

**Jawaharlal Institute of Postgraduate Medical
Education & Research
(JIPMER)
Puducherry**



**BSc Medical Laboratory Technology in
Blood Banking**

CURRICULUM

2021

This curriculum was approved at the 16th meeting of the Standing Academic Committee held on September 21, 2021, and will be applicable for students joining BSc (Allied Health Sciences) – Medical Laboratory Technology in Blood Banking from the academic year 2021-22. The curriculum document was prepared based on the model curricula for allied health sciences courses issued by the Ministry of Health and Family Welfare, Government of India.

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About JIPMER

Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry (JIPMER) under Government of India since the year 1956, is one of the leading Medical Institutions of India. Spread over a sprawling 195-acre campus in an urban locale of Puducherry (formerly Pondicherry), JIPMER is 170 kms by road from Chennai.

JIPMER has been declared as an “Institution of National Importance” by an Act of Parliament, JIPMER, Puducherry, Act, 2008. A copy of the Act was Gazette notified on 14-7-2008 to enforce this Act. Prior to this, the Institute was functioning under the administrative control of Directorate General of Health Services, Ministry of Health and Family Welfare, New Delhi. The Institution is now empowered to award Medical Degrees under the clauses 23 & 24 of the said Act. Such Degrees shall be deemed to be included in the schedules to the respective Acts governing Medical Council of India/National Medical Commission, Indian Nursing Council, and Dental Council of India, entitling the holders to the same privileges as those attached to the equivalent awards from the recognized Universities of India.

JIPMER imparts Undergraduate (UG), Postgraduate (PG) and Super Specialty Medical Training through a large hospital complex (JIPMER Hospital) and a Nursing College. Some of the courses offered are MBBS, BSc, MSc, MD, MS, DM, and MCh courses. Full-time Ph.D. programs are available in several disciplines.

About the Department of Transfusion Medicine

The Department of Transfusion Medicine at JIPMER started as blood bank in the old hospital block under Department of Pathology in 1966. This was established to cater to the needs of JIPMER hospital, the annual turnover was around 600 units. Blood component separation was started in 1988, with separation of 500 units of blood per annum. HIV testing and HCV testing of blood donors was started in the year 1988 and 2000 respectively. Plateletpheresis and therapeutic plasma exchange using cell separator were made available from the year 2002. Peripheral hematopoietic stem cell (bone marrow cells) collection for blood cancer patients was introduced in 2013.

Department of Transfusion Medicine was created in February'2009. Post Graduate Course in Transfusion Medicine and Immunohematology was started from the Academic year 2009-2010 with an intake of one student per annum. From February 2021, the Transfusion Medicine department is housed in a new state-of-the-art blood center with all the infrastructure as per the current regulations and guidelines. This was inaugurated on February 25, 2021 by Shri. Narendra Modi, the Hon'ble Prime Minister of India.

More than 100 voluntary blood donation camps are conducted annually and nearly 85% of the total collection is from voluntary blood donors. Present annual turnover is more than 18,000 units of blood and 100% of total collection is separated into blood components such as PRBC, FFP, Platelets and Cryoprecipitate, Cryo Poor Plasma. Advanced procedures such as Plasma exchange, Platelet apheresis, Leukapheresis for hematopoietic stem cell collection and as therapeutic measure etc., are being carried out in good numbers.

It currently has the status of a Regional Blood Transfusion Centre and Model Blood bank in Puducherry state, and caters to the needs of patients not only at JIPMER but also those in other hospitals in Pondicherry and Tamil Nadu. Thus, it meets 80% of the total blood requirements for the Union Territory of Puducherry. Apart from basic equipment needed for blood components separation and Apheresis unit, the department is equipped with sterile connecting device, automated component expressers, blood irradiator and other state of art equipment to prepare modified blood products, such as Leuco-depleted, aliquot preparation, irradiated or saline-washed blood components for use in special situations. It follows all the recommended quality-control steps, and its products meet the quality standards prescribed by the statutory authorities.

Annually about 500 Single Donor platelets are prepared using apheresis and about 50 peripheral blood hematopoietic stem cell collection procedures are being done. Facilities for therapeutic plasma exchange procedures are available round the clock; more than 100 such procedures are done annually. Department conducts CME's and Training programs for outside blood bank personnel and clinicians under the aegis of Pondicherry Aids Control Society. It also conducts Voluntary Blood donation awareness drives before conducting Voluntary Blood donation camps in colleges and various institutes.

COURSE DETAILS

Nomenclature: BSc (AHS) – Medical Laboratory Technology in Blood Banking

Introduction:

BSc (AHS) MLT in Blood Banking technology is a four-year full-time bachelor's degree programme including one-year compulsory Internship, where students are trained in various aspects of blood banking technology and other transfusion medicine procedures. With establishment of Transfusion Medicine department in Medical colleges all over India dedicated Transfusion medicine technologists are in need. The Transfusion Medicine encompasses not only basic blood banking but also it involves Apheresis procedures, Preparation of modified blood components, Immunohematology, HLA typing and cross matching for transplantation of organ, Regenerative medicine etc.

