

**Regulations and Curriculum For
Bachelor of Science in Medical Laboratory Technology
B.Sc (MLT)**

Amended up to 2018



(Established under Section 3 of UGC Act 1956)

Placed under category 'A' by MHRD, Govt. Of India, Accredited with 'A' Grade by NAAC

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VISION

To build a humane society through excellence in education and healthcare

MISSION

To develop

Nitte (Deemed to be University)

*As a centre of excellence imparting quality education,
generating competent, skilled manpower to face the scientific and social
challenges with a high degree of credibility, integrity,
ethical standards and social concern*

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Nitte University



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Date: 31-07-2014

NOTIFICATION

Subject: Regulations and Curriculum pertaining to B.Sc (Medical Laboratory Technology) Programme.

In exercise of the powers conferred under Rule No. R-09 of the Memorandum of Association, the Academic Council in its 22nd meeting held on 24-07-2014 under the Agenda item No. AC/10-22/14 has been pleased to approve the Regulations and Curriculum for Annual Scheme pertaining to B.Sc (Medical Laboratory Technology) programme in K.S. Hegde Medical Academy.

The Regulations and curriculum shall come into force from the Academic Year 2014-15.

By Order,

REGISTRAR



(Deemed to be University under section 3 of UGC Act 1956)

Placed under Category 'A' by MHRD, Govt. of India, Accredited as 'A' Grade University by NAAC
Mangaluru, Karnataka, India

Regulations and Curriculum for
Bachelor of Science in Medical Laboratory Technology
B.Sc. (MLT)
(Annual Scheme)

Preamble:

K S Hegde Medical Academy established in 1999 has been imparting graduate (MBBS), BSc (MIT) and BSc (A&OTT) and post graduate (MD/MS) education and training in medical sciences and health science technology. From the academic year 2009-10, K S Hegde Medical Academy became a constituent college of Nitte (Deemed to be University). From the academic year 2014-15, the College has started the Bachelor of Science in Medical Laboratory Technology BSc (MLT) Course. The Regulations for the Course are formulated as under:

1. Introduction:

- 1.1. These regulations shall be called Nitte (Deemed to be University). Regulations for BSc (Medical Laboratory Technology) course (Annual Scheme) and govern the policies and procedures including selection, admission, imparting of instructions, conduct of examinations, evaluation and certification of candidates performance and all amendments there to, leading to the award of BSc (Medical Laboratory Technology) degree. The regulations shall come into effect from the academic year 2018-2019.
- 1.2. This set of regulations shall be binding on all the candidates undergoing the said degree programme.
- 1.3. These regulations may be modified from time to time as mandated by the statutes of the university. These provisions shall be applicable to any new degree program that may be introduced from time to time.
- 1.4. This set of regulations may evolve and get refined or updated or amended or modified or changed through appropriate approvals from the Academic

Council or the Board of Management from time to time and shall be binding on all parties concerned including the candidates, faculty, staff, departments and College authorities.

- 1.5. All disputes arising from this set of regulations shall be addressed to the Board of Management. The decision of the Board of Management is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only.

2. **Definitions:**

Unless the context otherwise requires

- *BoM* means Board of Management of Nitte (Deemed to be University)
- *BoS* means Board of Studies (UG and PG) in Health Sciences Technology
- *He* includes both genders He and She; *similarly his and /or him*, himself includes her, as well in all cases.
- *Head of the Institution* means the Dean / Principal of the College (K S Hegde Medical Academy)
- *Institution/College* means K S Hegde Medical Academy
- *Regulations means* this set of academic regulations
- *Regulatory Authority* - Authority appointed/constituted by the central/state government/s to regulate Health Science Education.
- *Teaching Hospital means* Justice K S Hegde Charitable Hospital or any other Hospital owned by, or under the management of Nitte (Deemed to be University)
- *University* means Nitte (Deemed to be University)

3. **Duration of the Course:**

The Candidate shall undergo a period of study extending over three academic years followed by six months compulsory rotatory Internship. The internship is extendable up to one year at the option of the candidate.

4. **Medium of Instruction and Examinations:**

The medium of Instruction and Examination shall be English.

5. Maximum Period for completion of the course:

The maximum period for completion of the BSc (MLT) course is six years.

6. Eligibility for Admissions:

No candidate shall be admitted to the Curriculum of the first year of the MLT Course until:

1. He has completed the age of 17 years on or before the 31st December of the year of admission **and**
2. He has passed qualifying examination as under:
 - a) Two year Pre-University examination of the Government of Karnataka or an examination recognized as equivalent by Nitte (Deemed to be University) with Physics, Chemistry and Biology as principal subjects of study and English as one of the language (Course) with 40% average marks in the aggregate of these subjects

OR

- b) 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 PUC [10+2] examinations of Government of Karnataka Pre University Course.

Note:

- i. The candidate shall have passed individually in each of the principal subjects.
- ii. Candidates who have completed diploma or vocational course through correspondence shall not be eligible for admission.

A candidate with a pass in two/ three year full-time diploma in Medical Laboratory Technology issued by a Government Board is eligible for lateral entry to the II year.

Note: Candidates with two years full-time diploma in Medical Laboratory Technology from a recognized Government Board shall have passed 'plus – two' [10+2] with Physics, Chemistry and Biology, as principal subjects OR Candidates with 3 years full-time diploma from a recognized Government Board in Medical Laboratory Technology, should have studied Physics, Chemistry and Biology as principal subjects during the tenure of the course.

For SC/ST/Category I candidates the minimum average marks in the aggregate of Physics, Chemistry and Biology is a pass.

Foreign nationals and candidates who have qualified from a foreign University/Board should obtain permission from Nitte (Deemed to be University) prior to the admission for equivalence of the qualification.

7. Selection of eligible candidates:

Selection to the course shall be based on the basis of merit obtained in the qualifying examination.

8. Withdrawal -Temporary and Permanent:

8.1. Temporary:

8.1.1. A candidate who has been admitted to the course may be permitted to withdraw temporarily for a period of six months or more up to one year on the grounds of prolonged illness, grave calamity in the family etc. provided:

- a. He applies stating the reason of withdrawal with supporting documents and endorsement by parent/guardian.
- b. The Institution is satisfied that without counting the period of withdrawal candidate is likely to complete his requirement of the degree within maximum time specified.
- c. There are no outstanding dues or demands with the department, library, hostel, Institution etc.

8.1.2. The tuition fee for the subsequent year may be collected in advance based on the severity of the case before giving approval for any such temporary withdrawal.

8.1.3. Scholarship holders are bound by the appropriate rules applicable.

8.1.4. The decision of the Institution/University regarding withdrawal of a Candidate is final and binding.

8.2. Permanent withdrawal:

8.2.1. A candidate who withdraws admission before closing date of admission for the academic session is eligible for the refund of the deposit only. The fees once paid will not be refunded on any account.

8.2.2. Once the admission for the year is closed, and if a candidate wants to leave the Institution, he will be permitted to do so and take the Transfer Certificate from the Institution, if required only after remitting all the tuition fees for the remaining years.

- 8.2.3. Those candidates who have received any scholarship/stipend/other forms of assistance from the Institution shall repay all such amounts in addition to those mentioned in the clause above.
- 8.2.4. The decision of the Institution/University regarding withdrawal of a Candidate is final and binding.

9. Conduct and discipline:

- 9.1. Candidates shall conduct themselves within and outside the premises of the Institution in a manner befitting the student of an educational institution.
- 9.2. **As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.**
- 9.3. The following act of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures:
- 9.3.1 Ragging as defined and described by the Supreme Court / Government
- 9.3.2 Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.
- 9.3.3 Willful damage or stealthy removal of any property/belongings of the Institution/Hostel or of fellow students/citizens.
- 9.3.4 Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
- 9.3.5 Mutilation or unauthorized possession of library books.
- 9.3.6 Noisy or unseemly behaviour, disturbing studies of fellow students.
- 9.3.7 Hacking in computer systems (such as entering into other person's domain without prior permission, manipulation and/or damage to the computer hardware and software or any other cybercrime etc.)
- 9.3.8 Plagiarism of any nature.
- 9.3.9 Any other act of gross indiscipline as decided by the Board of management from time to time.
- 9.4. Commensurate with the gravity of offense, the punishment may be: reprimand, fine, expulsion from the hostel, debarment from an examination, disallowing the use of certain facilities of the Institution, rustication for a specific period or even outright expulsion from the Institution, or even

handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

- 9.5. For any offence committed in (i) a hostel (ii) a department or in a classroom and (iii) elsewhere, the Chief Warden, the Head of the Department and the Head of the Institution (student affair) respectively, shall have the authority to reprimand or impose fine.
- 9.6. All cases involving punishment other than reprimand shall be reported to the Vice-Chancellor.
- 9.7. Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Dean (Academic affairs) for taking appropriate action.

10. Graduation Requirements:

A Candidate shall be declared eligible for the award of the degree if he has:

- Fulfilled Degree Requirement.
- No dues to the University, Institute, Departments, Hostels, Library, etc.
- No disciplinary action pending against him.

The award of the degree must be recommended by the Board of Management.

11. Convocation:

Degrees will be awarded in person for the candidates who have graduated during the preceding academic year. Degrees will be awarded in absentia to such candidates who are unable to attend the convocation. Candidates are required to apply for the convocation along with prescribed fee within the specified date, after having satisfactorily completed all degree requirements, in order to arrange for the award of degree during the convocation.

Provisional pass certificate will be issued by the University provided the candidate fulfils requirements mentioned in clause (10) above. The provisional certificate will be issued on submission of an application through the college and will be valid until the convocation.

12. Academic Appeals Board (AAB)

There shall be an Academic Appeals Boards constituted by the University

Constitution:

Head of the institution of a constituent college <i>(By seniority)</i>	...	Chairman
A Professor from a constituent college <i>(Nominated by the Vice-Chancellor)</i>	...	Member
Three faculty members <i>(Nominated by the Vice-Chancellor)</i>	...	Members
The Controller of Examinations	...	Member -Secretary

Note:

- The Chairman may co-opt and/or invite more members.
- Depending on the prevailing circumstances, the senior most member in the Board shall Act as chairman instead of Chair person
- The quorum of each meeting shall be minimum of four

Functions of the Board:

- To receive grievance/ complaints in writing from the students regarding anomaly in award of marks due to bias, victimization, erratic evaluation etc. and redress the complaints.
- To interact with the concerned teacher and the student separately, before taking the decision.
- The decision of the AAB will be based on simple majority.
- The recommendation of the AAB shall be communicated to the Controller of Examinations for further appropriate action as required.

