

# **SHRI GURU RAM RAI UNIVERSITY, DEHRADUN (UTTARAKHAND)**

## **REGULATION OF THE UNIVERSITY FOR THE AWARD OF THE DEGREE OF**

### **BACHELOR OF SCIENCE MEDICAL MICROBIOLOGY**

In exercise of the powers conferred by section of the S.G.R.R. University Act no.3 of 2017. The Academic Council of the Shri Guru Ram Rai University Dehradun hereby makes the following regulations:-

#### **SHORT TITLE AND COMMENCEMENT**

- I. These regulations shall be called "THE REGULATIONS FOR THE BACHELOR OF SCIENCE – MEDICAL MICROBIOLOGY OF THE SHRI GURU RAM RAI UNIVERSITY, DEHRADUN, UTTARAKHAND"
- II. These Regulations and the syllabus shall come into force from the 2001-2002 academic sessions onwards.
- III. The regulations framed are subject to modification from time to time by the standing Academic Board of the University.

# **OBJECTIVES OF ALLIED HEALTH SCIENCE**

## **GRADUATE TRAINING PROGRAMME:**

**NATIONAL GOALS:** At the end of undergraduate program, the Allied Health Science student shall endeavor to be able to:

- a) Recognize 'health for all' as national goal and health right of all citizens and by undergoing training for Allied Health Science profession fulfill his/her social obligation towards realization of this goal; learn every aspect of National policies of health and devote himself/herself to its practical implementation.
- b) To help to achieve competence in practice of holistic medicine, encompassing promotive, preventive, curative and rehabilitative aspects of diseases particularly with Physiotherapy and Occupation Therapy;
- c) Develop scientific temper, acquire educational experience for proficiency in profession and promote healthy living; particularly in the field of rehabilitation.
- d) Become exemplary citizen by observation of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

### **INSTITUTIONAL GOALS:**

In consonance with the national goals each Allied Health Science Institution should evolve institutional goals to define the kind of trained manpower (or professional) they intend to produce. The undergraduate student coming out of a Allied Health Science Institute should: Be competent therapeutic techniques of common health problems of the individual and the community, associated with or concerned with physiotherapy commensurate with his/her position as a member of the health team at the Primary, Secondary or tertiary level, using his/her clinical/technical skills based on history, physical examination and relevant investigation techniques and as per the advise of the attending physician.

Be competent to practice preventive, promotive, curative and rehabilitative medicine in respect to the all the applicable and encountered health problems with occupational Therapy and Physiotherapy;

To help to appreciate rationale for different therapeutic modalities pertaining to the subjects of physiotherapy.

To be able to appreciate the socio-psychological, cultural economic and environmental factors affecting health and develop human attitude towards the patients in discharging one's professional responsibilities (Occupational Therapy and Physiotherapy);

Possess the attitude for continued self-learning and to seek further expertise or to pursue research in any chosen area of Occupational therapy and Physiotherapy.

Acquire basic management skills in the area of human resources, materials and resources management related to health care delivery.

Be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures (Occupational Therapy and Physiotherapy); in community rehabilitation.

Be able to work as a leading partner in health care teams and acquire proficiency in communication skills;

Be competent to work in a variety of health care settings.

Have personal characteristics and attitude required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

## **ADMISSION, SELECTION, MIGRATION AND TRAINING**

### **ADMISSION TO THE B.Sc (MEDICAL MICROBIOLOGY) COURSE**

#### **'ELIGIBILITY CRITERIA'**

No candidate shall allow to be admitted to the B.Sc (Medical Microbiology) until:-

- 1) He/She has completed the age of 17 years on or before first day of July of the year commencing the prescribed academic session of the said course.
- 2) He/She has passed qualifying examination are as under:
  - (a) The Indian School Certificate Examination which is equivalent to 10+2 Higher Secondary Examination after a period of 12 years study, the last two years of study comprising of Physics, Chemistry, Biology and Mathematics or any other elective subjects with English at a level not less than the core course for English as prescribed by the National Council for Educational Research and Training after the introduction of the 10+2+3 years educational structure as recommended by the National Committee on education.

**OR**

- (b) The Intermediate examination in science of an Indian University/Board or other recognized examining body with Physics, Chemistry and Biology which shall include a practical test in these subject and also English as a compulsory subject.

**OR**

- (c) The pre-professional or medical examination with Physics, Chemistry, Biology, after passing there, the higher secondary school examination, or the pre-University or an equivalent examination. The professional/pre-medical examination shall include a practical test in Physics, Chemistry and Biology and also English as a compulsory subject.

**OR**

- (d) The first year of the three years degree course of a recognized university with Physics, Chemistry, Biology including a practical test in these subjects provided the examination is a "University Examination" and candidate has passed 10+2 with English at a level not less than a core course.

**OR**

- (e) B.Sc Examination of an Indian University, provided that he/she has passed the B.Sc examination with not less than two of the following subjects-Physics, Chemistry, Biology (Botany, Zoology) and further that he/she has passed the earlier qualifying examination with the following subjects-Physics, Chemistry, Biology and English (10+2 level).

**OR**

- (f) Any other examination which in scope and standard is found to be equivalent to the intermediate science examination of an Indian University/Board, taking Physics, Chemistry, Biology including a practical test in each of these subjects and English.

**Note:** 10+2 with vocational training in Nursing/Medical Lab technology/Medical Microbiology are also eligible and 10+20 with Diploma in Medical Microbiology are also eligible for the respective course. Marks obtained in Mathematics are not to be considered for admission to the B.Sc M.L.T. Course. After the 10+2 course is introduced, the integrated courses should be abolished.

## **MIGRATION/TRANSFER OF CANDIDATES**

- a) Migration/Transfer of candidates from one recognized institution to another institution of this University or from another University will not generally be considered.
- b) However, under extraordinary circumstances, the vice-Chancellor shall have the powers to place any migration/transfer he deems fit in the Governing Council and get its approved for grant of permission for migration/transfer to candidates undergoing course of study in affiliated institution of this University.