Objective:

By the end of the BSc AHS MLT in Blood Banking course, the student should be proficient enough to:

1. Select whole blood donors, collect whole blood by phlebotomy, and manage adverse donor reactions at blood centres and outdoor camps.
2. Prepare various licensed blood components including modified products and label them as per statutory requirements
3. Perform all Immunohematology laboratory investigations like- blood grouping, resolving blood group discrepancies, Compatibility testing in different situations, Antibody screening and identification, etc.
4. All mandatory transfusion-transmitted infection screening including safe disposal.
5. To collect various samples, investigate and workup required in transfusion reactions.
6. Demonstrate and do safe disposal of biomedical and other wastes generated in the blood centre.
7. Latest Indian Drugs and Cosmetic Act and rules, guidelines provided by other recognized agencies, and proficiency with legal aspects of the blood centre.
8. Maintain various blood centre records, equipment, and instruments as per statutory rules and guidelines. Prepare indent, procurements, and documentation as per rules.
9. Involve and perform entire quality control management of all the processes, and procedures, blood bags, Reagents, Various kits, various blood components, Instruments, equipment, etc. statutory rules, and guidelines.
10. Perform all donors and therapeutic Apheresis procedures
11. Know HLA typing, crossmatching, etc. procedures

Course overview:

BSc (AHS) – MLT in Blood Banking is a four-year course with three-year academic program divided into three phases of one year each and one-year compulsory internship period.

First phase: one year

Phase one serves as a foundation where students will be taught the basic subjects Anatomy, Physiology, Biochemistry, Foundation course and Blood bank organization and Donor management. They will be introduced to Blood donation & donor management and Blood Banking, Organization & Statutory acts like Indian Drugs and cosmetic act & rules 1945.

Second phase: one year

In the second phase students will be taught Basic Immunohaematology & Immunology, Haematology & Transfusion Microbiology. They will learn Blood components and its separation along with Transfusion therapy in various conditions and diseases. They will be intensively trained in Blood grouping, cross matching, Blood component preparation and storage, Use of blood components for various clinical conditions.

Third phase: one year

The third phase focusses more in advanced concepts namely – Handling and maintenance of Blood bank Equipment, Advanced Immunohematology & Immunology, Biomedical waste management, Infection control, Quality management system, Apheresis, Regenerative Medicine & Recent concepts in Transfusion Medicine. The students will be taught and trained in Antibody screening, Identification, elution etc., and HLA workup. Students will be focused on advanced training like Apheresis, recent advances in stem cell and Tissue banking. They will also be trained exhaustively in Quality control and documentation in blood banking which is a mandatory exercise as per statutory authorities. Each student will be asked to choose a project or elective posting like HLA lab, Clinical Haematology, cardiothoracic vascular surgery, Bone marrow transplantation ward etc.

Internship: one year

Compulsory Internship: After successful completion of three years they have to get trained as interns mandatorily for one year in transfusion medicine department. The interns will be given hands-on training in handling various blood bank equipment under supervision.

Job profile:

Future Scope of Bachelor of Allied health Science MLT in Blood bank Technology is bright as the Indian Drugs and cosmetic act & rules 1945 allows (recognizes) them to be employed as Blood centre technologists, technical supervisors, etc. They stand a better chance to get appointed. They can also be employed as Quality managers. With advancements in modified blood products, Immunohematology, Apheresis, Molecular techniques, organ transplantation, etc. since these graduates are trained in almost all such fields the career and job opportunities in blood centres both in private and corporate hospitals are best. The students can also pursue a Postgraduate degree and further research. This may allow them to work as teachers in Paramedical training institutes.

Eligibility for the course:

- The Applicant should be an **Indian National**.
- He/she should have completed **17 years** at the time of application cut-off date.
- There is **no upper age limit**.

The applicants should have passed the qualifying examinations in the manner mentioned below:

- The Higher / Senior Secondary Examination or the Indian School Certificate Examination which is equivalent to 10+2 Higher/Senior Secondary Examination after a period of 12 years study, the last two years of such study comprising Physics, Chemistry, Biology/ Botany & Zoology (which shall include practical tests in these subjects) and with English as a subject.
- The applicant must have passed in the subjects of Physics, Chemistry, Biology/Botany & Zoology and English individually and must have obtained a minimum of 50% marks taken together in Physics, Chemistry, Biology/Botany & Zoology at the qualifying examination
- Candidates belonging to the Scheduled Castes/Scheduled Tribe or Other Backward Classes must have obtained a minimum of 40% marks in the subjects of Physics, Chemistry, Biology / Botany & Zoology taken together in the qualifying examination.
- For PwD candidates in general and EWS categories, the minimum marks in Physics, Chemistry, Biology/ Botany & Zoology taken together in the qualifying examination is 45%.