13. Subjects of Study and Training:
First Year:

No.	Subject	Total Hours of Instruction		Total
		Theory	Practical/ Clinics	
1	Human Anatomy	90*	-	90
2	Physiology	80	30	110
3	Biochemistry-I	60*	-	60
4	Pathology-I	108	20	128

5	Microbiology-I	70	15	85
i	Communicative English	30	-	30
ii	Constitution of India	30	-	30
iii	Kannada	30	-	30
Total		498	65	563

* including demonstration/practicals

525 hours of Hospital Postings

Second Year:

No.	Subject	Total Hours of Instruction		Total
		Theory	Practical/ Clinics	
1	Biochemistry-II	90	60	150
2	Pathology-II	134	80	214
3	Microbiology-II	100	80	180
i	Human Rights, Gender Equity and Environmental Studies	30	-	30
Total		354	220	574

514 hours of Hospital/Clinical Postings

Third Year:

No.	Subject	Total Hours of Instruction		Total
		Theory	Practical/ Clinics	
1	Biochemistry-III	90	70	160
2	Pathology-III	134	80	214
3	Microbiology-III	100	80	180
i.	Biostatistics	30	-	30
Total		350	230	584

504 hours of Hospital/Clinical Postings

13.1. Internship

- 13.1.1 Every candidate after passing the final year examination is required to undergo compulsory rotatory internship to the satisfaction of the College authorities and University for a period of six months (180 hospital working days) so as to be eligible for the award of the degree.
- 13.1.2 Internship is in partial fulfillment of the requirements of the course and no candidate shall be declared to have completed the course otherwise.
- 13.1.3 All parts of internship shall be done in the teaching hospital of the medical college.
- 13.1.4 Internship shall be completed within one year of the date of passing final examinations
- 13.1.5 The internship is extendable up to one year at the option of the candidate. If a candidate opts for one year internship, the extended period commences immediately after the compulsory internship.

13.1.6. Time Distribution

Sl. No	Posting Area	Time Period Spent in postings
1	Pathology	
	a. Blood Bank/Histopathology	1 month
	b. Hematology	1 month
2	Clinical Biochemistry	2 months
3	Clinical Microbiology	2 months

Note: 10 days of phlebotomy postings in each of the main THREE departments is compulsory.

13.1.7. Assessment of Internship

The intern shall maintain a record of work which is to be verified and certified by the faculty under whom he works. Based on the record of work and date of evaluation, the Head of the institution will issue a certificate of satisfactory completion of training, following which the university will award the B.Sc. Medical Laboratory Technology degree or declare him eligible for it.

13.1.8. Satisfactory completion shall be determined on the basis of the following:

No.	Parameter	Score
1.	Proficiency of knowledge required for each case management	0-5
2.	The competency in skills expected for providing clinical laboratory services	0-5
3.	Responsibility, punctuality, work up of case, involvement in patient-care	0-5
4.	Ability to work in a team (Behaviour with other health-care professionals including medical doctors, nursing staff and colleagues)	0-5
5.	Initiative, participation in discussions, research aptitude	0-5

- | | |
|---------------------------|------------------------|
| 0: Extremely dissatisfied | 3: Somewhat satisfied |
| 1: Very dissatisfied | 4: Very Satisfied |
| 2: Somewhat dissatisfied | 5: Extremely satisfied |

Note: A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

14. Attendance:

- 14.1. A candidate pursuing BSc (MLT) course shall study and work in the concerned departments of the Institute for the entire period as a full time candidate. No candidate is permitted to run a clinic/laboratory/ work in any laboratory / institution / hospital / nursing home etc., during the period of study (including internship). No candidate should join any other course of study or appear for any other degree examination conducted by this university or any other university in India or abroad during the period of registration (including internship)
- 14.2. Each year shall be taken as a unit for the purpose of calculating attendance in every subject.
- 14.3. 75% attendance separately in theory and in practical/clinical, in each subject, including subsidiary subjects, for appearing in the examination is compulsory, excluding attendance in non-lecture teaching i.e. seminars, group discussions, tutorials, demonstrations, hospital (Tertiary, Secondary and Primary) postings etc. A candidate who does not fulfill the attendance requirements shall repeat the year

15. Examinations:

There shall be an examination at the end of each academic year, in addition to periodical tests conducted by the College for internal assessment.

15.1. Scheme of Examination:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (university examination).

15.1.1. Internal Assessment:

Internal assessment marks will be calculated on the basis of sessional tests conducted by the college, seminars and assignments. There shall be at least three sessional tests. The marks of the best two sessional tests along with marks obtained in seminars and assignments will be considered, to calculate the internal assessment marks. A candidate must appear for all the sessional tests conducted in order to get the benefit of ‘Average of best two’. In case of failure to attempt all three sessional tests, final marks in internal assessment shall be calculated taking average of three attempts.

15.1.2. University Examination:

A candidate who satisfies the requirements of attendance, progress and conduct shall be eligible to appear for the university examinations. There shall be a university examination at the end of each academic year.

First Year:

No.	Subject	Theory			Practical			Grand Total
		Univ. Exam	IA	Total	Univ. Exam	IA	Total	
1	Human Anatomy	80	20	100	-	-	-	100
2	Physiology	80	20	100	-	-	-	100
3	Biochemistry-I	80	20	100	-	-	-	100
4	Pathology-I	80	20	100	-	-	-	100
5	Microbiology-I	80	20	100	-	-	-	100
Total								500
i	Communicative English*	100	-	100	-	-	-	100
ii	Constitution of India *	100	-	100	-	-	-	100
iii	Kannada*	100	-	100	-	-	-	100

Second Year:

No.	Subject	Theory			Practical			Grand Total
		Univ. Exam	IA	Total	Univ. Exam	IA	Total	
1	Biochemistry-II	80	20	100	80	20	100	200
2	Pathology-II	80	20	100	80	20	100	200
3	Microbiology-II	80	20	100	80	20	100	200
Total								600
i.	Human Rights, Gender Equity and Environmental Studies*	100	-	100	-	-	-	100

Third Year:

No.	Subject	Theory			Practical			Grand Total
		Univ. Exam	IA	Total	Univ. Exam	IA	Total	
1	Biochemistry-III	80	20	100	80	20	100	200
2	Pathology-III	80	20	100	80	20	100	200
3	Microbiology-III	80	20	100	80	20	100	200
Total								600
i.	Biostatistics	100	-	100	-	-	-	100

Note: * College exams only:

The College level examination will be held before the commencement of the University examination. A Pass in the subject with a minimum of 40 marks (40% of the total 100) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. There shall not be supplementary examination in these subjects. Failed candidates will have to appear for the examination in respective subsidiary subjects at the end of next academic year.

15.2. Criteria for Pass:

A candidate shall be declared as pass if he secures 40% of marks (including internal assessment) in each subject in theory and practical examination separately.

A candidate who fails in theory or practical exam in a subject, shall appear for both theory and practical in that subject in the subsequent examination. The candidate should satisfactorily complete rotatory internship.

15.3. Carry over Benefit

A candidate of I year is permitted to carryover all the failed subjects and proceed to II year and appear for II year examination concurrently along with failed subjects of the I year. However, he has to pass all the failed subjects of I year to become eligible to proceed to III year.

A candidate of II year is permitted to carryover all the failed subjects and proceed to III year and appear for III year examination concurrently along with failed subjects of the II year. However, he has to pass all the subjects of II year before the announcement of III year results.

15.4. Rules for grace marks:

Grace marks upto 1% of the maximum total marks in the examination subject to a maximum of 5 marks shall be awarded to the failed subject(s), provided on award of grace marks the candidate passes in that subject(s)/ examination.

There shall be no provision to award grace marks for improvement of class.

15.5. Re-totaling:

Re-totalling of marks is permitted for theory papers only. The university, on application within the stipulated time and remittance of a prescribed fee, shall permit a recounting of marks, for the subject (s) applied. The marks obtained after re-totalling will be the final marks awarded.

16. Supplementary Examinations:

Supplementary examination shall be conducted by the university for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

- A candidate detained for lack of attendance, internal assessment marks will be barred from appearing in any one or all course/s for the supplementary examination.
- A candidate dropping from appearance in any or all subjects /courses at regular examination is disallowed from taking dropped subject(s)/course(s) at the supplementary examinations.
- If a candidate submits application for appearing for the examination but does not appear for any of the subjects in the university examination, he can

appear for supplementary examination provided other conditions such as attendance requirement, internal assessment marks, etc. are fulfilled.

- A candidate who is promoted to the next higher class as per carry over regulations (except where apex bodies do not permit), if he clears the lower year/semester/phase examinations in the main examination is allowed to appear for the higher class examination during supplementary examinations provided other conditions such as attendance requirement, internal assessment marks, etc. are fulfilled.

A candidate permitted to appear for the supplementary examination can improve his internal assessment marks before he takes the supplementary examination by subjecting himself to internal assessment procedure as practiced in the college.

17. Declaration of Results and Classification:

Class will be awarded only to those candidates who pass the examination in the first attempt. Class shall be declared at the end of every year and will be on the basis of the aggregate of marks scored in that year.

70% and above - First Class with Distinction

60% and above but less than 70% - First class

50% and above but less than 60% - Second class

40% and above but less than 50% - Pass class

Candidates who pass the examinations in more than one attempt shall be declared as passed in 'Pass' class irrespective of the percentage of marks secured.

- An attempt means the appearance of a candidate for one or more courses either in part or full in a particular examination.
- A candidate who fails in main examination and passes one or more subjects or all subjects in the supplementary examination is not eligible for award of class or distinction. Passing in supplementary examination by such candidates shall be considered as attempt.
- If a candidate submits application for appearing for the regular examination but does not appear for any of the courses/subjects in the regular University examination, he can appear for supplementary examination provided other conditions such as attendance requirement, internal assessment marks, etc.

are fulfilled and his appearing in the supplementary examination shall be considered as the first attempt.

- Candidates who pass the subjects in the supplementary examinations are not eligible for the award of Gold Medal or Merit Certificate.