## **TRAINING PERIOD AND TIME DISTRIBUTION**

- 1) Every student shall undergo a period of certified study extending over. Three and a half academic years Or Six semesters, plus 6 months internship from the date of commencement of his study for these subjects comprising the B.Sc Medical Microbiology curriculum to the date of completion of examination and followed by compulsory rotating internship. Each academic year shall consist of 180 days each Semesters of 90 days teaching of 8 hours each day college working time, including one hour of lunch.
- 2) The period of three & half year is divided into phased as follows:-
  - a) Phase-I – First year B.Sc Medical Microbiology (one Year Duration-two semesters)

- i. Human Anatomy and Physiology
- ii. Basic Pathology
- iii. Clinical Biochemistry
- iv. Preventive Medicine & Health Care
- v. Fundamentals of medical Microbiology
- vi. Instrumentation Techniques in Medical Microbiology

Phase-II- Second year B.Sc Medical Microbiology (one Year Duration two semesters)

- I. Bacterial Pathogens & Associated Diseases
- II. Systematic Bacteriology
- III. Misc. Microbes, fungal Pathogens & Asso. Diseases
- IV. Lab. Diagnosis of Microbial Diseases
- V. Human Parasitology
- VI. Applied Medical microbiology

b) Phase-III- Third year B.Sc Medical Microbiology (one Year Duration two semesters)

- I. Pathogenic Viruses and Associated Diseases
- II. Applied Immunology & Serodiagnosis
- III. Advanced Diagnostic Technology
- IV. Automation & Computerization in Medical Micro.
- V. Molecular Biology & Clinical Lab, Technology.

c) Phase-III- Fourth year B.Sc Medical Microbiology (Six Months duration) Internship.

## DISTRIBUTION OF MARKS TO VARIOUS DISCIPLINES

### I<sup>st</sup> Year

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
BMM 101	Human Anatomy & Physiology	30	70	100	30	70	100	200
BMM 102	Basic Pathology	30	70	100	-	-	-	100
BMM 103	Clinical Biochemistry	30	70	100	30	70	100	200
BMM 104	Preventive Medicine & Health Care	30	70	100	-	-	-	100
BMM 105	Fundamentals of Medical Microbiology	30	70	100	30	70	100	200
BMM 106	Instrumentation Techniques in Medical Microbiology	30	70	100	-	-	-	100
<b>TOTAL</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>90</b>	<b>210</b>	<b>300</b>	<b>900</b>

### II<sup>nd</sup> Year

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
BMM 201	Bacterial Pathogens & Associated Diseases	30	70	100	30	70	100	200
BMM 202	Systematic Bacteriology	30	70	100	-	-	-	100
BMM 203	Misc. Microbes Fungal, Pathogens & Asso. Disease	30	70	100	30	70	100	200
BMM 204	Lab Diagnosis of Microbial Diseases	30	70	100	-	-	-	100
BMM 205	Human Parasitology	30	70	100	30	70	100	200
BMM 206	Applied Medical Microbiology	30	70	100	-	-	-	100
<b>TOTAL</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>90</b>	<b>210</b>	<b>300</b>	<b>900</b>

### III<sup>rd</sup> Year

Course code	Course title	Marks for Theory			Marks for Practical			Total Marks
		IA*	EE*	Total	IA*	EE*	Total	
BMM 301	Pathogenic Viruses and Associated Diseases	30	70	100	30	70	100	200
BMM 302	Applied Immunology & Serodiagnosis	30	70	100	-	-	-	100
BMM 303	Advanced Diagnostic Technology	30	70	100	30	70	100	200
BMM 304	Automation & Computerization in Medical Microbiology	30	70	100	-	-	-	100
BMM 305	Molecular Biology & Clinical Lab Technology	30	70	100	30	70	100	200
<b>TOTAL</b>		<b>180</b>	<b>420</b>	<b>600</b>	<b>90</b>	<b>210</b>	<b>300</b>	<b>800</b>

**Note:** Results of all University examination shall be declared before the start of teaching for next semesters.

**Note:** Course structure (Teaching duration) will be of 2 hrs. /week for theory & 3 hrs. /week for practicals for each paper.

1. The minimum pass marks will be 40% in individual subjects in theory and practical and 50% in aggregate
2. The theory and practical papers will be of equal weightage with 30% in sessional and 70% in final University Examination.
3. The division will be determined on the basis of the aggregate of the marks of all the course/subjects prescribed for the degree as under:
  - (i) Passed with honours will be rewarded on 75% and above only in first attempt.
  - (ii) First Division will be marked on 60% and above.
  - (iii) Second Division will be marked on 50% and above but less than 60%

### Compartments/Supplementary/Back Paper

- (i) A student who obtain 40% of the marks individually but has failed in two papers shall be permitted to appear in those papers only at the two consecutive examinations and if he/she passes at either of those examination he/she will be deemed to have passed the examination and will be promoted to higher class (aggregate marks should be 50%)

- (ii) A student (s) appearing in back paper/supplementary shall be eligible to join the next higher class provisionally however any student who fails to pass I<sup>st</sup> year would not be admitted in 3<sup>rd</sup> year course.

**Theory Examination:** All the paper in each year carrying 100 marks out of which 30 marks will be internal assessment and 70 marks for external assessment based on the question paper sent by the University the paper will be 3 hrs. Each paper will have 8 questions out of which the candidate will have to attempt 5 questions.

The practical examination will be held with the final Examination. The Practical and Viva Voice in each subject will carry 30% marks as internal & 70% marks as external assessment (according to examination scheme) prescribed for the year.

### **PHASE DISTRIBUTION AND TIMING S OF EXAMINATIONS:**

I<sup>st</sup> Annual examination (or at the end of second semester)

II<sup>nd</sup> Annual examination (or at the end of fourth semester)

III<sup>rd</sup> Annual examination (or at the end of sixth semester)

Six months internship after third annual examination.

### **EXAMINATION REGULATIONS.**

Essentialities for qualifying to appear in professional examinations. The performance in essential components of training is to be assessed based on.

**ATTENDANCE:** 75% of attendance in a subject for appearing in the examination is compulsory provide he/she has 80% attendance in non lecture teaching i.e. seminars, group discussion tutorials, demonstrations, practicals Hospital (Tertiary, Secondary, Primary) postings and bed side clinics etc.