Candidates intake per year:

Five candidates will be admitted to the course every year. There is no provision for sponsored / nominated candidates.

Duration of the course

4 years (48 months) duration including 3 years of classes and one year of compulsory internship.

Medium of instruction:

English

Vacation:

Students will be eligible for 4 weeks of vacation in summer and 2 weeks in winter.

Subject details:

Phase	Paper	Title of the paper
I	I	Foundation course (T & P)
	II	Anatomy and Physiology (T & P)
	III	Pathology and Microbiology (T)
	IV	Blood banking organization & Blood donation management and Biochemistry (T & P)
II	I	Basic Immunohaematology & Immunology (T & P)
	II	Haematology & Transfusion Microbiology (T & P)
	III	Blood components & Transfusion therapy (T & P)
III	I	Advanced Immunohematology & Apheresis (T & P)
	II	Blood bank equipment (T & P)
	III	Biomedical waste management (BMW), infection control & Quality management system (QMS) (T & P)
IV	Internship period	

T- Theory, P- Practical

Teaching hours:

Phase	Subject	Theory	Practical	Others
I	Foundation course	80	40	
	Anatomy	60	180	
	Physiology	60	180	
	Pathology	40		
	Microbiology	40		
	Blood banking organization & Blood donation management	30	280	
	Biochemistry	30		
	Self-study/Library			60
	Total			
II	Basic Immunohaematology & Immunology	60	280	
	Haematology & Transfusion Microbiology	60	280	
	Blood components & Transfusion therapy	60	280	
	Self-study/Library			60
	Total			
III	Advanced Immunohematology & Apheresis	60	280	
	Blood bank equipment	60	280	
	Biomedical waste management (BMW), infection control & Quality management system	60	280	
	Self-study/Library			60
	Total			
IV	Internship			

SYLLABUS

Phase I

Paper I: Foundation course

Theory:

Introduction to National Healthcare System

The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world. Topics to be covered under the subject are as follows:

1. Introduction to healthcare delivery system
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Health system in developed countries.
 - d. Private Sector
 - e. National Health Mission
 - f. National Health Policy
 - g. Issues in Health Care Delivery System in India
2. National Health Programme- Background objectives, action plan, targets, operations, achievements, and constraints in various National Health Programme.
3. Introduction to AYUSH system of medicine
 - a. Introduction to Ayurveda.
 - b. Yoga and Naturopathy
 - c. Unani
 - d. Siddha
 - e. Homeopathy
 - f. Need for integration of various system of medicine
4. Health scenario of India- past, present, and future
5. Demography & Vital Statistics-
 - a. Demography – its concept
 - b. Vital events of life & its impact on demography
 - c. Significance and recording of vital statistics
 - d. Census & its impact on health policy
6. Epidemiology
 - a. Principles of Epidemiology
 - b. Natural History of disease
 - c. Methods of Epidemiological studies

d. Epidemiology of communicable & non-communicable diseases, disease transmission, host defence immunizing agents, cold chain, immunization, disease monitoring and surveillance.

Medical terminologies and record keeping

This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes. Topics include origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests.²⁵ Topics to be covered under the subject are as follows:

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic medical terms.
5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
6. Interpret basic medical abbreviations/symbols.
7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.
8. Interpret medical orders/reports.
9. Data entry and management on electronic health record system.

Basic computers and information science

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation. Topics to be covered under the subject are as follows:

1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
2. Input output devices: Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems).
3. Processor and memory: The Central Processing Unit (CPU), main memory.
4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.

5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing, and maximizing, etc.).
6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.
7. Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
8. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
9. Introduction of Operating System: introduction, operating system concepts, types of operating system.
10. Computer networks: introduction, types of networks (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
11. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
12. Application of Computers in clinical settings.

Medical law and ethics

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.²⁶

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analysing, and attempting to resolve the ethical problems that arise in practice".²⁶ Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are as follows:

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia

7. Organ transplantation
8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.
9. Professional Indemnity insurance policy
10. Development of standardized protocol to avoid near miss or sentinel events
11. Obtaining an informed consent.

Communication and soft skills

Major topics to be covered under Communication course –

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills. With focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
3. Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization.
4. Basic concepts & principles of good communication
5. Special characteristics of health communication
6. Types & process of communication
7. Barriers of communication & how to overcome

Introduction to Quality and patient safety

1. Quality assurance and management - The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system.
 - a. Concepts of Quality of Care
 - b. Quality Improvement Approaches
 - c. Standards and Norms
 - d. Quality Improvement Tools
 - e. Introduction to NABH guidelines
2. Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also

considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows:

- a. Vital signs and primary assessment
- b. Basic emergency care – first aid and triage
- c. Ventilations including use of bag-valve-masks (BVMs)
- d. Choking, rescue breathing methods
- e. One- and Two-rescuer CPR
- f. Using an AED (Automated external defibrillator).
- g. Managing an emergency including moving a patient

At the end of this topic, focus should be to teach the students to perform the manoeuvres in simulation lab and to test their skills with focus on airways management and chest compressions. At the end of the foundation course, each student should be able to perform and execute/operate on the above-mentioned modalities.