18. Award of Merit Certificate:

Merit Certificate shall be awarded on the basis of aggregate marks of all the years of examinations as per the duration of the course. In case lateral entry candidates are admitted, Merit Certificate shall be awarded on the basis of aggregate marks of the common years of study for both regular and lateral entry students.

Further, only those candidates who have completed the course and fulfilled all the requirements in the minimum number of years prescribed and who have passed each year in the first attempt are only eligible for the award of Merit Certificate.

I Year B. Sc. (Medical Laboratory Technology)

Subject: HUMAN ANATOMY

Theory (including Demonstration): 90 Hours

Course Outcomes

At the end of the course students will be able to...

- CO1:** Describe the general anatomy of human body
- CO2:** Explain normal disposition of various structures and organs in the body and its clinical correlation
- CO3:** Describe the microscopic structure of various tissues
- CO4:** Determine the topography of various structures on the surface of the body
- CO5:** Identify and locate structures of the body
- CO6:** Identify organs and tissues under microscope
- CO7:** Point out various features of appearance of normal body in skiagrams

Objectives:

1. To understand the general anatomy of the human body.
2. Anatomical correlation of body parts.
3. Application of anatomical terminologies in Medical Laboratory Technology.

Skills:

1. Explain the subdivisions of anatomy, terms of location and position, fundamental planes, vertebrate structure of man, organization of the body cells and tissues.
2. Anatomical Correlation of Bones, arteries, veins, nerves and organs.
3. Identify different body organs and their exact location.
4. Different body positioning terminologies

SYLLABUS

Unit 1

Theory: 13 hours /Demo: 6 Hours

1. Introduction: Human Body as a Whole:

Theory

Definition of anatomy and its subdivisions, 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

Demonstration:

Histology of types of epithelium, Histology of serous, mucous and mixed salivary gland, Surface marking of the body region wise.

2 Locomotion and Support

Theory

Cartilage – types, examples and histology

Bone – classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel's of fetal skull. Joints – classification of joints with examples, typical synovial joint (in detail).

Muscular system – classification of muscular tissue and histology

Important muscles of the body- Sternocleidomastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.

Demonstration

Histology of hyaline, elastic and fibrocartilage, Demonstration 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.

Unit 2

Theory:14 hours /Demo: 6 Hours

1. Cardiovascular System

Theory

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

Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system – cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymphnodes – cervical, axillary and inguinal lymph nodes.

Demonstration

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

2. Respiratory System**Theory**

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

Demonstration

Demonstration of parts of respiratory system, Normal radiographs of chest, Histology of lung and trachea.

Unit 3**Theory: 09 hours /Demo: 5 Hours****1. Gastro-Intestinal System****Theory**

Parts of GIT- oral cavity (lip, cheek, tongue, salivary glands, palate, dentition) pharynx (Waldeyer's ring) oesophagus, stomach, small and large intestine and appendix, Liver, gall bladder, pancreas and spleen, Histology of oesophagus, stomach, small and large intestine, liver, gall bladder and pancreas.

Demonstration

Demonstration of parts of GIT, liver, gall bladder, pancreas and spleen, Histology of tongue, salivary glands, oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas and spleen, Radiographs of abdomen plain and contrast.

2. Peritoneum

Theory

Description of reflection, folds and pouches in brief.

Demonstration

Demonstrations of reflections, folds and pouches.

Unit 4

Theory: 08 hours /Demo: 7 Hours

1. Urinary System

Theory

Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder.

Demonstration

Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen – IVP, retrograde cystogram.

2. Reproductive System

Theory

Parts of male reproductive system- testis, vas deferens, epididymis, prostate, Parts of female reproductive system- uterus, fallopian tubes, ovary, mammary gland, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary.

Demonstration

Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary, Radiographs of pelvis – Hysterosalpingogra.

3. Endocrine Glands

Theory

Names of all endocrine glands, describe in detail on pituitary gland, thyroid gland and parathyroid gland, suprarenal gland, Histology of pituitary, thyroid, parathyroid, suprarenal gland.

Demonstration

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

suprarenal glands.

Unit 5

Theory: 16 hours /Demo: 6 Hours

1. Nervous System

Theory

Neuron, Classification of nervous system, Cerebrum, cerebellum, brain stem, spinal cord & spinal nerve, Meninges, ventricles and cerebrospinal fluid, Blood supply of the brain, Cranial nerves (in brief), Nerve plexus (Brachial & lumbar)

Demonstration

Histology of peripheral nerve and optic nerve, Demonstration of major nerves in the body, Demonstration of cranial cavity and parts of brain, Histology of cerebrum, cerebellum, spinal cord

2. Sensory Organs

Theory

Skin and its appendages, Eye – parts of eye ball and lacrimal apparatus, Extra-ocular muscles, Histology of cornea and retina, Ear – parts of ear- external, middle and inner ear and contents

Demonstration

Histology of thin and thick skin, Demonstration of histology of cornea and retina.

3. Embryology

Spermatogenesis and oogenesis, Ovulation, fertilization, Placenta

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Human Anatomy shall be held after the end of the I year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks.

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

There is no practical examination in the subject of Human Anatomy

Recommended Books:

1. Shobha Rawlani and Shivlall Rawlani, Text Book of General Anatomy, 2nd edition, 2013, Jaypee brothers.
2. Sampah Madhyastha, Manipal Manual of Anatomy, 2nd edition, 2012, CBS publishers & distributors Pvt.Ltd.

Reference Books:

1. B.D. Chaurasia's- Human Anatomy, Vol.1,2 & 3, 5th edition, 2010, CBS publishers & distributors Pvt.Ltd.
2. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippincott. Philadelphia
3. T.W Sadler, Langman's Medical Embryology, 11th edition, 2009, Wolters Kluwer.
4. Inderbir Singh, G.P. Pal, Human Embryology, 9th edition, 2012, Macmillan India Ltd.
5. Latha V. Prabhu, Arunachalam Kumar, Mangala M. Pai, T.B. of Histology, 2nd edition, 2011, EMMESS Medical Publishers.

I Year B. Sc. (Medical Laboratory Technology)**Subject: PHYSIOLOGY****Theory: 80 Hours****Practical/Demonstration: 30 Hours****Course Outcomes***At the end of the course students will be able to...*

- CO1:** Explain the normal functioning of organs and systems.
- CO2:** Understand the interrelationships and interactions among various organs and systems for maintaining homeostasis.
- CO3:** Assess the relative contribution of each organ systems towards the maintenance of constant internal environment
- CO4:** Differentiate between normal and abnormal functioning of organs and systems,
- CO5:** Understand physiological basis of pathogenesis and treatment of diseases and disorders.
- CO6:** Apply the physiological basis in the field of allied health care

Objectives:

1. To recognize the basic physiological principals behind different body functions.
2. To understand the relative contribution of each organ system to maintenance of milieu interior.
3. Have an intuitive understanding of the role of physiology, especially in life processes and diseases.
4. To know the physiological principles underlying pathogenesis and management of diseases.

Syllabus

- 1. General physiology** **4 hours**

Introduction to Physiology, Concept of Homeostasis, cell – Morphology – Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments;
- 2. Muscle nerve physiology** **4 hours**

Neurons: Morphology, RMP, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction.
- 3. Blood** **15 hours**

Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Hemoglobin: Functions, concentration, physiological variations. Fate of Hemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner’s laws, ABO system, determination of blood groups, blood transfusion, complications of incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank, Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways.
Disorders of clotting – hemophilia, vitamin K deficiency. Anticoagulants – mechanism of action and their uses, Anemia: Classification – Morphological and Etiological, Blood volume: normal values.
- 4. Cardiovascular system** **10 hours**

Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate – Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values,

physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.

5. Respiratory system

8 hours

Respiratory and Non respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory tract. Respiratory membrane. Respiratory muscles. Surfactant: functions, respiratory distress syndrome.

Definitions of terms used in respiratory physiology: Eupnoea, Hyperpnoea, Tachypnea, Apnoea, Dyspnea.

Mechanics of breathing – intrapulmonary and Intrapleural pressure changes during a respiratory cycle.

Spirometry – Lung volumes and capacities. Vital capacity.

Oxygen transport: Role of hemoglobin, factors affecting, oxygen carrying capacity. Carbon dioxide transport: forms, chloride shift (Hamburgers phenomenon). Respiratory centers. Role of chemo receptors in regulation of respiration. Pulmonary ventilation and alveolar ventilation.

Partial pressure of gases, Calculation of partial pressure of gasses in mixture.

Arterial and venous blood gas concentrations and contents.

Hypoxia: Types and effects. Cyanosis, Asphyxia, Periodic Breathing, Acclimatization.

Hyperbaric O₂ therapy, Artificial respiration and Ventilators.

6. Excretory system

6 hours

Functions of kidneys. Nephrons – Juxta glomerular apparatus – functions, Steps in Urine formation – Ultrafiltration, Tubular Reabsorption, Tubular Secretion, GFR – Definition, normal values, factors affecting GFR, measurement of GFR, Renal threshold for glucose, tubular load for glucose, Role of aldosterone and ADH in urine formation, Micturition, Innervation of bladder. Diuresis, Renal functions tests – Based on analysis of urine and analysis of blood, Skin: Functions of skin. Sweat glands.

- 7. Digestive system** **7 hours**
Introduction, structure of alimentary canal, Saliva: Composition, functions, Stomach: Functions. Gastric Juice: composition, functions, Pancreatic Juice: Composition and functions, Liver: Functions, Bile: composition, functions, Gall bladder: functions, Succus entericus: Composition, functions. Functions of large intestine, Movements of small intestines, Deglutition.
- 8. Endocrine system** **8 hours**
Major endocrine glands- Hormone: Definition, Anterior pituitary: hormones and their functions, disorders – Gigantism, acromegaly, dwarfism, Posterior pituitary: Hormones – diabetes insipidus, Thyroid: Hormones, normal values, functions, role of TSH. Disorders: simple goitre, myxoedema, cretinism, Grave's disease, Adrenal cortex: hormones, functions of cortisol and aldosterone. Addison's disease, Cushing's syndrome, Adrenal medulla: actions of adrenaline and noradrenaline, Endocrine pancreas: Insulin & glucagon, functions, Regulation of blood glucose level, diabetes mellitus, Parathyroid: Functions of PTH.
- 9. Nervous system** **10 hours**
Synapse: Types, Transmission, Sensory receptors: Definition, Classification Organization of spinal cord, Functions of Dorsal column and Spinothalamic tract, Functions of Corticospinal tract, Reflex Action: Definition, reflex arc, Functions of Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Cerebral cortex: Lobes & functions. EEG – Definition and uses, Autonomic nervous system: Organization & functions, Cerebrospinal fluid: Composition and function.
- 10. Special senses** **4 hours**
Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell
- 11. Reproductive system** **4 hours**
Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.

