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<tr>
<td>GRAND TOTAL</td>
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</table>

SCHEME OF EXAMINATION – PRACTICALS
The scheme of examination for Biochemistry III Practical shall be as follows: Distribution of marks

<table>
<thead>
<tr>
<th>Type of Question</th>
<th>Marks allotted</th>
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<tbody>
<tr>
<td>Quantitative estimation</td>
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<tr>
<td>Renal Calculi</td>
<td>20</td>
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<tr>
<td>Urine examination</td>
<td>20</td>
</tr>
<tr>
<td>Case Reports</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
</tr>
</tbody>
</table>

Split up fo 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., | 25 mks + 2 mks |
| III yr B.Sc., | 40 mks + 5 mks |

Distribution of Marks for University Theory and Practical Exam

<table>
<thead>
<tr>
<th>Theory</th>
<th>Viva</th>
<th>IA</th>
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<th>Practicals</th>
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<tbody>
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<td>Theory</td>
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</table>

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.
- 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
- Biophysical chemistry-Principles and Techniques by Upadhay, Upadhay 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 Lieberman

MICROBIOLOGY III
(Immunology, Virology and Mycology)

THEORY: 100 HOURS
PRACTICALS: 80 HOURS

I. IMMUNOLOGY

1. Infection 2 hrs

2. Immunity 4 hrs
   - Innate immunity
   - Acquired immunity (adaptive immunity)
   - Active and passive immunity

3. Immune system
• Cell development
• B lymphocytes (general knowledge of their role)
• T lymphocytes
• Natural killer cells

4. Immune responses

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

5. Antigens

6. Antibodies

• Properties of Antibodies (immunoglobulins)
• Classes of immunoglobulins

7. Antigen-antibody reactions

Precipitation, Agglutination, ELISA, Immunofluorescence and miscellaneous tests.

8. Complement system

9. Hypersensitivity reactions

Immediate and delayed type

10. Autoimmunity

11. Transplantation and malignancy immunity

12. Immunodeficiency diseases

II. Virology

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

III. Mycology

1. Introduction of Mycology, Classification
2. Lab Diagnosis of Fungal Infections
3. Mycoses
   a. Superficial Mycoses
      Malsezia furfur, T. nigra, T. pidera
   b. Dermatophytes
   c. Subcutaneous Mycoses
      Mycetoma, Rhinosporidium, Sporotrichosis, Chromomycosis
   d. Systemic Mycoses
      Histoplasmosis, Blastomycosis, Coccidiodosis, Paracoccidiosis
   e. Opportunistic fungi
      Aspergillosis, Penicilliosis, Zygomycosis, Pneumocystis
   f. Candida, Cryptococcus


Practicals

1. Immunology: Serological tests
   Principle, procedure, normal values, significant titer, interpretation and limitation of the following tests
   WIDAL, Brucella
   VDRL, RPR
   ASO, CRP, RF
   ELISA for HbsAg, HIV

2. Virology
   Demonstration of embryonated egg inoculation/animals/inclusion bodies
   Virology exercise
   ELISA (HIV, HBV)
   Western blot
   Spot test (tridot/immuno comb test)

3. Mycology
   Slide culture techniques
   KOH mount
   Identification of fungal culture
   Macroscopic and microscopic examination of candida, Cryptococcus, Dermatophytes, aspergillus, rhizopus, mucur, penicillium
INTERNAL ASSESSMENT
Theory-average of 2 exams conducted 20
Practicals: record and lab work 20

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

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SCHEME OF EXAMINATION – PRACTICALS
The scheme of examination for Microbiology III Practical shall be as follows: Distribution of marks

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Virology exercise</td>
<td>10</td>
</tr>
<tr>
<td>Mycology 2 exercise</td>
<td>15</td>
</tr>
<tr>
<td>Serology (Widal/ Brucella)</td>
<td>15</td>
</tr>
<tr>
<td>Serology (ASO/ CRP RPR/ RF)</td>
<td>10</td>
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<tr>
<td>Spotters</td>
<td>20</td>
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<td>Record</td>
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Distribution of Marks for University Theory and Practical Exam

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<tr>
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PATHOLOGY III

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

No. Theory classes: 100 hours
No. Practical classes: 80 hours

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

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

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

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

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

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

Tissue culture and Immunohistochemistry
1. Equipments for Tissue culture studies
   (a) Laminar air flow equipment
   (b) Carbon dioxide incubator
   (c) Inverted microscope
2. Derivation of culture from tissue
   (a) Enzymatic digestion of tissue using collagenase, protease
   (b) Plating in tissue culture media
   (c) Observation of cells in Invertoscope
   (d) Subculturing & derivation of cell lines
3. Characterization of cell lines
   (a) Determination of biochemical markers in cells
   (b) Chromosomal & DNA content of cells
   (c) Immunological properties of cells
4. Preservation of Immortalized cell lines
   (a) Storage in Glycerol in Liquid Nitrogen
   (b) Storage in Dimethyl sulfoxide in Liquid Nitrogen
Cytogenetics
1. Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes
2. Methods of karyotypic analysis
(a) Culture of bone marrow cells, peripheral blood lymphocytes, solid tumors & skin fibroblasts
Direct preparation from tumor materials
3. Characterization of human chromosomes by various banding techniques
4. Sex chromatin identification
5. Chromosomes in neoplasia and oncogenes

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

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

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

INTERNAL ASSESSMENT
Theory-average of 2 exams conducted 20
Practicals: record and lab work 20

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

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**Scheme of Examination — Practical**

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

<table>
<thead>
<tr>
<th>Type of Question</th>
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<tbody>
<tr>
<td>Pap stain</td>
<td>20</td>
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<tr>
<td>Blood grouping and typing</td>
<td>10</td>
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<td>Cross matching</td>
<td>15</td>
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<td>Coomb's test</td>
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**Distribution of Marks for University Theory and Practical Exam**

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**Subsidiary Subjects**

**Biostatistics**

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 SO

**Unit - V : Probability and Standard Distributions.**
Meaning of probability of standard distribution.
The binomial distribution.
The normal distribution.
Divergence from normality - skewness, kurtosis.

**Unit - VI : Sampling Techniques**
Need for sampling - Criteria for good samples.
Application of sampling in Community.
Procedures of sampling and sampling designs errors.
Sampling variation and tests of significance.

**Unit - VII : Health Indicator**
Importance of health indicator.
Indicators of population, morbidity, mortality, health services.
Calculation of rates and rations of health.

Recommended Books.

**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:**

**Concept of Software.**
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