### **INTERNAL ASSESSMENT:**

- (i) It shall be based on day today assessment (see note). Evaluation of student assignment, preparation for seminar, Clinical case presentation etc.
- (ii) Sessional examination shall be conducted throughout the course. The question of number of examinations is left to the institution.
- (iii) Day to day records should be given importance during internal assessment.
- (iv) Weightage for the internal assessment shall be 30% of total marks in each subject.
- (v) Student must secure at least 50% marks of the total marks fixed for internal assessment in particular subject in order to be eligible to appear in final university examination of that subject.

**Note: -** Internal assessment shall relate to different ways in which students' participation in learning process during semesters is evaluated. Some examples are as follows:

- (i) Preparation of subject for students seminar
- (ii) Preparation of a clinical case for discussion.
- (iii) Clinical case study problem solving exercise.
- (iv) Participation in Project for health care in the community (planning stage to evaluation).
- (v) Proficiency in carrying out a practical or a skill in small research project.
- (vi) Multiple choice question (MCQ) test after completion of a system/teaching.

Each item tested shall be objectively assessed and recorded. Some of the items can be assigned as home work/Vocational work.

## **UNIVERSITY EXAMINATIONS:**

Theory papers will be prepared by the examiners as prescribed Nature of question will be short answer type/objective type and marks for each part indicated separately.

Practical/clinical will be conducted in the laboratories or hospital wards Objective will be to assess proficiency in skills. Conduct of experiment, interpretation of data and logical conclusion clinical cases should be Preferably include common diseases not esoteric syndromes or rare disorders. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation.

Viva/oral includes evaluation of management approach and handling of emergencies Candidates skill in interpretation of common investigation data also is to be evaluated.

The examinations are to be designed with a view to ascertain whether the candidate has acquired necessary for knowledge, minimum skills along with clear concepts of the fundamentals, which are necessary for him to carry out his professional day to day work competently. Evaluation will be carried out of an objective basis.

Question paper should preferable be of short structure/objective type.

Clinical cases/practical shall take into account common diseases, which the student is likely to come in contact in practice.

During evaluation (both external and internal) it shall be ascertained if the candidate has acquired the skills.

**There shall be one main examination in a year and a supplementary to be held not later than 6 months after the publication of its result.**

**Note:** Results of all University examinations shall be declared before the start of teaching for next semesters.

### **DURATION OF EXAMINATION & QUESTIONS**

- (i) Each written will be of three hours duration having eight questions, only five questions to be attempted. No choice will be given in any questions.
- (ii) A clinical/practical examination in any subject for student shall not be for more than a day. In no case more than 20 students be examined for Clinical/practical & Oral in a day.

### **GENERAL**

If Candidate obtains an aggregate of 75 percent in all the subject of any professional Examination, he will be declared to have passed that Examination with Honors, provided he/she passes in all subject in the first attempt.

## **INTERNSHIP**

### **General**

Internship is a phase of training wherein a graduate is expected to conduct actual practice of Medical Microbiology and acquire skills under supervision so that he/she may become capable of functioning independently.

### **SPECIFIC OBJECTIVE**

At the end of internship training the graduate shall be able to:

- (i) Perform all the diagnostic techniques
- (ii) Use discretely the essential laboratory services
- (iii) Manage all type of clinical diagnostic methods
- (iv) Demonstrate skills in handling the modern equipment in Medical Microbiology
- (v) Develop leadership qualities to function effectively as a reader of the laboratory environment
- (vi) Render service to the laboratory set up and to communicate effectively with the Doctors and the hospital management.

## **INTERNSHIP TIME DISTRIBUTION**

### **Main Objective**

Development of skill and competency in data processing, reporting and maintenance of records, Laboratory investigations.

Total Period of Internship: 6 Months

Histopathology & Cytology Lab.	-	1-1/2 Months
Clinical Pathology & Hematology Lab	-	1-1/2 Months
Clinical Biochemistry Lab	-	1-1/2 Months
Medical Microbiology Lab	-	1 Month
Transfusion Medicine/Blood Bank	-	15 Days

### **OTHER DETAILS**

- (i) All parts of internship shall be done as far as possible in the Hospitals of Medical College
- (ii) Every Candidate will be required after passing the final B.Sc (Medical Microbiology) Examination to undergo compulsory rotating internship to the satisfaction of the college Authorities and University concerned for a period of six months so as to be eligible for the award of the degree of Bachelor of Science in Medical Microbiology.
- (iii) The University shall issue a provisional B.Sc Pass Certificate on passing the final examination.
- (iv) The State medical faculty and council for allied health profession will grant provisional registration which will be for a period of 1 year. In the event of shortage or unsatisfactory work, the period of provisional registration and the compulsory rotating internship may be suitably extended by the appropriate authorities.
- (v) The intern shall be entrusted with Laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.
- (vi) Interns will not issue certified Laboratory reports or other related documents under their signature.

## **ASSESSMENT OF INTERNSHIP**

- (i) The interns maintain the record of work, which is to be verified and certified by the Senior Medical Officer/Technician under whom he/she works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and the end of the training, Based on the record work and date of evaluation the Director/Principal shall issue 'Certificate of Satisfactory Completion' of training following which the University shall award the B.Sc (Medical Microbiology) Degree of declare the candidate eligible for the same.
- (ii) Satisfactory completion shall be determined on the basis of the following:
  - (a) Proficiency of knowledge required for each Laboratory Techniques
  - (b) The Competency in skills expected to manage each Laborites Technique. Competency for performance of self performance of having assistant in procedures of having observed
  - (c) Responsibility Punctuality work up of Laboratory Techniques involvement in procedutes, follow of reports.
  - (d) Capacity to work in a team (behavior with colleagues, nursing staff and relationship with Medical and Paramedical).
  - (e) Initiating, Participation in discussions, research aptitude.
  - (f) Full registration shall only be given by the State Medical faculty and council for Allied Health Professor on the award of B.Sc Medical Microbiology Degree by the University on its declaration that the candidate is eligible for it.

## **VACATION**

There shall be a minimum 30 days vacation every year or as per session requirement settled by the Institute.

## **MEDIUM OF INSTRUCTION**

English shall be the Medium of Instructions for all the subjects of study and for examinations of the Bachelor of Medical Microbiology course.