Practical / Demonstrations:	30 Hours
1. Study of Microscope and its uses	02
2. Collection of blood and study of haemocytometer	02
3. Haemoglobinometry	02
4. Determination of RBC count	04
5. Determination of WBC count	04
6. Determination of blood groups	02
7. Leishman's staining and differential leukocyte count	06
8. Calculation of blood indices	02
9. Determination of bleeding time	01
10. Determination of clotting time	01
11. Determination of ESR	01
12. Determination of PCV	01
13. Recording of Arterial Blood Pressure	02

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Physiology shall be held after the end of the I year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks.

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

There shall be no practical examination in the subject of Physiology

Recommended Books:

1. A. P. Krishna - Text Book of Physiology
2. A.K. Jain Text Book of Physiology

I Year B.Sc (Medical Laboratory Technology)**Subject: BIOCHEMISTRY I****Theory: 60 Hours****Course Outcomes***At the end of the course students will be able to...*

- CO1:** Know the responsibility of health care personals and hazards faced in the clinical laboratory.
- CO2:** Describe the different types, use, care and maintenance of the laboratory apparatus and instruments.
- CO3:** Explain chemistry and metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes and vitamins.
- CO4:** Describe the fundamental chemistry and knowledge of different solutions.
- CO5:** Define acid, bases, salts, indicators and also explain about acid base balance.
- CO6:** Explain the management of biomedical waste.
- CO7:** Describe collection of specimen and processing.
- CO8:** Enumerate different types of body fluids analysed in the lab
- CO9:** Explain different methods for disposal of the used samples.
- CO10:** Describe various techniques used in biochemistry.
- CO11:** Classify and explain different functional test like LFT, RFT and TFT.
- CO12:** Explain formation and analysis of renal calculi and gall stones.
- CO13:** Describe over view of genetics
- CO14:** Enlist tumour markers and cardiac markers.

Objectives:

MLT student at the end of the training in biochemistry will be able to:

1. Understand the responsibility of health care personals and hazards faced in the clinical laboratory.
2. Understand the different types, use, care and maintenance of the laboratory apparatus and instruments.
3. Understand the chemistry and metabolism of carbohydrates, proteins,

- lipids, nucleic acids, enzymes and vitamins.
4. Understand the fundamental chemistry and knowledge of different solutions.
 5. Understand what are acid, bases, salts, indicators and also know about acid base balance.
 6. Understand the management of biomedical waste.
 7. Understand the collection of specimen and processing.
 8. Understand the different types of body fluids analysed in the lab and the disposal of the used samples.
 9. Understand the techniques used in biochemistry.
 10. Understand the different functional test like LFT, RFT and TFT.
 11. Understand the formation and analysis of renal calculi and gall stones.
 12. Understand the over view of genetics, tumor markers and cardiac markers.
 13. Understand the basic concepts of quality control and also about internal and external quality control.
 14. Understand the automation used in clinical laboratory.
 15. Perform in proper manner all the clinical biochemistry procedures and related techniques.

SYLLABUS

Unit 1

8 hours

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

4 hours

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

2 hours

Biomedical waste management

2 hours

Unit 2

14 hours

Laboratory apparatus : Different types, use, care and maintenance: Different materials used in laboratory – significance of borosilicate 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 6 hours

Instruments: Use, care and maintenance; Water bath; Oven & Incubators; Distillation apparatus - water distillation plant and water deionisers, Reflux condenser; Cyclomixers; Magnetic stirrer; Refrigerators, Deep freezers, Cold box; Laboratory balances*: Physical and analytical. Mono & double pan, Electronic balances; Weighing different types of chemicals, liquids, hygroscopic compounds etc; Principle, Components, working, Procedure of operation & Application of –Different types of centrifuges; Photometers; pH meter. 8 hours

Unit 3 22 hours

Chemistry of Carbohydrates: Definition classification & importance of carbohydrates; Composition properties and importance of monosaccharides, disaccharides and Polysaccharides. 6 hours

Chemistry of amino acids and proteins: Definition classification & importance of amino acids; Biologically important peptides and its functions; Proteins- Definition, classification & Functions; Structural organization of proteins and denaturation of proteins. 6 hours

Chemistry of Nucleic acids: Chemistry of nucleotides: Purine and Pyrimidine bases. Composition of nucleosides and nucleotides. Occurrence of bases; Structure of DNA. Watson-Crick model, different forms of DNA; Structure of RNA. Types & function 5 hours

Chemistry of lipids: Classification of lipids; Functions of lipids; Classification & functions of Phospholipids, lipoproteins. 5 hours

Unit 4 16 hours

Fundamental Chemistry: Valency, Molecular weight & Equivalent weight of elements and compounds, Normality, Molarity, Molality of solution 6 hours

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- Normal, Molar and percent solution Dilution; Preparing working standard from stock standard; Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors. 6 hours

Acids, Bases, Salts and Indicators: Basic concepts: Definition and examples of acid, base and buffers, Derivation of Henderson-Hasselbalchs equation & its application, Different types of Indicators & their use 4 hours

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Biochemistry I shall be held after the end of the I year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl. No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

There is no practical examination in the subject of Biochemistry I

Recommended Text and Reference Books:

1. U Sathyanarayana & U Chakrapani Biochemistry – 3rd revised edition
2. Godkar and Godkar Textbook of Medical Laboratory technology 2nd edition.
3. Burtis. C.A. Ashwood E. R. Tietz Text book of Clinical Chemistry and molecular diagnostics – 3rd, 4th and 5th editions

4. Shivananda Nayak B Manipal manual of clinical biochemistry for medical laboratory and M.Sc, student 3rd edition.
5. Varleys Practical Clinical Biochemistry 4th, 5th, 6th editions

I Year B.Sc (Medical Laboratory Technology)

Subject: PATHOLOGY–I

Theory: 108 Hours

Practical/Demonstration: 20 Hours

Course Outcomes

At the end of the course students will be able to...

- CO1:** Develop competency in techniques of pathology branches like haematology, clinical pathology, blood bank, histopathology and cytology.
- CO2:** Acquire knowledge and understand the formation of blood cells, structure, functions and methods of estimating different parameters.
- CO3:** Learn about different haematological diseases and role of laboratory for identification of abnormalities.
- CO4:** Perform special laboratory methods used in investigation of anemias.
- CO5:** Learn about bone marrow aspiration and biopsy techniques, preparation of smears and staining.
- CO6:** Understand the detailed aspects of blood coagulations, disorders of hemostasis, principles and methods of assessment of coagulation.
- CO7:** Collect blood by various methods to efficiently perform routine and special investigations in clinical haematology laboratory.
- CO8:** Demonstrate collection, preservation and examination of body fluids to report the abnormalities.
- CO9:** Learn about various histotechniques, handling, decalcification, processing, cutting of paraffin and frozen tissue specimens as well as staining procedures.
- CO10:** Learn about theory of staining and perform routine as well as special staining techniques.
- CO11:** Understand the principles of immunohaematology, blood collection, infectious marker determination, compatibility testing and coomb's testing.
- CO12:** Understand basics of transfusion medicine, hazards, component preparation, quality control and apheresis techniques.
- CO13:** Apply safety precautions, quality assurance, biomedical waste management, automation in haematology, histopathology and cytology.

CO14: Demonstrate cytological investigations including collection, handling, processing and staining procedures for different clinical specimens.

CO15: Demonstrate basic techniques of cytogenetics, tissue culture and immunohistochemistry.

Objectives:

1. To understand fundamental analytical principles and processes used in Pathology laboratory testing.
2. To understand the practical and theoretical basis for clinical laboratory test selection and interpretation.
3. To respond appropriately and effectively to situations commonly encountered when taking call.
4. To begin learning the body of knowledge needed for board exams.
5. To obtain an understanding of the elements that contribute to professional competence, including patient care, medical knowledge, practice-based learning, interpersonal and communications skills, professionalism and systems-based practice.

SYLLABUS

Haematology - I

26 hours

Unit 1

12 hours

Introduction to Hematology; Normal constituents of blood, structure and function; Laboratory Safety guidelines; SI units and conventional units in hospital laboratory; Glass wares, their preparation and usage

Unit 2

14 hours

Collection of blood sample; Anticoagulants; Haemoglobin; PCV; ESR; Various instruments used in hematology; Quality control

Clinical pathology

40 hours

Unit 3

25 hours

Introduction; Collection, transport, preservation of various clinical specimens; Urine Examination; Examination of Body Fluid; Examination of CSF

Unit 4	15 hours
Sputum Examination; Stool Examination; Semen analysis	
Histopathology	42 hours
Unit 5	30 hours
Introduction to Histopathology; Receiving of specimens in the Laboratory; Grossing Techniques; Fixatives, mode of action, preparation and indication; Decalcification of tissues; Processing	
Unit 6	12 hours
Uses and care of compound microscope; Record maintenance, Filing of slides & Dispatch of reports; Biomedical waste management	
Practicals	20 hours
1. Urine analysis: Physical, Chemical, Microscopic	
2. Hemoglobin Estimation	
3. ESR	
4. PCV	

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Pathology–I shall be held after the end of the I year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl. No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

There is no practical examination in the subject of Pathology I

Reference books:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred greg – Diagnostic cytopathology
5. Prafull B Godkar - Medical Laboratory Technology
6. Todd & Sanford - Clinical Diagnosis by laboratory method
7. Dacie & Lewis – Practical Haematology
8. Ramanik Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi –1996)
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi – 1998
10. Sachdev K.N. Clinical Pathology and Bacteriology 8th Ed, J.P. Bros, New Delhi-1991.

I Year B.Sc. (Medical Laboratory Technology)**Subject: MICROBIOLOGY I****Theory: 70 Hours****Practical/Demonstration: 15 Hours****Course Outcomes***At the end of the course students will be able to...*

- CO1:** Describe the structure, classification, growth and identification of various microorganisms including bacteria, fungi, parasite and virus.
- CO2:** Describe the various disease producing organisms that includes bacteria, fungi, parasite and virus.
- CO3:** Describe the different methods of infection control and practices in laboratory and their role in hospital infection control program
- CO4:** Describe the various diagnostic tests employed in the laboratory diagnosis of diseases.
- CO5:** Describe the concepts and principles of Antibiotic sensitivity testing and their role in drug resistance in bacteria.
- CO6:** Explain the concepts and principles of immunity, hypersensitivity, Autoimmunity, and immunization.