3. Bio medical waste management and environment safety- The aim of this section will be to help prevent harm to workers, property, the environment, and the general public. Topics to be covered under the subject are as follows:

- a. Definition of Biomedical Waste
- b. Waste minimization
- c. BMW – Segregation, collection, transportation, treatment, and disposal (including colour coding)
- d. Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste
- e. BMW Management & methods of disinfection
- f. Modern technology for handling BMW
- g. Use of Personal protective equipment (PPE)
- h. Monitoring & controlling of cross infection (Protective devices)

4. Infection prevention and control - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include –

- a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)],
- b. Prevention & control of common healthcare associated infections,
- c. Components of an effective infection control program, and
- d. Guidelines (NABH and JCI) for Hospital Infection Control

5. Antibiotic Resistance-

- a. History of Antibiotics
- b. How Resistance Happens and Spreads
- c. Types of resistance- Intrinsic, Acquired, Passive
- d. Trends in Drug Resistance
- e. Actions to Fight Resistance
- f. Bacterial persistence
- g. Antibiotic sensitivity
- h. Consequences of antibiotic resistance
- i. Antimicrobial Stewardship- Barriers and opportunities, Tools and models in hospitals

6. Disaster preparedness and management- The objective of this section will be to provide knowledge on the principles of on-site disaster management. Concepts to be taught should include-

- a. Fundamentals of emergency management,
- b. Psychological impact management,
- c. Resource management,
- d. Preparedness and risk reduction,
- e. Key response functions (including public health, logistics and governance, recovery, rehabilitation, and reconstruction), information management, incident command and institutional mechanisms.

Professionalism and values

The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant professionalism in terms of healthcare system is and how it affects the overall patient environment.

1. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality
2. Personal values- ethical or moral values
3. Attitude and behaviour- professional behaviour, treating people equally
4. Code of conduct, professional accountability and responsibility, misconduct
5. Differences between professions and importance of team efforts
6. Cultural issues in the healthcare environment

Research Methodology and Biostatistics

The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.

1. Introduction to research methods
2. Identifying research problem
3. Ethical issues in research
4. Research design
5. Basic Concepts of Biostatistics
6. Types of Data
7. Research tools and Data collection methods
8. Sampling methods
9. Developing a research proposal

Principles of Management

The course is intended to provide a knowledge about the basic principles of Management.

1. Introduction to management
2. Strategic Management
3. Foundations of Planning
4. Planning Tools and Techniques
5. Decision Making, conflict and stress management
6. Managing Change and Innovation
7. Understanding Groups and Teams
8. Leadership
9. Time Management
10. Cost and efficiency

Community orientation and clinical visit

The objective of this section of the foundation course is to sensitize potential learners with essential knowledge; this will lay a sound foundation for their learning across the undergraduate program and across their career. Innovative teaching methods should be used to ensure the attention of a student and make them more receptive such as group activities, interactive fora, role plays, and clinical bed-side demonstrations.

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries, and clinics.
2. The student will also be briefed regarding governance at village level including interaction and group discussion with village panchayat and front-line health workers.
3. Clinical visit to their respective professional department within the hospital.

Practical:

Fundamentals of computers

1. Learning to use MS office: MS word, MS PowerPoint, MS Excel
2. To install different software.
3. Data entry efficiency

Paper II: Anatomy and Physiology

Gross anatomy and Histology

Theory:

General Anatomy:

Introduction – Anatomical terms, position, movements; epithelium – classification, structure & examples; Tissues – classification and structure; skin – structure, thick and thin skin; cartilage – types, structure, hyaline, elastic, and white fibrocartilage; bones – classification, structure, growth; muscles - classification & structure; glands - classification & structure.

Musculoskeletal system:

Axial and appendicular skeleton – muscle groups and regions muscles with action.

Cardiovascular and lymphatic system:

Structure of pericardium, heart & major blood vessels – arteries, veins, and lymphatic system – classification and structure of lymphoid organs – thymus, spleen, lymph node, tonsil, and major lymphatic vessels.

Respiratory system:

Parts of respiratory system, structure of external nose, paranasal air sinuses, nasal cavity, nasopharynx, larynx, trachea, pleura, lungs & diaphragm.

Gastrointestinal system:

Parts of gastrointestinal system, salivary glands, oral cavity, oropharynx and laryngopharynx, esophagus, stomach, small intestine, large intestine, liver, gallbladder, extrahepatic biliary apparatus, and pancreas.

Excretory system:

Parts of excretory system – structure of kidney, ureter, urinary bladder & urethra.

Male and female reproductive systems:

Structure & parts of male reproductive system, external genitalia, testis, epididymis, vasdeferens, seminal vesicle and prostate.