## **WORKING DAYS IN AN ACADEMIC YEAR**

Each Academic year shall spread over a period of not less than 180 works.

## **CONDONATIONS OF LACK OF ATTENDANCE**

As per the existing rules & regulations of the Shri Guru Ram Rai University, Dehradun.

## **SUBMISSION OF RECORD NOTE BOOKS**

At the time of practical examination, each candidate shall submit to the examiners the records books duly certified by the Head of the College as a bonafide record of work done by the candidate.

## **CLASSIFICATION OF SUCCESSFUL CANDIDATES REVALUATION OF ANSWER PAPERS**

The regulations as prescribed by the University for other Undergraduate Course shall be applicable.

## **AWARD OF MEDALS AND PRIZES**

The University shall award at its convocation medals and prizes to outstanding candidates, as and when Instituted by the donors as per the schedule prescribed for the award.

## **UNIVERSITY RANKING**

First, Second and third University ranks may be awarded to candidates, who have passed all the examinations in the first appearance and taking into consideration the aggregate marks obtained in all the subjects, in which the candidate had been examined during the entire course of study.

# **CURRICULUM (SUBJECT WISE)**

## **SYLLABUS FOR MEDICAL MICROBIOLOGY**

### **GOAL**

The broad goal of teaching of B.Sc (Medical Microbiology) students in Allied Medical Science aims at providing comprehensive knowledge of structure, function and pathological changes of the organs and the basis for understanding the clinical correlation of diseases and the pathological basis for the disease presentation specially with respect to Physical Pathology.

### **Objectives:**

#### **(A) Knowledge:**

At the end of course, student shall be able to comprehend the normal dispositions, clinically relevant interrelationship, functional Anatomy of various structures in the body. Correlate the structures with the functions as pre requisite for understanding the alter state in various disease processes specially with respect to Physical Pathology & Microbiological diagnosis.

#### **(B) Skills:**

At the end of the course, student shall be able to identify and locate all the structures of the body and mark the topography of the living Anatomy, identify the organs and tissues. Understand the principles of karyotyping, Understand clinical bases of common clinical procedures of diagnosis of Microbial infections and infestations.

#### **(C) Integration:**

From the integrated teaching of other basic sciences, students shall be able to comprehend the regulation and integration of the functions of the organs and systems in the body and thus interpret the pathological, bimolecular & microbiological basis of diseases including advanced diagnostic technology.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER I: HUMAN ANATOMY & PHYSIOLOGY**

### **Unit I**

1. Introduction to Medical Sciences.
2. Organization of human body and integrated physiology.
3. Cell organizations, fundamental tissues of body and organ systems.
4. Primary defense mechanisms of human body against pathogenic microbes.
5. Gross Anatomy and histology of organs of respiratory system, organs of respiration mechanism of respiration and factors controlling it.
6. Gross anatomy and histology of organs of alimentary system, organs of digestive systems, and various glands associated with the digestive system, mechanism and physiology of digestion and absorption.

### **Unit II**

1. Cells and organs of immune system Morphology & their distribution.
2. Gross Anatomy and Physiology of reticulo – endothelial system.
3. Secondary immune response of human body to external stimuli.
4. Physiology of various body fluids: CSF, peritoneal, pericardial, Pleural and synovial fluids.
5. Gross Anatomy, histology & Physiology of excretory system.
6. Gross Anatomy and histology of organs of Cardio-Vascular system, organs of the systems, mechanism and physiology of blood flow through the cardiovascular system.

### **Unit III**

1. Gross Anatomy and histology of musculo-skeletal system, classification & functions of bones and muscles. Physiology of muscular contraction and factor controlling them. Various types of joints and their physiology.
2. Gross Anatomy and histology of organs of nervous system, division of nervous system and mechanism of nerve impulse transmission & reflex arc, sensory and motor system, special sense organs.
3. Gross Anatomy and histology of organs of reproduction system, mechanism of reproduction and factors controlling it.
4. Gross Anatomy and histology of organs of endocrine system, different glands of the system and their distribution. Mechanism of hormone production, factors controlling it and their mechanism of action.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER II: BASIC PATHOLOGY**

### **Unit I**

1. Introduction to hematology. Laboratory organization & Safety measures.
2. Formation, Composition and functions of blood.
3. Auticoagulants, mode of action of anticoagulants and their merits & demerits.
4. Collection, preservation, transport and handling and disposal of blood samples.
5. Basic hematology and estimation of haematocrit values, physiological variations, normal and absolute values and quality assurance in hermatology.

### **Unit II**

1. Romanowsky dyes, preparation and staining procedures of blood smears, Morphology of blood cells and their identifications.
2. Haemo-globinometry: Various methods errors involved and standardization of instruments.
3. Haemi-cytometry: Procedure of cell count, visual as well an electronic, red cells, leucocyte and platelet count. Errors involved and mean to minimize such errors.
4. Determinations of innate immunity and its mechanism, phagocytosis, the compliment system, gross structure and development of cells concerned with antibody production, cellular processes involved in antibody formation.

### **Unit III**

1. Pathology of Inflammation in response to microbial invasion. Pathology of localized and systemic infections. Various routes of transport of Microbes to human body and methods of defense. Invastive techniques for diagnosis of acute and chromic microbial infections.
2. Pathology of specific chronic infective disorders: Tuberculosis, Leprosy, Syphills, SABE (Subacule bacterial endocarfitis) and Rheumatological disorders.
3. Study of microbes responsible for pathogenesis of tumors and their oncogenesis.
4. Immuno-histopathology & Immuno-histochemistry (Basic Principles, Procedures and applications).
5. Introduction to blood banking technology.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER III: CLINICAL BIOCHEMISTRY**

### **Unit I**

1. Introduction to Clinical Biochemistry and role of medical microbiologist, ethics, responsibility, safety measures and hazards in Clinical Biochemistry Lab and first aid in Laboratory accidents.
2. Basic awareness of laboratory in respect to equipments & glassware's. Unit of measurements and calibration of volumetric apparatus. Colorimetry, Spectrophotometry, flame-photometry, analytical balance etc. (principles, instrumentations & applications).
3. Preparation and storage of reagents, standard solutions, buffer solutions and pH determination, Biophysical techniques-osmosis, dialysis, surface, tension, sedimentation and viscosity -principles & applications.
4. Sterilization and disinfection: Study of various methods of sterilization-dry and moist heat, radiation, filtration, autoclaving and chemical disinfection.
5. Henderson- Hassalbach equation and its clinical applications. Acid base disturbances and their clinical significance. Acid- base-buffer and pH-simple calculations. Concept of clinical sensitivity and specificity and factors affecting the clinical results.