Objectives:

1. Explain the concepts and principles of microbiology and its importance.
2. Describe the structure, classification, morphology growth of bacteria.
3. Describe the methods of infection control and role in hospital infection control program.
4. Describe different disease producing organisms.
5. Describe the various diagnostics tests employed in the laboratory diagnosis of diseases.
6. Explain the concepts of immunity, hypersensitivity and immunization.

SYLLABUS

- Unit 1** **6 hours**
Introduction: History of Microbiology, classification of microorganisms, use of microscope in the study of bacteria, Morphology of bacterial cell
- Unit 2** **6 hours**
Growth and nutrition: Nutrition, growth and multiplication of bacteria, culture media and culture methods
- Unit 3** **5 hours**
Sterilization and disinfection: Principles and use of equipments of sterilization, chemicals used in disinfection
- Unit 4** **2 hours**
Biomedical waste management principle and practice
- Unit 5** **4 hours**
Immunology: Immunity, Vaccines, Immunization schedule, Definition of Antigen, antibody, list of antigen antibody reactions and their applications
- Unit 6** **6 hours**
Infection: Definition, types, sources and mode of transmission, Hospital infections, – causative agents, mode of transmission and prophylaxis, Antimicrobial susceptibility testing
- Unit 7** **15 hours**
Systematic bacteriology: Disease caused and lab diagnosis of medically important bacteria (Staphylococcus, Streptococcus, Neisseria, Escherichia coli, Salmonella, Shigella, Vibrio, Mycobacteria, Treponema, Leptospira) (No need of classification, antigenic structure, virulence mechanism)
- Unit 8** **8 hours**
Parasitology: Introduction to Parasitology, List of medically important parasites and diseases (Morphology, Life cycle Diagnosis of E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma), Lab diagnosis of parasitic infections

Unit 9**10 hours**

Virology: Introduction to virology, List of medically important viruses and diseases (Briefly discuss the disease, causative agent and diagnosis of AIDS, Hepatitis, Rabies, Polio, influenza, Dengue, Chikungunya), Lab diagnosis of viral infections

Unit 10**8 hours**

Mycology: Introduction to Mycology; List of medically important fungi and diseases (Discuss Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis and Mucoromycosis), Lab diagnosis of fungal infections

Practicals**15 hours**

- | | |
|--|---------|
| 1. Compound Microscope | 1 hour |
| 2. Demonstration and sterilization of equipments. | 2 hours |
| 3. Demonstration of commonly used culture media and media with growth. | 2 hours |
| 4. Antibiotic susceptibility test. | 1 hour |
| 5. Demonstration of common serological tests
– Widal, VDRL, RA, CRP, ASO, ELISA | 6 hours |
| 6. Grams stain, Acid fast staining | 2 hours |
| 7. Stool exam for Helminthic ova | 1 hour |

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Microbiology I shall be held after the end of the I year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

There is no practical examination in the subject of Microbiology I.

Reference Books:

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

First Year B.Sc. (Medical Laboratory Technology)

Subject: COMMUNICATIVE ENGLISH

Course Description: The course is designed to enhance the personality of the students by introducing and improving their spoken knowledge and speaking skills apropos their professional work.

Course Outcomes

At the end of the course students will be able to...

- CO1:** Analyze and restate the meaning of a text in English
- CO2:** Demonstrate the skill to write in English without grammatical error
- CO3:** Practice listening effectively to communication in English
- CO4:** Develop the ability to speak English language with the right way of pronunciation.
- CO5:** Express the viewpoints with confidence in English
- CO6:** Express values and skills gained through effective communication to other disciplines
- CO7:** Compose articles and compositions in English
- CO8:** Discuss and socialize effectively in English

Objectives: After completing this course the students will be able to:

- Read and write correct English.
- Communicate effectively in English language.
- Demonstrates skill in writing and speaking English language.

Hours- 30 Hours

Unit I Language-Basic

05 hours

Content: Review of grammar, Remedial study of grammar, building vocabulary

Introduction

Parts of speech

Exercise on use of grammar

Tense, Number, Gender

Assessment methods: Objective type, Fill in the blanks.

Unit II

03 hours

Content: Read and comprehend prescribed course books
Reading, Summarizing, Comprehension

Assessment methods: Fill in the blanks and one mark questions

Unit III

06 hours

Content: Various Forms of Composition

Letter writing

Note taking

Precise writings

Diary writing

Reports on health problem etc.

Official correspondence:

Outgoing correspondence, replying incoming correspondence, writing circulars, notices, charge memos, note taking, writing summaries, observation reports.

Teaching learning activities: Exercise on writing: Letter writing, resume/CV Essay writing.

Assessment methods: Applications, short reports to be written.

Unit IV

10 hours

Content: English- Spoken mode, Debates, Telephonic conversion, formal & informal conversation: Agreeing emphasizing, interrupting, politely, opinions, interviews, visual presentation.

Teaching learning activities: Participating in seminar, Telephonic conversion, conversation in different situations, practice in public speaking

Assessment methods: Assessment of the skills based on the checklist.

Unit V

06 hours

Content: Listening to comprehension media, audio, video, speeches, definition of listening, types of listening, purposes of listening, obstacles for listening, contexts of listening, to be a good listener, listening to a lecture etc.

Teaching learning activities: Listening to audio, video tapes and identify the key points.

Assessment methods: Practical test of listening and filling out the blanks, essay type
There shall be examination for 100 marks at the end of the academic year, which will be conducted by the college.

Reference Books:

1. Tom Koorkkakala, *Communicative English for General Nursing Students*, K.J. Publications, 2008.
2. *King's English*, Addone Publishing Group, Thiruvananthapuram.
3. John Ellison Kahn & others, *How to write and speak Better*, Reader's

I Year B. Sc. (Medical Laboratory Technology)

Subject: CONSTITUTION OF INDIA

Theory: 30 Hours

Course Outcomes

At the end of the course students will be able to...

CO1: Understand the meaning and importance of Constitution

CO2: Explain about making of Indian Constitution - contribution of Constituent assembly on it.

CO3: Describe the Salient (Outstanding) features of Indian Constitution.

CO4: Describe the importance of Preamble of the Indian Constitution and its significance.

SYLLABUS

Unit 1

8 hours

1. Constitution of India:

4 hours

An Introduction to Indian Polity, Meaning and importance of Constitution; Making of the Indian constitution – The Constituent Assembly; Salient features of the Indian Constitution; Preamble of the Indian Constitution and its significance;

2. Fundamental Rights and Directive Principles:

4 hours

Fundamental Rights, Directive Principles of the State Policy, Fundamental Duties

Unit 2

9 hours

1. Government of the Union

4 hours

- i. The Union Executive- the President and the Vice-President- The Council of Ministers and the Prime Minister, The Union Legislature - The Parliament- The Lok Sabha and the Rajya Sabha, composition, Powers and functions, Important Committees -Privileges, Role of the Speaker

2. **Government of the States:** 4 hours
The Governor- The Council of Ministers and the Chief Minister; The State Legislature- composition powers and functions
3. **Democratic decentralization or Panchayath Raj in India** 1 hour

Unit 3 **10 hours**

1. **Federalism in India** 5 hours
- i. Federal Features Indian federalism, Centre-State relations- distribution of legislative powers, Administrative and financial relations between the Union and the States, The Finance Commission, The Planning Commission, National Development Council, Military Features
2. **The Judiciary** 5 hours
The Supreme Court – Organization, Jurisdiction and Role, the High Court – Organization, Jurisdiction and Role, Judicial Review, Judicial activism, Independence of Judiciary in India

Unit 4 **3 hours**

1. Electoral Process in India – Election Commission, Organization and Functions
2. Local Governments – Rural and Urban – Organization, Powers and Role

Examination:

There shall be an examination for 100 marks at the end of the academic year, which will be conducted by the college

Books for Reference:

1. M V Pylee: An Introduction to the Constitution of India, Vikas Publishing House Pvt Ltd, 2009
2. C K Jain (ed): Constitution of India in Precept and Practice, Lok Sabha Secretariat, New Delhi
3. J C Johari: Indian Politics, Vishal Publications, Jalandhar
4. A P Avasthi: Indian Government and Politics, Lakshmi Narain Agarwal, Agra
5. J C Johari: The Constitution of India – A Politico-Legal Study- Sterling Publication Pvt. Ltd, New Delhi

6. M Hidayatullah: Democracy in India and the Judicial Process, Metropolitan, New Delhi
7. K C Markandan: Directive Principles in the Indian Constitution, Allied Publishers, Mumbai

Kannada Land and Language/PAŁABqÀ ŁÁqÀÀ ŁÀÄr ŸAjZÀAiÄÄ
 Our Land/ ŁÀÄÄHgÀÄ

The student groups are made with local students as the group leaders, so that they help the non-Kannada students to improve the language skills outside the class and even after completion of the course. All students should attend these classes and must have minimum 75% attendance. It is mandatory that they pass the examination conducted at the end of the course to become eligible to appear for the 1st Year University Examination.

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Prescribed Kannada Text Book:

Sayeegeetha, Kannada NudiKalikegonduKaipidi, Nitte University, 2016.

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Ä-ÄVÄvÁ, PÀŁABqÀ ŁÄÄrPÀ°PÉUÉÆAzÄÄPÉÉ!r, ðmÉÖ «±Äé«zÁâ®AiÄÄ, 2016

Examination:

There shall be an examination for 100 marks at the end of the academic year, which will be conducted by the college

Reference Books:

Ed.: Dr.Sayeegeetha, English-Kannada-Tulu Dictionary, Nitte University, 2018.