Structure & parts of female reproductive system, uterus, ovary, fallopian tubes, and mammary gland

Endocrine system:

Location & structure of thyroid, parathyroid, pituitary, adrenal glands.

Special senses:

Structure of eyeball, external, middle & internal ear, and papillae of tongue.

Nervous system:

Neuron, neuroglia, classification, autonomic nervous system, meninges, parts of brain, cerebrum, cerebellum, basal nuclei, limbic system, thalamus, hypothalamus, spinal cord, circulation of cerebrospinal fluid.

Histology:**General histology:**

Microscopy – Types of microscopes, parts of microscope, cleaning, and maintenance of microscope.

Microscopic features of

1. Cartilages
 - 1.1 Hyaline,
 - 1.2 Elastic
 - 1.3 White fibro cartilages
2. Bones
 - 2.1 Longitudinal section of compact bone
 - 2.2 Cross section of compact bone
3. Muscles
 - 3.1 Skeletal muscle
 - 3.2 Cardiac muscle
4. Glands
 - 4.1 Serous gland
 - 4.2 Mucous gland
 - 4.3 Mixed gland
5. Blood vessels
 - 5.1 Medium sized artery
 - 5.2 Large sized artery
 - 5.3 Medium sized vein
 - 5.4 Large sized vein
6. Nervous tissue
 - 6.1 Peripheral nerve H & E stain
 - 6.2 Peripheral nerve Osmic acid stain
 - 6.3 Dorsal root (spinal) ganglia
 - 6.4 Autonomic ganglia
7. Lymphoid organs
 - 7.1 Thymus
 - 7.2 Lymph node
 - 7.3 Spleen
 - 7.4 Tonsil
8. Skin
 - 8.1 Thick skin
 - 8.2 Thin skin

Practical: Anatomy (Gross anatomy and Histology)

1. Demonstration of bones
2. Demonstration of various parts of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of reproductive system
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system
8. Demonstration of various parts of nervous system
9. General histology slides

Textbooks Recommended (Latest edition):**General anatomy:**

1. Handbook of General Anatomy – B.D. Chaurasia - CBS Publishers

Systemic Anatomy:

1. Textbook of Anatomy – Vishram Singh – Elsevier
2. B.D. Chaurasia's Human Anatomy – CBS Publishers
3. Manipal Manual of Anatomy for Allied Health Science Courses

Histology:

1. Textbook of Human Histology: With Color Atlas 3D Illustrations – Dr. Yogesh Sontakke
2. Textbook of Histology - A Practical guide – Dr. J. P Gunasegaran
3. Di Fiore's Atlas of Histology – Eroschenko – Lippincott Williams & Wilkins

Reference textbook:

Gray's Anatomy: The Anatomical Basis of Clinical Practice – Susan Standring – Elsevier

Physiology**Theory:****1. General Physiology**

- a. Principle of homeostasis
- b. Cell membrane, cell organelles, intercellular junctions
- c. Transport across cell membrane
- d. Body fluids: Classification of body fluid compartments, ionic composition, measurement
- e. Resting membrane potential

2. Blood

- a. Composition of blood
- b. Plasma proteins: classification and functions
- c. RBC: development, morphology, counts, functions and dysfunctions
- d. Hemoglobin: types, structure, synthesis, function, degradation, anemia
- e. WBC: development, classification, morphology, counts, functions and dysfunctions
- f. Immunity: definition, classification, Innate, Cellular and Humoral Immunity
- g. Platelets: morphology, counts, development, functions and dysfunctions
- h. Blood coagulation: clotting factors, mechanism, dysfunctions
- i. Anticoagulants
- j. Blood grouping: classification, cross matching, blood transfusion, Rh factor and incompatibility

3. Nerve

- a. Structure, function, classification of neurons
- b. Neuronal action potential: ionic basis and properties
- c. Conduction of nerve impulses
- d. Nerve Injuries
- e. Neuromuscular junction: structure, mechanism of transmission & applied aspects

4. Muscle

- a. Structure of skeletal muscle & sarcomere system
- b. Mechanism of contraction and relaxation of skeletal muscle
- c. Isotonic and isometric contraction
- d. Properties of skeletal muscle
- e. Smooth muscle: structure, properties, and mechanism of contraction
- f. Differences between skeletal, smooth, and cardiac muscles

5. Autonomic nervous system

- a. Divisions and functions

6. Gastrointestinal (GI) system

- a. Functional anatomy of GIT
- b. Gastrointestinal hormones
- c. Principles & Functions of GI secretions, applied aspects
- d. Movements of GIT, applied aspects

7. Endocrine system

Hormones, actions, and dysfunctions of various endocrine glands:

- a. Hypothalamus
- b. Pituitary
- c. Thyroid
- d. Parathyroid and hormones involved in calcium homeostasis
- e. Adrenal gland
- f. Endocrine pancreas