### **Unit II**

1. Collection of blood specimens avoiding haemolysis, de-proteinization & separation of serum/plasma.
2. Biochemical composition of body fluids and their physiological variations.
3. Physical and biochemical examination of urine samples: Qualitative tests of inorganic urinary ingredients: Chlorides, Phosphate, sulphur compounds, sodium, potassium, calcium and magnesium and their clinical significance.
4. Qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Qualitative tests of urine for urea and creatinine. Quantitative estimation of 24 hours urine for albumin and 17 – ketosteroids and their clinical significance.
5. Physiological variation of biometabolytes in various body fluids and their clinical significance. Pathological changes in composition of body fluids and their clinical correlation. Qualitative test of urine for ketone bodies, bilesalts, bile-pigments and urobilinogen and their clinical significance.

### **Unit III**

1. Carbohydrates: Structure, Classification and their function in biological system.
2. Lipids: General structure of Fatty Acids and classification of Lipids.
3. Proteins: Classifications, structural organization and function of protein.
4. Enzymes: Definition, classification of Enzymes. Concept of active sites and general mode of action of Enzymes.
5. Nucleic Acids: Structure function and types of DNA and RNA Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic Acids.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER IV: PREVENTIVE MEDICINE AND HEALTH CARE**

### **Unit I**

1. Water, air and noise pollution: Removal of water hardness, purification of water and standards of water quality. Air and noise pollution and their prevention. Housing and air conditioning.
2. Hygiene and Sanitation: Sanitation barriers, excreta disposal and disposal of hospital waste, Incineration and disinfection.
3. Infections and control: Microbial pathogenicity, source and spread of infections in community, Pathogenesis toxogenicity, invasiveness, variations and Virulence. Host factors controlling infections. Source of infections to men, mode of spread and their control by physical & chemical agents.

### **Unit II**

1. Epidemiology: Epidemiology, surveillance and control of community infections. Role of laboratory in community and hospital infections. Emergence of drug resistance. Methods of prevention & control- isolation of patients, quarantine & incubation periods of various infectious diseases. Management of patients in infectious disease hospital (IDH).
2. Prophylactic Immunization: Rationale of immunization, immune response and duration of immunity controlled studies of prophylactic Vaccines and hazards of immunization. Various national immunization programs and vaccine schedules.
3. Reproductive, Family planning & Child Health Care Programs.

### **Unit III**

1. Bacteriology of water, milk, food and air: Bacteriological examination of water- collection of specimens, presumptive coliform count, cloacal room test, colony count and interpretation of results, Bacterial examination of sewage and sewage effluents. Bacteriological examination and control of swimming bath, membrane filter technique and isolation of pathogens.
2. Bacteriological examination milk, bacterial standards and various tests for pasteurized milk. Bacterial examination of ice-cream, shellfish and canned foods, milk bottles, crockery and cutlery. Examination of food stuff in cases of outbreak of food poisoning, Bacteriological examination of air and environments dust.
3. Health care by balance diet and yoga: Normal constituents of diet, various diet programs, balance diet and factors responsible for etiology of various nutritional disorders. Carcinogens in food. Role of regular exercise & yoga in prevention & management of various diseases.
4. Health Planning & Management: Health planning, Planning Cycle, Malaria eradication & various other National Health policy & programs.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER V: FUNDAMENTALS OF MEDICAL MICROBIOLOGY**

### **Unit I**

1. Microbiology & Medicine: Introduction to Medical Microbiology. Discovery of micro-organisms. Contribution of Robert Koch, Antony Van Leeuwenhock, Louis Pasteur, Border, Paul Ehrlich, Alexander Fleming. Metchnikoff, Needham, Tyndall, Jensen, Joseph Lister, Karl Landsteiner etc. Scope & relevance and safety measures of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.
2. Morphology & Nature of Bacteria: Anatomy of bacterial cell, intracellular components and their functions bacterial reproduction, morphological study of bacteria and its appendages-flagella, fimbriae, pili, capsule, spore and cysts.
3. Classification and identification of bacteria: Biological groups, morphological and biological classification, DNA composition as a basis of classification system of identification- morphology, staining reactions, cultural characters, biochemical reactions & antigenic characters etc.
4. Sterilization and disinfection: Various physical methods of sterilization- heat, UV radiations, ionizing radiations, character affecting sterilizations, autoclave control and its compounds. Alcohol, halogen heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound. Use and abuse of disinfectants.

### **Unit II**

1. Cultural Media: Liquid and solid media, containers for media, distribution of media in tubes, bottles and petri dishes. Common ingredients of cultural media. Synthetic media, peptone water, nutrient agar and broth, chocolate and blood agar, meat extract broth, milk agar etc. Special media for neisseria, corynebacterium, mycobacterium & enterobacteriaceae group etc.
2. Cultivation of bacteria: Instruments used, inoculation hood, laminar flow, culture procedure, incubation (Aerobic and Anaerobic). Isolation of pure culture and its preservation. Suspending media for freeze drying of bacteria. Blood culture.
3. Pure Culture: Maintenance & Preservation of pure cultures. Collection, transport processing & storage of clinical samples for Microbiological Analysis.
4. Growth and Nutrition of Bacteria: Typical growth curve, various phases of growth, physiology of bacteria-catabolism and anabolism, Nutrition of microbes and physical condition required for growth. Effect of Carbon, Nitrogen, Growth factors. Vitamins, temperature, pH Osmotic pressure. Oxygen and Carbon Dioxide on microbial growth.