Kannada- Lingadevaru Halemane, Kannada Kali, Kannada University Hampi, 2002

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„ÄA: qÁ. „Á-ÄVÄvÁ, EAVèµi-PÀÈÀßqÀ-vÄÄ¼ÄÄ ¥ÄzÀPÉÆÄ±À, µmÉÖ
«±Äé«zÁâµ®AiÄÄ, 2018
‘PÀÈÀßqÀ PÀ°’, -ÉÄ: °AUÄzÉÄªÀgÄÄ °Ä¼ÉªÄÄÉÉ, PÀÈÀßqÀ
«±Äé«zÁâµ®AiÄÄ, °ÄAi, 2002

II Year B.Sc (Medical Laboratory Technology)

Subject: BIOCHEMISTRY II

Theory: 90 Hours

Practical/Demonstration: 60 Hours

Course Outcomes

At the end of the course students will be able to...

- CO1:** Know the responsibility of health care personals and hazards faced in the clinical laboratory.
- CO2:** Describe the different types, use, care and maintenance of the laboratory apparatus and instruments.
- CO3:** Explain chemistry and metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes and vitamins.
- CO4:** Describe the fundamental chemistry and knowledge of different solutions.
- CO5:** Define acid, bases, salts, indicators and also explain about acid base balance.
- CO6:** Explain the management of biomedical waste.
- CO7:** Describe collection of specimen and processing.
- CO8:** Enumerate different types of body fluids analysed in the lab
- CO9:** Explain different methods for disposal of the used samples.
- CO10:** Describe various techniques used in biochemistry.
- CO11:** Classify and explain different functional test like LFT, RFT and TFT.
- CO12:** Explain formation and analysis of renal calculi and gall stones.
- CO13:** Describe over view of genetics
- CO14:** Enlist tumour markers and cardiac markers.
- CO15:** Describe basic concepts of quality control- internal and external quality control.
- CO16:** Explain automation used in clinical laboratory.
- CO17:** Perform in proper manner all the clinical biochemistry procedures and related techniques.

SYLLABUS

Unit 1	12 hours
Specimen collection and processing: Type and time of sample collection, Precautions to be taken during sample collection, Blood collection: type of sample required (plasma or serum or cell), nature of blood collected(capillary, venous or arterial), Use of anticoagulants, Transport, processing, storage and preservation of samples, Care of infected samples, Urine collection: time of urine collection for different analysis, timed urine collection and urine preservatives used, Collection of different body fluids	5 hours
Body fluids: Composition and biochemical analysis of blood, urine, cerebrospinal, ascitic, peritoneal, pleural, pericardial and synovial fluids	5 hours
Disposal of samples	2 hours
Unit 2	29 hours
Enzymes: Definition and properties, Classification of enzymes, Specificity of enzymes, Coenzymes and Proenzymes: definition and examples, Factors affecting enzyme activity: effect of substrate, enzyme concentration, pH, temperature and activators, Enzyme inhibition: types, features and clinical importance, Isoenzymes: definition, examples and clinical importance, Diagnostic importance of enzymes, Analytical and therapeutic role of enzymes.	12 hours
Vitamins: Sources, RDA, biochemical functions, deficiency manifestations, toxicity (if any) and antivitamins of fat soluble and water soluble vitamins.	17 hours
Unit 3	37 hours
Metabolism of carbohydrates: Digestion and absorption of carbohydrates Disorders of digestion and absorption of carbohydrates; Glycolysis: definition, reactions, energetics, inhibitors and importance; Citric acid cycle: definition, reactions, energetics, inhibitors and importance; Gluconeogenesis: definition, reactions, energetics and importance; Importance of pentose phosphate pathway; Enzyme deficiency and clinical manifestations of von-Gierke's disease, galactosemia, McArlde's disease, Hereditary fructose intolerance, essential fructosuria; Normal levels and Regulation of blood glucose level; Glucose tolerance test: procedure and interpretation; Causes, Clinical manifestations, complications and biochemical tests of diabetes mellitus; Glycated hemoglobin: normal level and clinical importance; Causes and biochemical analysis of reducing sugars in urine	16 hours

Metabolism of amino acids and proteins: Digestion and absorption of proteins; Disorders of digestion and absorption of proteins; Sources, transport and detoxification of ammonia; Urea cycle: reactions, disorders, normal level and its clinical importance; Biosynthesis and clinical importance of biologically important compound of glycine, tyrosine, tryptophan, arginine and methionine;

Aminoacidurias 14 hours

Metabolism of nucleotides: Synthesis of uric acid, Hyperuricemia 7 hours

Unit 4 12 hours

Techniques: Principle, types, instrumentation and applications of chromatography, Principle and applications of reflectance photometry, turbidometry and nephelometry, Principle, instrumentation, procedure of use and application of glucometers 12 hours

Practicals: 60 hours

1. Qualitative analysis of carbohydrates, protein and non-protein nitrogen.
2. Precipitation reactions of proteins.
3. Analysis of normal and abnormal urine.
4. Colorimetry: verification of Beer's –Lambert's law.
5. Preparation and importance of calibration curve.
6. Different or common methods used for the analysis plasma glucose, blood urea, serum creatinine and uric acid.
7. CSF analysis: sugar and protein.
8. Urine protein analysis
9. Microalbuminuria
10. Glucose tolerance test
11. Chromatography demonstration

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Biochemistry II shall be held after the end of the II year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Biochemistry II for 100 marks, including 20 marks for internal assessment.

Recommended Text and Reference Books:

1. U Sathyanarayana & U Chakrapani Biochemistry 3rd revised edition
2. Godkar and Godkar Textbook of Medical Laboratory technology 2nd edition.
3. Burtis. C.A. Ashwood E. R. - Tietz Text book of Clinical Chemistry and molecular diagnostics 3rd, 4th and 5th editions
4. Shivananda Nayak B - Manipal manual of clinical biochemistry for medical laboratory and M.Sc, student 3rd edition
5. Varley's Practical Clinical Biochemistry 4th, 5th, 6th editions

II Year B.Sc (Medical Laboratory Technology)

Subject: MICROBIOLOGY II

(Systematic Bacteriology + Parasitology)

Theory: 100 Hours

Practical/Demonstration: 80 Hours

Course Outcomes

At the end of the course students will be able to...

- CO1:** Describe the structure, classification, growth and identification of various microorganisms including bacteria, fungi, parasite and virus.
- CO2:** Describe the various disease producing organisms that includes bacteria, fungi, parasite and virus.
- CO3:** Describe the different methods of infection control and practices in laboratory and their role in hospital infection control program
- CO4:** Describe the various diagnostic tests employed in the laboratory diagnosis of diseases.
- CO5:** Describe the concepts and principles of Antibiotic sensitivity testing and their role in drug resistance in bacteria.
- CO6:** Explain the concepts and principles of immunity, hypersensitivity, Autoimmunity, and immunization.

SYLLABUS

Unit 1	70 hours
Systematic Bacteriology	8 hours
1. Biochemical reactions for identification of bacteria	5 hours
2. Antimicrobial Susceptibility Testing	2 hours
3. Normal flora of the human body	1 hour
Gram Positive Bacteria:	15 hours

Systematic study of the following bacteria with special reference to morphology, cultural characteristics, pathogenicity, lab diagnosis and prophylaxis

Staphylococcus	1 hour
Streptococcus	2 hours
Pneumococcus	1 hour
Corynebacterium	2 hours
Bacillus	2 hours
Mycobacterium	3 hours
Clostridium	3 hours
Actinomycetes	1 hour
Gram Negative Bacteria:	20 hours
Neisseria	2 hours
Haemophilus, Bordetella, Brucella	4 hours
Enterobacteriaceae, Salmonella & Shigella	6 hours
Vibrio, Campylobacter & Helicobacter	4 hour
Pseudomonas, Burkholderia & non fermenters	3 hours
Yersinia	1 hour
Spirochaetes & Others	15 hours
Treponemes, Leptospira & Borrelia	4 hours
Mycoplasma, Chlamydia & Rickettsia	3 hours
Non sporing anaerobes	1 hour
Gardenerella, Legionella & Listeria	3 hours
Miscellaneous Bacteria	4 hours
Applied bacteriology	10 hours
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	2 hours
Unit 2	30 hours
Parasitology	
Protozoology	12 hours
– Entamoeba, Balantidium coli	2 hours
– Trichomonas, Giardia, Leishmania, Trypanosoma	4 hours
– Malaria, Toxoplasma	3 hours

– Cryptosporidium, Microsporidium, Isospora, Cyclospora	3 hours
Helminthology	16 hours
• Cestodes : Taenia, Echinococcus, D. latum, H. Nana	5 hours
• Trematodes : Schistosoma, Fasciola	2 hours
• Nematodes : Ascaris, Ancylostoma, Enterobius, Trichuris, Strongyloides, Trichinella,	
• Dracunculus, Wuchereria and other Filarial worms.	9 hours
Lab Diagnosis of Parasitic Infections	1 hour
Arthropods of Medical Importance	1 hour
Practicals	80 hours
1. Staining: Gram Stain, Z N Stain, Albert stain	
2. Hanging drop Preparation	
3. Culture media and 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	

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Microbiology II shall be held after the end of the II year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Microbiology II for 100 marks, including 20 marks for internal assessment.

Distribution of marks for Practicals

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

II Year B.Sc (Medical Laboratory Technology)**Subject: PATHOLOGY – II****Theory: 134 Hours****Practical/Demonstration: 80 Hours****SYLLABUS****Histopathology** **72 hours****Unit 1** **15 hours**

Automation in histopathology – Automatic tissue processor, Automatic knife sharpener, Automatic slide stainer; Celloidin, Gelatin, Resin embedding, mountants and mounting; Vacuum embedding oven; Tissue tech system

Unit 2 **25 hours**

Paraffin Section cutting, routine H&E staining; Frozen section cutting technique - Freezing microtome, Cryostat, Staining; Special stains for - Carbohydrate, Lipids, Pigments, Connective tissues - Collagen fibers, Elastic fibers, Reticulin fibers; Microorganisms - Bacteria, Fungi, Parasites; Nervous tissue, Bone tissue

Unit 3 **32 hours**

Microscopes: Principle, features and applications of the following microscopes
Electron microscope – preparing sections for electron microscopy (Ultra microtome) - Scanning, Transmission; Dark ground Microscope; Phase contrast Microscope; Fluorescent Microscope; Polarizing Microscope; Museum
Technology; Microphotography and its applications; ICDS classification and coding; Application of computers in pathology

Haematology – II **62 hours****Unit 4** **16 hours**

Hematopoiesis, Blood cell Counts: Principle, RBC, WBC, Platelet count, AEC and automation, Red cell indices, Reticulocyte count, Preparation and staining of blood films, Examination of blood film for morphology of red cell and differential count,

Bone marrow aspiration and trephine biopsy

Unit 5 24 hours
Anemia - Introduction, Classification of anemia, Anemia – Iron deficiency anemia, megaloblastic anemia and associated (ACD) with investigations
Hemolytic anemia – Nomenclature, Beta thalassemia, Hereditary spherocytosis, sickle cell anemia and PNH
Special tests OFT - Auto hemolysis, Acidified serum test (HAM test), Tests for Hemoglobin S, Estimation of Fetal Hemoglobin, Heinz Body test, Tests for unstable hemoglobin, Hemosiderin in Urine, Preparation of Hemolysate, Hemoglobin Electrophoresis at Alkaline pH, Estimation of Hb A2 level.