8. Reproductive System

- a. Male and female gametogenesis

- b. Structure and function of male reproductive system
- c. Structure of female reproductive system, menstrual cycle, pregnancy, parturition, lactation
- d. Contraceptives

9. Kidney

- a. Structure & function of kidney, structure of nephron, composition of urine
- b. Glomerular filtration rate: definition, values, regulation and measurement
- c. Mechanism of urine formation: tubular functions, concentration of urine, acidification of urine
- d. Micturition reflex
- e. Diuretics
- f. Dialysis

10. Cardiovascular system

- a. Functional anatomy of heart
- b. Circulatory system: arterial, venous, capillary circulation
- c. Structure and properties of cardiac muscle
- d. Electrophysiology of heart and conduction of impulse
- e. ECG: waveforms and physiological basis
- f. Cardiac cycle, heart sounds, Jugular venous pulse
- g. Stroke volume, heart rate, cardiac output – definition, normal values and their regulation
- h. Blood pressure and regulation
- i. Coronary circulation
- j. Lymphatic circulation
- k. Applied aspects: shock, hypertension, hypotension, tachycardia, bradycardia, heart failure

11. Respiratory system

- a. Functional anatomy of respiratory system
- b. Mechanics of breathing, lung volumes and capacities, compliance, surfactant
- c. Alveolar ventilation, dead space, pulmonary circulation, ventilation-perfusion ratio
- d. Diffusion and gas exchange
- e. Transport of oxygen and carbon dioxide
- f. Brief account of respiratory regulation
- g. Acclimatization, definition & types of hypoxia, oxygen therapy, cyanosis, asphyxia.
- h. Methods of artificial respiration

12. Central nervous system

- a. Parts and functions of brain and spinal cord
- b. Sensory system: receptors and ascending pathways
- c. Motor system: motor neurons, motor units, muscle spindle, stretch reflex, and descending tracts with emphasis on corticospinal tract
- d. Cerebellum- functional anatomy, functions, and dysfunctions

- e. Basal ganglia- functional anatomy, functions, and dysfunctions
- f. Functions of hypothalamus
- g. Functions of Thalamus
- h. Types of sleep and EEG
- i. Cerebrospinal fluid
- j. Higher functions: types of memory, centers of speech, types of aphasia in brief, Cerebral cortex-lobes and functions
- k. Blood-brain barrier

13. Special senses

- a. Vision: Components of visual apparatus, visual acuity, color vision, accommodation, errors of refraction, visual pathway, pupillary reflexes
- b. Hearing: External, middle ear, inner ear and their functions, auditory pathway, hearing tests.
- c. Taste – receptors and pathway
- d. smell: receptors and pathway

14. Integrative Physiology

- a. Structure and functions of skin
- b. Regulation of temperature

Practical: Physiology

1. Hematology

- a. Methods of collection of blood
- b. Microscopy
- c. Haemocytometry
- d. Total RBC count
- e. Estimation of haemoglobin
- f. Calculation of blood indices
- g. Demonstration of osmotic fragility of red blood cells
- h. Determination of ESR
- i. Total leucocyte count
- j. Absolute eosinophil count
- k. Peripheral blood smear
- l. Differential leukocyte count
- m. Arneht count
- n. Determination of blood group
- o. Bleeding time, Clotting time
- p. Demonstration of reticulocyte count
- q. Demonstration of platelet count
- r. Demonstration of PCV

2. Clinical

- a. General physical examination
- b. Clinical examination of Radial pulse
- c. Determination of blood pressure
- d. Recording of Electrocardiogram
- e. Examination of cardiovascular system
- f. Examination of respiratory system
- g. Demonstration of spirometry
- h. Determination of vital capacity and effect of posture of vital capacity
- i. Examination of sensory system
- j. Examination of motor system
- k. Visual acuity
- l. Color vision
- m. Pupillary reflexes
- n. Perimetry
- o. Tests of hearing
- p. Mosso's ergography

Textbooks recommended: (Latest edition)

1. Textbook of Medical Physiology by G.K. Pal (Theory)
2. Textbook of Practical Physiology by G.K. Pal & Pravati Pal (Practical)

Teaching learning methodology:

The course content in Physiology will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical classes & demonstrations
4. Seminars
5. Assignments

Paper III: Pathology and Microbiology

Pathology

The Pathology syllabus introduces the principles of **Pathology** with emphasis on applied aspects of Pathology particularly in the following areas:

1. Collection and transport of specimens for routine pathological investigations
2. Common routine pathology tests
3. General concepts of Pathology
4. Laboratory diagnosis of common pathological conditions
5. Systemic Pathology
6. Applied Surgical Pathology, cytopathology, hematopathology, renal pathology and neuropathology

Theory:

1. Adaptations, cell injury and repair

- a. Hyperplasia,
- b. hypertrophy,
- c. atrophy,
- d. metaplasia,
- e. Necrosis and
- f. Apoptosis

2. Acute and chronic inflammation

- a. Cardinal signs of inflammation
- b. Outcomes of acute inflammation
- c. Chronic inflammation
- d. Granulomatous inflammation
- e. Acute phase proteins

3. Tissue repair, regeneration, and hemodynamic disorders

- a. Cutaneous wound healing
- b. Pathological aspects of repair
- c. Hyperaemia and congestion
- d. Thrombosis and Virchow triad
- e. Embolism, infarction, and shock

4. Disorders of immune system

- a. Types of hypersensitivity reactions
- b. Autoimmune diseases

5. Neoplasia

- a. Definition of neoplasia.