### **Unit III**

1. Introduction & scope of Immunology: Immunological principles, antigens, antibodies and antigen antibody reaction: Antigen and antigenic specificity antigenic determinate, general properties of antigens, immunoglobulin's, their structure and functions, Types of immunity and its determinants. Tissue involved in immune response. Structure and function of immune response.
2. Introduction to Virology, Mycology & Parasitology: Characteristic, morphology, classification, nomenclature pathogenesis.
3. Antimicrobial agents and antibiotic: Disinfectants, antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein, nucleic acid and cytoplasmic membrane. Future development of chemotherapy.

# **B.Sc Medical Microbiology I<sup>st</sup> year**

## **PAPER VI: INSTRUMENTATION TECHNIQUES IN MEDICAL MICROBIOLOGY**

### **Unit I**

1. Microscopy: Study of Compound microscope-magnification, numerical aperture, resolution and compounds of microscope. Dark ground illumination care of microscope and common difficulties. Micrometry Study of Phase contrast, interference, fluorescent an electron microscope. Preparation of smear for electron microscope.
2. Study of pH in Microbiology: Methods for measurements pH meter, Preparation dilution and chemistry of suspension fluids. Oxidation – reduction (redox) potential.
3. Preparation of Stains: Making of films, staining methods, mounting media, Grams stain- preparation of stain and staining methods. Special stains for AFB, diphtheria spores, capsule, intracytoplasmic lipids, polysaccharides nuclear material, Fields Stain for amoebae, fungi and rickettsiae.

### **Unit II**

Study of instruments used in Medical Microbiology.

1. General instruments: Distillation plant, Centrifuge Machine, Analytical Balance, Hotplate, Magnetic Stirrer, water Bath, Automatic Dispensers and diluters. Deidonizer etc.
2. Microbiological Instruments: Autoclave, Incubator, Hot air oven, Laminar Air Flow, Colony Counter. Muffle furnace. Refrigerator, inoculators, Mac-intos field- jar etc.
3. Instruments used in immunology: Electrophoresis, immunodiffusion, starplate, chromatography, ELISA reader, automatic washer and RIA equipment etc.
4. Care and management of experimental animals: General directions for the care of animals, material inoculated necroscopy, common diseases and experimental procedures. Various experimental animals-rabbits, guinea pigs, mice, rats, hamsters, fowls and monkeys- their data, cages, feeling and handling.
5. Safety measures in Microbiology Laboratory: Occurrence of lab infections, route of infection in laboratory, safety measures precautions in use of Pathogens in teaching lab organization, management, recording of results and quality control in Medical Microbiology.
6. Culture and Drug sensitivity tests: Culture, isolation and identification of Pathogens from urine, pus and sputum and recording of their results.

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER I: BACTERIAL PATHOGENS & ASSOCIATED DISEASES**

### **Unit I**

Normal microflora of human body: Skin, Respiration system Gastrointestinal, and Genitourinary tracts. Source of infections, mode of spread and portals of entry.

Description, pathogenecity, mode of infection, incubation period and toxigenecity of:-

1. Staphylococcus
2. Streptococcus
3. Pneumococcus
4. Neisseria
5. Bordetella
6. Haemophilus

### **Unit II**

Host Parasite interaction in bacterial infections. Pathogenic of bacteria (colonization of surface, invasion of tissue, production of exo and endo toxins). Antibacterial defence of the host.

Description Pathogenecity, mode of infection, incubation period and toxigenecity of:-

1. Corynebacteria, Erysipelothrix, Listeria,
2. Mycobacteria
3. Atypical Mycobacteria
4. Anthrax bacillus
5. Brucella
6. Yersenia, Pasteurella & Francisella.

### **Unit III**

Physiology & Biochemistry of bacteria: Protein, Carbohydrate, lipid, and nucleic acid as antigens.

Description, Pathogenecity, mode of infection, incubation period and toxigenecity of:

1. Salmonella
2. Shigella
3. Proteus
4. Pseudomonas, Loefflerella
5. Vibrio
6. Escherichia coli
7. Clostridia

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER II: SYSTEMATIC BACTERIOLOGY**

### **Unit I**

The role of laboratory in the diagnosis and control of infections: Management and quality control of medical microbiology laboratory.

- a) Specimen Collection from patients, clinics, and hospitals
- b) Specimen collection for epidemiological investigations.
- c) Training of medical microbiologist to handle epidemics, Morphology, staining, Cultural Character of Bacteria, Selective cultural media, identification by special tests, biochemical reactions and sero-typing of:
  - a) Grams positive cocci: - Cluster forming, chain forming and diplococci.
  - b) Neisseria, Bordetella and Haemophilus.

### **Unit II**

Isolation of pure culture and its preservation.  
Morphology, Staining, Cultural Character, selective cultural media, identification by special tests, biochemical reactions and serotyping of:-

- 1. Corynebacterium.
- 2. Mycobacterium.
- 3. Atypical Mycobacterium.
- 4. Anthrax bacillus.
- 5. Brucella.
- 6. Yersenia and Pasteurella.

### **Unit III**

Microbial drugs sensitivity tests and its clinical interpretation  
Morphology, Staining, Cultural character, Selective cultural medias, identification by special tests, biochemical reactions and serotyping of:-

- |                |                     |
|----------------|---------------------|
| 1. Salmonella  | 5. Vibrio           |
| 2. Shigella    | 6. Escherichia coli |
| 3. Proteus     | 7. Clostridia       |
| 4. Pseudomonas |                     |

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER III: MISCELLANEOUS MICROBES, FUNGAL PATHOGENS AND ASSOCIATED DISEASES**

### **Unit I**

Principle and mode of action of antibiotics, antifungal and antiviral agents.  
Description, Pathogenecity, mode of infection, incubation period and toxigenecity of:-

1. Bacteroides, Streptobacilli, Donovanias.
2. Lactobacillus.
3. Actinomyces, norcardia.
4. Leptospira.
5. Treponema, Borrelia.
6. Mycoplasma.