Unit 6 3 hours
Leukemia: Causes; Classification-Clinical features, Laboratory findings

Unit 7 19 hours
Normal Hemostasis, Tests of Hemostasis and coagulation, LE cells, Hemoparasites, Cytochemistry, Automation in Hematology, Organization and Quality control

Practicals **80 hours**

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

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Pathology II shall be held after the end of the II year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Pathology II for 100 marks, including 20 marks for internal assessment.

Distribution of marks for Practicals

Type of Question	Marks allotted
Haematoxylin and eosin or a special stain	10
Haemoglobin or PCV	10
Total count	10
Differential count	10
ESR	10
Blood smear preparation and staining	10
Record	10
Spotters	10
Total	80

II Year B. Sc. (Medical Laboratory Technology)**Subject: HUMAN RIGHTS, GENDER EQUITY AND ENVIRONMENTAL STUDIES****Theory: 30 Hours****Course Outcomes***At the end of the course students will be able to...*

- CO1:** Understand the very fact human rights system.
CO2: Understand the gender equity.
CO3: Understand the human rights advocacy.
CO4: Understand the concepts of womens' status in India
CO5: Explain about, what is environmental studies.
CO6: Know the values of natural resources.
CO7: Participate in conservation and preservation of environment discussion, and contributing to the country by protecting.

SYLLABUS**Unit 1****Human rights** **08 hours**

1. Human Rights – Meaning; Universal Declaration of Human Rights 4 hours
2. Human Rights Advocacy: Global Advocacy of Human Rights; Amnesty International and other organization ; People’s Union for Civil Liberty (PUCL); Human Rights Commission in India; Minority Commission in India; Remedies against violation of Human Rights in India
3. United Nations and Human Rights: Civil and Political Rights: Economic, Social and Cultural Rights 4 hours

Unit 2**Gender equity** **11 hours**

1. Sex and Gender – Masculinity and Feminity – Patriarchy, Matriarchy, Gender Roles and Attributes, Gender Division of Labour – Gender bias, Gender

- Stereotypes – Need for Gender Sensitization 3 hours
2. Women’s Status in India: Important indicators – sex ratio, education, health, nutrition, maternal and infant mortality, work participation rates, political participation 3 hours
 3. Contemporary Women’s issues: Discrimination against girl child; Violence against women; Problems of Health and Nutrition; Women’s Education and gender bias in education; Trafficking of Women; Globalization and impact on women 3 hours
 4. State Initiative on Gender Issues: Constitution rights of women; Laws pertaining to women; National and State Commission for women 2 hours

Unit-3

Environmental studies 11 hours

1. Environment: Components of Environment Concepts of Ecology; Ecological factors: Soil, air, water; Eco System – Pond and Forest as Ecosystem; Human Population Growth 4 hours
2. Environmental Pollutions: Types of Pollution – a) soil, air, water b) noise and radioactive pollution; Sources of Pollution and their effects; Control measures: Legal and administrative 4 hours
3. Conservation and Preservation of Environment: Natural resources and their conservation – water, soil and forest; Agencies involved in environmental protection in India; Environmental Movements in India ; Legal and administrative measures for environmental protection 2 hours

Examination:

There shall be an examination for 100 marks at the end of the academic year, which will be conducted by the college

Recommended Books:

A. Human Rights

1. S. Davidson: Human Rights, Buckingham, Open University,
2. Nirmal Chiranjivi: Human Rights in India, New Delhi, Oxford University Press

B. Gender Equity

1. Usha Sharma (ed): Gender Mainstreaming and Women’s Rights, Authorspress, New Delhi, 2004

2. Sushma Yadav and Anil Datta: Gender Issues in India, Radha Publications, New Delhi, 2003

C. Environmental Studies

1. N.K. Chakravarthy: Environmental Protection and Law, Ashis Publishing House, New Delhi
2. Kumar N: Air Pollution and Environmental Protection, Mittal Publication, New Delhi
3. Erach Baruch: Text Book For Environmental Studies, UGC, New Delhi and Bharati Vidyapeeth Institute Environment Education and Research, Pune
4. Jadhav H & Bhosale, VM: Environmental Protection and Laws, Himalaya Publishing House, New Delhi

III Year B.Sc (Medical Laboratory Technology)

Subject: BIOCHEMISTRY- III

Theory: 90 Hours

Practical/Demonstration: 70 Hours

Course Outcomes

At the end of the course students will be able to...

- CO1:** Describe the structure, classification, growth and identification of various microorganisms including bacteria, fungi, parasite and virus.
- CO2:** Describe the various disease producing organisms that includes bacteria, fungi, parasite and virus.
- CO3:** Describe the different methods of infection control and practices in laboratory and their role in hospital infection control program
- CO4:** Describe the various diagnostic tests employed in the laboratory diagnosis of diseases.
- CO5:** Describe the concepts and principles of Antibiotic sensitivity testing and their role in drug resistance in bacteria.
- CO6:** Explain the concepts and principles of immunity , hypersensitivity , Autoimmunity , and immunization.

SYLLABUS

Unit 1	18 hours
Mineral metabolism: Metabolism of Calcium, Phosphorus and Iron.	6 hours
Calculi: Theory of formation and analysis of renal calculi and gall stone	2 hours
Acid-base balance: Hydrogen ion concentration and pH of blood, Regulation of acid base balance, Disorders of acid base balance, Principles in estimation of parameters of acid base balance	6 hours
Water and electrolyte metabolism: Overview of water and electrolyte balance, Principles and applications of ion selective electrodes, Principles and applications of osmometry	4 hours

Unit 2	18 hours
Lipid metabolism: Digestion and absorption of lipids; Disorders associated with digestion and absorption; β -oxidation of fatty acids-reactions and energetics; Synthesis & utilization of Ketone bodies, Ketosis; Cholesterol: normal level, transport, excretion and metabolic disorders; Risk factors for atherosclerosis; Fatty liver and lipotropic factors; Lipoproteins: classification and functions	12 hours
Nutrition: BMR and its importance, Nutritional importance of different nutrients, Dietary fibers, Protein energy malnutrition, Biochemistry of starvation and obesity	6 hours
Unit 3	10 hours
Plasma proteins: Functions, separation techniques and clinical importance of plasma proteins; Structure and functions of Immunoglobulins.	5 hours
Tumour markers: Definition, classification and clinical applications of different tumour markers	3 hours
Cardiac marker: Diagnostic and prognostic use of cardiac markers	2 hours
Unit 4	13 hours
Genetics: Overview of replication, transcription and translation process, Features of Genetic code, Mutations, Overview of recombinant DNA technology	13 hours
Unit 5	14 hours
Liver function tests: Classification of LFT based on function, analysis and their clinical importance	5 hours
Renal function tests: Test performed to assess the overall and specific functions of kidney	5 hours
Thyroid function tests: Overview of function of thyroid hormones; Clinical utility and methods for the measurement of circulating thyroid hormones.	4 hours
Unit 6	17 hours
Techniques: Principle, instrumentation and application: Emission flame photometry and atomic absorption photometry; Agarose gel electrophoresis for separation of plasma proteins; Immunochemical assays: RIA, ELISA and Chemiluminescence.	10 hours

Quality control: Basic concepts; Internal and external quality control	5 hours
Automation in clinical chemistry	2 hours

Practical syllabus: **70 hours**

1. Qualitative analysis for renal calculi & Gall stones
 2. Estimation of serum total and conjugated Bilirubin
 3. Estimation of serum plasma proteins
 4. Estimation of serum inorganic phosphate
 5. Analysis of AST, ALT by manual method
 6. Estimation of serum electrolytes
 7. Estimation of ALP
 8. Estimation of lipid profile
 9. Estimation of thyroid hormone
 10. Estimation of fertility hormones
 11. Estimation of troponin T or I, CK, CK-MB
- } Kit Method

Case reports

1. Inborn errors of carbohydrates and amino acid metabolism
2. Interpretation of liver function tests
3. Interpretation of electrophoretogram
4. Interpretation of thyroid function tests
5. Interpretation of acid base parameters
6. Interpretation of lipid profile

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Biochemistry- III shall be held after the end of the III year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Biochemistry- III for 100 marks, including 20 marks for the internal assessment.

Recommended Text and Reference Books

1. U Sathyanarayana & U Chakrapani - Biochemistry 3rd revised edition
2. Godkar and Godkar - Textbook of Medical Laboratory technology 2nd edition.
3. Burtis. C.A. Ashwood E. R. - Tietz Text book of Clinical Chemistry and molecular diagnostics 3rd, 4th and 5th editions
4. Shivananda Nayak B - Manipal manual of clinical biochemistry for medical laboratory and M.Sc, student 3rd edition
5. Varley's Practical Clinical Biochemistry 4th, 5th, 6th editions

III Year B. Sc. (Medical Laboratory Technology)

Subject: MICROBIOLOGY III
(Immunology, Virology and Mycology)

Theory: 100 Hours

Practical/Demonstration: 80 Hours

COURSE OUTCOMES

At the end of the course students will be able to...

- CO1:** Describe the structure, classification, growth and identification of various microorganisms including bacteria, fungi, parasite and virus.
- CO2:** Describe the various disease producing organisms that includes bacteria, fungi, parasite and virus.
- CO3:** Describe the different methods of infection control and practices in laboratory and their role in hospital infection control program
- CO4:** Describe the various diagnostic tests employed in the laboratory diagnosis of diseases.
- CO5:** Describe the concepts and principles of Antibiotic sensitivity testing and their role in drug resistance in bacteria.
- CO6:** Explain the concepts and principles of immunity , hypersensitivity , Autoimmunity , and immunization.