- b. Differences between benign and malignant tumours
- c. Metastasis
- d. Carcinogenesis – causes

6. Applied general pathology related to transfusion medicine

- a. ABO blood group & Rh system (terminologies)
- b. Principles of blood grouping and cross matching
- c. Shelf life of stored blood
- d. Anticoagulants used for storing blood and temperature for storage

7. RBC, WBC, and bleeding disorders

- a. Anaemia – definition and classification
- b. Iron deficiency anaemia and haemolytic anaemia
- c. Leukocytosis and leukaemia
- d. Causes of splenomegaly
- e. Thrombocytopenia and coagulation disorders
- f. Phlebotomy, haemoglobin estimation, peripheral smear examination, bleeding time, PT and APTT

8. Disorders of GI tract, liver, biliary tract, and pancreas

- a. Causes of peptic ulcer, carcinoma stomach, intestinal obstruction, acute appendicitis, and colonic carcinoma
- b. Jaundice – classification based on pathophysiology
- c. Cirrhosis – definition and causes
- d. Hepatitis – types and mode of transmission
- e. Portal hypertension and hepatic failure

9. Blood vessels, heart, and lung diseases

- a. Risk factors for atherosclerosis and their classification
- b. Hypertension – definition and causes
- c. Varicose veins, thrombophlebitis and phlebothrombosis
- d. Congenital heart disease and heart failure
- e. Myocardial infarction and cor-pulmonale
- f. Rheumatic heart disease
- g. Chronic obstructive airway disease
- h. Asthma, pneumonia, and lung carcinoma

10. The kidney and lower urinary tract, male and female genital tract

- a. Acute and chronic renal failure
- b. Nephrotic and nephritis syndrome
- c. Acute tubular necrosis and urolithiasis
- d. Carcinoma penis, testicular tumours, and prostatic hyperplasia
- e. Endometriosis, adenomyosis and leiomyoma

11. Endocrine and nervous system

- a. Diagnostic criteria, types, and complications of diabetic mellitus
- b. Intracerebral, subarachnoid, and subdural haemorrhage
- c. Meningitis and encephalitis
- d. Epilepsy and CNS tumours

12. Applied Surgical Pathology & Cytopathology, renal pathology, and neuropathology

- a. Histopathology techniques
- b. Fine needle aspiration cytology and imprint cytology
- c. Basic terminologies of surgical specimens
- d. Urine analysis and renal biopsy
- e. CSF cytology, nerve and muscle biopsy, squash cytology

Textbooks recommended (latest edition):

1. Illustrated Pathology – McFarlen
2. Essentials of Rubin's Pathology
3. Basic Pathology by Robbins
4. General and systemic Pathology – Underwood and Cross

Teaching and Learning methodology

Mostly will be didactic lectures with tutorials.

Microbiology

The Microbiology syllabus introduces the principles of **Microbiology** with emphasis on applied aspects of Microbiology of infectious diseases particularly in the following areas

1. Universal and Standard precaution.
2. Collection and transport of specimens for routine microbiological investigations.
3. Common routine serological tests
4. General concept of infection
5. Common Bacteriological, Viral, Fungal, Parasitic infection and Laboratory diagnosis
6. Nosocomial infection
7. Biomedical waste management
8. Vaccine

Theory:**Introduction and Morphology**

Introduction of microbiology, Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.

Growth and Nutrition

Nutrition, Culture media, Types of medium with example and uses of culture media in diagnostic bacteriology, antimicrobial sensitivity test.

Sterilisation and Disinfection

Principles and use of equipment of sterilization namely Hot Air oven, Autoclave and serum inspissator. Pasteurization, Anti septic and disinfectants.