### **Unit II**

Clinical presentation and pathology of miscellaneous microbial infections.  
Description, pathogenecity mode of infection, incubation period and toxigenecity of:-

1. Chlamydia.
2. Rickettsiae.
3. Yeast, Yeast like organism and Candidiasis.
4. Dermatophytes and Superficial fungal infections.
5. Systematic fungi-Aspergillosis

### **Unit III**

Pathogenic & Nonpathogenic fungi: - Clinical features and pathology.  
Description, classification, Pathogenecity, mode of infection, incubation period and toxigenecity of:-

1. Pathogenic fungi: cryptococci, Blastomyces, Coccidioides, Paracoccidioides etc.
2. Superficial and deep fungal infections of Eye, Ear and skin.
3. Entomology: Insects: Mosquitoes, housefly, sand fly, fleas, lice, ticks and mites, Cyclops, bed bugs and cockroaches, rodents: Rats and mice.

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER IV: LAB DIAGNOSIS OF MICROBIAL DISEASES**

### **Unit I**

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Osteomyelitis, sore throat, scarlet fever, rheumatic fever, acute glomerulonephritis, Pneumonia, whooping cough, respiratory infections, meningitis, gonorrhea, rat bite fever actinomy cosis dental caries and leptospirosis.

### **Unit II**

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Diphtheria, tuberculosis, skin, ulcers and leprosy, malignant pustules and isortiers diseases, brucellosis, plague, genital infections, typhus, oral thrush, ringworms and mycetoma.

### **Unit III**

Itiopathogenesis, Pathology, Clinical features and Lab diagnosis of: Typhoid and paratyphoid fever, bacterial food poisoning, bacillary dysentery, gastroenteritis, choleraangrene, tetanua, botulism, wound infections, Aspergillois, Blastomycosis etc.

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER V: HUMAN PARASITOLOGY**

### **Unit I**

Protozoology- Introduction and Classification.

Phylum – Protozoa

- a) Class Rhizopoda-Amoeba.
- b) Class Mastigophora-Intestinal, oral and vaginal flagellates trypanosome and leishmania.
- c) Class Sporozoa – black water
- d) Class Ciliata.

### **Unit II**

Protozoa of uncertain classification- Sacocysts, Pnemocystis and toxoplasma.

Phylum-platyhelminthes

- a) Class-Cestoidea
- b) Class-Trematoda

### **Unit III**

Phylum nemathelminths- Class- Nematoda.

Lab Diagnostic procedures and special methods of demonstration of human parasites in blood, stool, tissue and other body fluids.

# **B.Sc Medical Microbiology II<sup>nd</sup> year**

## **PAPER VI: APPLIED MEDICAL MICROBIOLOGY**

### **Unit I**

1. Preparation of container and swabs for collections of specimens for microbial examinations.
2. Portal regulation and transport of specimen.
3. Flowchart of Lab diagnostic procedures.
4. Documentation of specimen in Laboratory.
5. Preservation of Micro-Organisms: Periodic subculture methods, cold Storage, freezing, deep freezing, lyophilize on methods. Total and viable counts of bacteria.

### **Unit II**

1. Infection syndromes and diagnostic procedures.
2. Strategy of anti-microbial therapy.
3. Epidemiology markers of microorganisms: Serotyping and Bacteriophage.
4. Prophylactic mass immunization.
5. Nosocomial infection and sterility testing of I.V. fluids and processing of various samples for various hospital infections.

### **Unit III**

1. Diagnosis, treatment and control of common infections and infestations.
2. Cell, tissue and organ culture.
3. Specific serological methods of diagnosis.
4. Test of sensitivity to antimicrobial agents and their preparation.
5. Specific culture and drug sensitivity methods.

# **B.Sc Medical Microbiology III<sup>rd</sup> year**

## **PAPER I: PATHOGENIC VIRUSES AND ASSOCIATED DISEASES**

### **Unit I**

1. Pox-Viruses: Smallpox, Vaccinia, Molluscum contagiosum.
2. Herpes Virus: H Simplex, Chickenpox-Zoster, CMV, IMN and burkitt's Lymphomas.
3. Adenoviruses: Pharyngeal infections, Respiratory infections and conjunctival infections.

### **Unit II**

1. Orthomixoviruses (Influenza Type A, B, C etc): Influenza.
2. Paramyxovirus: Respiratory Infections, mumps and measles.
3. Miscellaneous Viruses: Rubella, Corona, Arbo viruses: Rubella, common cold is lymphocytic choriomeningitis.
4. Picorna Viruses: Enteroviruses, Poliomyelitis Aseptic and Epidemic Myalgia.
5. Rhinoviruses-Common Cold.

### **Unit III**

1. Hepatitis Viruses: Infectious and serum Hepatitis
2. Arbo Viruses: Encephalitis, Yellow fever, Dengue fever
3. Rhabdo Viruses: Rabies
4. Slow and oncogenic Virus: Scrapie, Kuru and animal virus tumors
5. Cell culture and observation of effect of viruses on cell. Technique, Procedure and interpretation of results.

# **B.Sc Medical Microbiology III<sup>rd</sup> year**

## **PAPER II: APPLIED IMMUNOLOGY & SERO-DIAGNOSIS**

### **Unit I**

1. Basic Concept: Antigen, antibody complements and immune complexes. Immune reactions and laboratory tests for detection of antigen and antibodies.
2. Electrophoresis & Chromatography: Principles, technique and application. Gas – Liquid chromatography (GLC), Ion Exchange Chromatography, exclusion chromatography (TLC). Polyacrylamide Gel- Electrophoresis (PAGE), SDS-PAGE. Agarose Gel Electrophoresis and Immuno Electrophoresis.
3. Spectroscopic I & Centrifugation techniques: Visible & UV Spectroscopy, Electron spin resonance (ESR), Nuclear Magnetic resonance (NMR). Basic Principles of sedimentation and applications of analytical centrifuges.
4. Antibody production by microbial agents and its clinical significance.
5. Hepatitis markers: HbsAg, anti HBC Igm, HbeAg/anti Hbe Ag, HDV, anti HBs, HBVvDNA and Hv RNA: Technique and interpretation of results. Clinical significance of Hepatitis markers.

### **Unit II**

1. Autoimmune disorders: Pathogenesis and clinical feature, Autoimmune disorders markers: C3, C4, ANCA, ANA, antismooth muscle antibodies, immune complexes, HLA B0-27, anti sperm antibody, clinical significance, Autoimmune disorders: Anti mitochondrial, anti SCL-70. Anti parietal cell antibody, lupin anticoagulants.
2. ELISA and allied techniques: Radio Immuno assay and polymerase chain reaction, principle technique and applications.