SYLLABUS

Unit 1

35 hours

Immunology: Infection, Immunity, Innate immunity, Acquired immunity (adaptive immunity), Active and passive immunity; Immune system - Primary Lymphoid organs, Secondary Lymphoid organs, Cell development, B lymphocytes(general knowledge of their role), T lymphocytes, Natural killer cells; Immune responses - Humoral Immunity, Cell mediated immunity, Primary and secondary responses,

Theories of antibody productions, Monoclonal Antibodies (production and applications); Antigens; Antibodies - Properties of Antibodies (immunoglobulins), Classes of immunoglobulins; Antigen-antibody reactions - Precipitation, Agglutination, ELISA, Immunofluorescence and miscellaneous tests; Complement system; Hypersensitivity reactions - Immediate and delayed type; Autoimmunity; Transplantation and malignancy immunity; Immunodeficiency diseases

Unit 2
40 hours

Virology: General properties of virus including morphology of virus and classification; 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

Unit 3
25 hours

Mycology: Introduction of Mycology, Classification; Lab Diagnosis of Fungal Infections; Mycoses - Superficial Mycoses: Malassezia furfur, T. Nigra, Piedra, Dermatophytes, Subcutaneous Mycoses, Mycetoma, Rhinosporidium, Sporotrichosis, Chromomycosis, Systemic Mycoses, Histoplasmosis, Blastomycosis, Coccidioidosis, Paracoccidioidosis, Opportunistic fungi, Aspergillosis, Penicillosis, Zygomycosis, Pneumocystis, Candida, Cryptococcus; Mycotoxins and antifungal agents.

Practicals
80 hours
1. Immunology: Serological tests:
35 hours

Principle, procedure, normal values, significant titer, interpretation and limitation of The following test WIDAL, Brucella, VDRL, TRUST, RPR, ASO, CRP, RF, ELISA for HbsAg, HIV.

2. Virology:
15 hours

Demonstration of embryonated egg inoculation/inclusion bodies 5hours
 Virology exercise
 ELISA (HIV, HBV and HCV) 5hours
 Spot test (tridot/immuno comb test) 5hours

3. Mycology:
30 hours

KOH mount, Fungal stains, Culture media
 Slide culture techniques and LPCB mount-
 Identification of fungal culture-

Macroscopic and microscopic examination of Candida, Cryptococcus, Dermatophytes, aspergillus, rhizopus, mucor, penicillium

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Microbiology III shall be held after the end of the III year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Microbiology III for 100 marks, including 20 marks for internal assessment.

Distribution of marks for Practicals

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

III Year B.Sc (Medical Laboratory Technology)**Subject: PATHOLOGY – III****Theory: 134 Hours****Practical/Demonstration: 80 Hours****SYLLABUS****Blood bank 60 hours****Unit 1 15 hours**

Biosafety guidelines in Blood Bank; Blood group immunology; ABO blood group system; Rh blood group system; Sub group; Bombay phenotype; Other blood group system

Unit 2 23 hours

Blood donor Selection; Method of bleeding the donor; Blood container and anticoagulants; Preservation storage & transport of blood; Blood components and its preparation; Apheresis; Autologous Blood donation; AHG tests and its significance; Compatibility testing

Unit 3 22 hours

Transfusion reactions and workup; Screening of blood for infective material; HLA typing and its significance in blood bank; Blood bank organization and administration; Quality control in blood bank

Cytology 74 hours**Unit 4 25 hours**

Normal cell structure, functions, cytologic criteria of malignancy; Types of specimens, methods of collection & preparation of cell block; Different fixatives and methods of fixation; Staining - Papanicolaou's stain- principle, preparation and staining techniques, May Grunwald Giemsa stain, Shorr's stain, Aceto orcin stain; Female Genital tract - Anatomy, Histology, Physiology & normal cytology, Techniques of collection of specimen for cervical cytology study, Hormonal cytology and cytological indices, Cervical cytology screening for malignant and nonmalignant conditions,

Radiation changes & follow up,
Cytology of Endometrium – normal, nonmalignant and in malignant conditions,
Cytology in Ovarian cancers.

Unit 5**15 hours**

Respiratory tract, gastrointestinal tract and Urinary tract: Anatomy, Histology and Physiology- Collection of sample, preparation of smears and staining, Cytology of normal, nonmalignant & malignant conditions; CSF and Effusions- Cytology of CSF in inflammatory, nonmalignant & malignant Conditions, Cytology of effusions in nonmalignant and malignant conditions; Glands – Breast, Thyroid, Salivary glands and Lymph nodes- Anatomy, Histology and Physiology, Fine needle aspiration cytology of glands and other soft tissue mass, Cytologic features in nonmalignant and malignant conditions of different glands and nipple discharges; Automation in Cytology- Flow cytometry, Image Analysis; Principles, Equipments, procedures & Evaluation

Unit 6**15 hours**

Tissue culture: Equipments for Tissue culture studies- Laminar air flow equipment, Carbon dioxide incubator, Inverted microscope; Derivation of culture from tissue- Enzymatic digestion of tissue using collagenase, protease, Plating in tissue culture media, Observation of cells in Invertoscope, Subculturing & derivation of cell lines; Characterization of cell lines, Determination of biochemical markers in cells, Chromosomal & DNA content of cells, Immunological properties of cells; Preservation of Immortalized cell lines- Storage in Glycerol in Liquid Nitrogen, Storage in Dimethyl sulfoxide in Liquid Nitrogen

Unit 7**19 hours**

Cytogenetics: Introduction to cytogenetics, terminology, classification and nomenclature of human chromosomes; Methods of karyotypic analysis- Culture of bone marrow cells, peripheral blood lymphocytes, solid tumors & skin fibroblasts, Direct preparation from tumor materials; Characterization of human chromosomes by various banding techniques, Sex chromatin identification, Chromosomes in neoplasia and oncogenes
Immunohistochemistry: Basic concepts of immunohistochemistry; Monoclonal antibodies and their preparations; Immuno – fluorescence reactions; PAP techniques- Principle, Preparation of reagents and procedures

Practicals
80 hours

1. Preparation of various cytology smears and fixation
 - a. Papanicolaou's staining
 - Sputum cytology
 - Cervico – vaginal cytology
 - Hormonal cytology
 - Malignant cytology
 - Fluid Cytology
 - b. May Grunwald Geimsa staining
1. Semen Analysis
2. Fluid count
3. ABO grouping and Rh typing
4. Detection of weak D antigen
5. Cross matching techniques
6. Screening of Donors blood for infective agents
7. Transfusion reaction work up
8. Preparation of blood components

Examinations:

Evaluation is based on formative evaluation (internal assessment) and summative evaluation (University examination).

University Examinations:

The University Examinations in the subject of Pathology III shall be held after the end of the III year, generally in the month of June/July, in addition to the internal assessment examinations.

Scheme of Examination:

Theory: There shall be one theory paper of three hours duration carrying 80 marks. The marks for internal assessment is 20 marks

Pattern of question paper

Sl.No.	Type of question	Number of questions	Marks for each question	Total
1	Long Essay	3 (to answer 2)	10	20
2	Short Essay	8 (to answer 6)	5	30
3	Short Answer	12 (to answer 10)	3	30
Grand Total				80

Practical Examination: There shall be a university practical examination in the subject of Pathology III for 100 marks, including 20 marks for internal assessment.

Distribution of Marks for Practicals:

Type of Question	Marks allotted
Pap stain	20
ABO grouping & Rh typing	10
Cross matching	15
Coomb's test	15
Sportters	10
Record	10
Total	80

Reference books:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss – cytology
4. Winifred greg – Diagnostic cytopathology
5. Prafull B Godkar - Medical Laboratory Technology
6. Todd & Sanford Clinical Diagnosis by laboratory method
7. Dacie & Lewis – Practical Haematology
8. Ramanik Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi –1996)
9. Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi –1998
10. Sachdev K.N. Clinical Pathology and Bacteriology 8 Ed, J.P. Bros, New Delhi-1991.

III Year B.Sc (Medical Laboratory Technology)

Subject: BIOSTATISTICS

Theory: 30 Hours

Course Description: Introduction to Basic Statistical Concepts: Methods of Statistical Analysis; and Interpretation of Data

Course Outcomes

At the end of the course students will be able to...

CO1: Understand the Importance of statistics course in the curriculum

CO2: Possess Knowledge and Skill in the use of Basic Statistics in the analysis and interpretation of data

Objectives:

1. Understands Statistical Terms.
2. Possess Knowledge and Skill in the use of Basic Statistical and Research Methodology.

SYLLABUS

Unit 1

Introduction: Meaning, Definition, Characteristics of Statistics; Importance of the Study of Statistics. Branches of Statistics; Descriptive and Inferential Statistics; Variables and Their Types. Measurement Scales (2 hours)

Unit 2

Tabulation of Data: Raw Data, the Array, Frequency Distribution. Basic Principles of Graphical Representation; Types of Diagrams - Histograms, Frequency Polygons, Smooth Frequency Polygon, Commutative Frequency Curve, O give; Normal Probability Curve. (3 hours)

Unit 3

Measure of Central Tendency: Need For Measures of Central Tendency; Definition and Calculation of Mean; Ungrouped and Grouped Mean, 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. (7 hours)

Unit 4

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 (8 hours)

Unit 5

Probability and Standard Distributions: Meaning of Probability of Standard Distribution, The Binominal Distribution. The Normal Distribution; Divergence from Normality - Skewness, Kurtosis. (4 hours)

Unit 6

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. (4 hours)

Unit 7

Health Indicator: Importance of Health Indicator; Indicators of Population, Morbidity, Mortality, Health Services. Calculation of Rates and Ratios of Health. (2 hours)

Examination:

There shall be an examination for 100 marks at the end of the academic year, which will be conducted by the college.

Scheme of Theory Examination:

There shall be an examination for three hours duration carrying 100 marks.

Recommended Books:

1. Rao.N.S.N: Elements of Health Statistics
2. Sunder Rao.P.S.S: An introduction of Biostatistics:
3. B.K. Mahajan: Methods in Bio-Statistics

4. Inderbir Singh: Elementary Statistics in Medical Workers
5. Gupta C.B: An Introduction to. Statistical Methods, Ram Prasad & Sons
6. B.K. Mahajan & M. Gupta: Text Book of Preventive & Social Medicine, Jaypee Brothers.