### **Unit III**

1. Serological tests: Widal, ASO, CRP, Rose Wale, Brucella-Agglutination, Cold agglutination, VDRL, TPHA and STS.
2. HIV 1 & 2 screening and western blot.
3. Tumor markers: Various tumor markers and their clinical significance Automation and advance technology in various surface markers: Principles and Applications.
4. Preparation of antibiotics and antimicrobial agents: Principles and significance, Preparation of Vaccine and experimental study of immunogenicity.

# **B.Sc Medical Microbiology III<sup>rd</sup> year**

## **PAPER III: ADVANCED DIAGNOSTIC TECHNOLOGY**

### **Unit I**

1. Bacteriophages: Classification, morphological groups and applications of Bacteriophages in Medical Microbiology
2. DNA, Replication, translation and transduction: Principles, technology and applications in diagnosis.
3. TORCH-Profile: Technique and interpretation of results.
4. Anti A-60Mycobacterium IgG and mycodot, Technique and interpretation of results.

### **Unit II**

1. IgM to HB core antigen (HBCAg): Technique and interpretation of results.
2. IgG to Hepatitis C virus (HCV): Technique and interpretation of results.
3. IgG to Hepatitis A Virus (HAV): Technique and interpretation of results.
4. BHs Ag (ELFA): Technique and interpretation of results.
5. Cy: stercosis IgG (DLISIA): Technique and interpretation of result.

### **Unit III**

1. HIV P-24 Antigen test: Technique and interpretation of results.
2. Anti ds DNA test: Technique and interpretation of results.
3. Chlamydia IgM: Technique and interpretation of results.
4. Dengue IgM: Technique and interpretation of results.
5. IgG, IgA, IgM: Technique and interpretation of results.
6. Steller test and total IgE: Technique and interpretation of results.

**B.Sc Medical Microbiology III<sup>rd</sup> year**  
**PAPER IV: AUTOMATION AND COMPUTERIZATION IN MEDICAL MICROBIOLOGY**

**Unit I**

1. Computer Fundamental: Introduction to Computer Hardware central processing Unit (CPU), input drives, storage and output devices. Binary decimal, octal and hexadecimal system, BCD, EBCDIC and ASCII coding systems. An overview of operating system DOS/Windows, Computer Simulation, Computer linked to Microbiological Equipments.
2. FORTRAN: Writing FORTRAN program-Data type Contents Variable names Arithmetic Statements input/output statements. If statements, do loops, Subscribed Variables, Subprograms common and equivalence statements.
3. Application of FORTRAN: Computer programs for simple problems such as Matrix addition Multiplication and Transposition, trace of Matrix Chi sq.test. Fitting a straight light line (using principal of least square fit), Calculation of mean, standard deviation of CO-efficient of Correlation. Rearranging a set of numbers in as ascending or descending order.

**Unit II**

1. Computer Application and their use in Medical Microbiology: Features of Computers. Advantages of using Computers Getting data into/ out of computers Role of Computers. What is data processing? Application areas of Computers involved in data processing common activities in processing. Type of date processing characteristic of information, Authorization and report validation.
2. Hardware Concepts: Architecture of computers classification of computer concept of damage. Types of storage Devices characteristic of disk tapes terminals printers' network application concept of PC systems care, floppy care, data care etc.
3. Classification Software: Classification of software, system software, application software, Operating Systems, computer Viruses, Precautions against Viruses Dealing with Viruses Computers in Medical Electronics, Basic Anatomy of Computers, Micro Processors and computers. Principles of Programming etc.

**Unit III**

1. Introduction to internet, Internet basics of Microbiologists. Electronic Mail, Electron Mail servers. Down Loading, file with anonymous FTP. The Worldwide wave and mosaic and genome database, Sequence database and obtaining BLAST documentation and help.
2. Medical Transcription: What is medical Transcription, Type of Medical documents, contents of medical case sheet, Goals of Medical Transcription training? Basic Guidelines for medical transcription. Pronunciation guidelines. Basic elements of a medical world. Basic rules for building and defining medical worlds. Anatomical combining forms and general medical terms.
3. Automation of Medical Microbiology Laboratory.

# **B.Sc Medical Microbiology III<sup>rd</sup> year**

## **PAPER V: MOLECULAR BIOLOGY & CLINICAL LAB TECHNOLOGY**

### **Unit I**

1. Determination of Blood Glucose by various methods. Glucose tolerance test, Glycosylated hemoglobin: Interpretation of results & Clinical Co-relation.
2. Profile test: Serum Cholesterol, HDL, LDL, Triglycerides. Lipoproteins & lipids.
3. Determination of liver function tests: Serum bilirubin (Total, Direct & Indirect) SGOT (AST). SGPT (ALT), serum proteins, A/G ratio, Alkaline Phosphatase, Prothrombin Time (procedure. Interpretation & clinical correlation of results).
4. Function test: Blood urea, Serum Creatinine, Uric acid and various ionic tests.
5. Cardiac profile (CK – MB and LDH) and Electrolyte (Sodium, Potassium chloride & Bicarbonates).

### **Unit II**

1. Cerebrospinal and other body fluids analysis. (Normal & Abnormal values & Clinical significance).
2. ABO & RH blood Group System: Technique of Grouping & Cross Matching, components their preparation & uses. Quality assurance and safety measures in Blood Banking. Organization. Operation and administration of Bank.
3. Static Mechanism: Theories of Blood Coagulation & Diagnostic procedures for coagulation disorders.
4. Antiglobulin (Coombs') test: Principle procedure and application. Direct indirect coombs' test.
5. Anemia & Leukemia: Definition, Classification, Pathogenesis and Diagnostic Procedures.

### **Unit III**

1. Introduction to Histology, Histopathology & Histochemistry.
2. Fixation and Fixatives, types of Fixatives, Frozen section, Freeze Drying & Freeze Substitution.
3. Tissue Processing: Dehydration, clearing & impregnation in wax. Decalcification.
4. Microtomy & staining techniques dye-Chemistry & various types of stains.
5. Exfoliative cytology, FNAC and cervical cytology,. Techniques, applications and interpretation of results.