Immunology

Immunity, Types of Immunity, Vaccines, Types of Vaccine and immunization schedule. Principles and interpretation of commonly done serological tests namely Widal, VDRL, ASLO, ELISA, Rapid tests for HIV and HbsAg

Systematic Bacteriology

Morphology, diseases caused, laboratory diagnosis including specimen collection of the following bacteria (the classification, antigenic structure and pathogenicity are not to be taught) Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, C. diphtheriae, Mycobacterium tuberculosis, Clostridium spp., Bacillus spp., Shigella spp., Salmonella spp., Escherichia coli, Klebsiella spp., Proteus spp., Vibrio cholera, Pseudomonas spp. & Spirochaetes

Parasitology

Morphology, life cycle, laboratory diagnosis of following parasites E. histolytica, Plasmodium spp., Tapeworms, Intestinal nematodes, Filariasis

Mycology

Morphology, diseases caused, laboratory diagnosis of following fungi. Candida, Cryptococcus, opportunistic fungi

Virology

General properties of viruses, diseases caused, lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis

Hospital Infection

Causative agents, transmission methods, investigation, prevention and control Hospital infection, Universal precaution, Standard precaution

Principles and Practice Biomedical Waste Management**Applied Microbiology**

Causative agents, Sample collection and Laboratory diagnosis

Gastrointestinal infections, Nosocomial infections, Urinary tract infections, Respiratory tract infections, Pyogenic Meningitis, Food borne infections, Vector borne infections, Blood borne infections, Aerosol borne infections.

Textbooks recommended (latest editions):

1. CP. Baveja. Textbook of Microbiology for nurses. Arya Publishing Company.
2. RL Ichhpujani, Rajesh Bhatia. Essentials of Medical Microbiology. Jaypee Brothers Medical Pub (p) Ltd.
3. Seema Sood. Microbiology for Nursing Students & Nurses. Elsevier India Pvt.Ltd.
4. Satish Gupte. Short Textbook of Medical Microbiology. Jaypee Brothers Medical Pub (p) Ltd.
5. CK Jayaram Paniker, Ananthanarayan R. Textbook of Microbiology for nurses. Publisher Universities Press (India) Limited.
6. B.S.Nagoba. Clinical Microbiology. Bi Publications Pvt Ltd.
7. Clint E Carter, Burton J Bogitsh, Thomas N Oeltmann. Human Parasitology. Publisher Elsevier India Pvt. Ltd.

Paper IV: Blood Banking Organization & Blood donation management and Biochemistry**Blood Banking Organization**

1. History of Transfusion Medicine

- Identify and relate the important features of the history of transfusion medicine
- Outline the scientific benchmarks in the evolution of transfusion medicine-
- Explain how specific innovations affected transfusion medicine practice
- Describe recent trends in the practice of transfusion medicine

2. History of development Transfusion Medicine in India- Whole blood, Components & Apheresis, Recent developments –

3. Organization of blood bank services Regional blood transfusion center, Blood banks and blood storage centres, Blood Bank premises and infrastructure .Mandatory Technical Staffing pattern of blood bank and role, functions and responsibility of each Technical staff.

4. Technical requirements: Accommodation and environmental conditions, Blood bank management system, Regulations for blood bank operation, Drugs and cosmetics Law, National blood policy, standards in Blood Banking, licensing procedures, ethical aspects of blood transfusion

5. Statutory regulators of Blood banking in India- Drug controller of India, State, Director General Health services & NACO.

6. Indian Drugs and cosmetic act and rules 1945 pertaining to Blood bank

7. Indian & other Pharmacopeia pertaining to blood products-

8. Licensing norms, Inspections and Compliance-

9. Terminologies used in blood banking including blood donation.

10. Introduction blood and blood products.

11. Introduction to Blood bank equipments

12. Weights, Volume. Specific gravity, Conversion of weight to volume, Volume dilutions, Weight dilutions etc.

13. Etiquette and discipline to be maintained in blood bank-

14. Reporting Formats and statistics

Blood Donation & Donor Management**Objective**

To teach principles of donor selection, acceptance criteria and collect blood from healthy voluntary donors. To teach the need for organizing camps and how to go about to

organize and conduct blood donation camps. Student will learn various strategies of blood donor motivation, recruitment and retention of voluntary blood donors.

Part I

Donor Motivation, Motivational Techniques, Social Marketing, Preparation of IEC Materials. Blood donation Motivating factors for donation Types of blood donors, Donor selection, Donor questionnaire and interview: Eligibility and deferral criteria, medical interview and medical examination, Pre donation Investigations -haemoglobin estimation & Blood grouping, Equipments & Reagents used in screening, investigations. Managing rejected blood donors, technique for conversion of first time donor into regular voluntary donor, donor felicitation. Donor recruitment & Retention. Pre donation & Post donation donor counselling. Medico-legal Aspects, NACO & DGHS guidelines. Right to information, Donor Consent, reports, Leave letters, certificates

Part II

Blood collection room equipment, their principles, and use, emergency medicines, Pre donation counselling, Solutions & Method for Preparing Phlebotomy Site, Test Tube Samples– Method of accurately relating product to donor bleeding of the donor, post donation care. Mandatory emergency medicines to be made available and their uses. Donor reactions and their management. Screening of blood units for mandatory tests, discarding infected units, post donation counselling.

Part III

Blood Donation drive: Awareness programs prior to blood donation drive, Camp site, staff requirement, management of camp, transportation of blood units from camp site to blood bank.

Part IV

Types of blood bags available, collection, storage and labelling.

Different types of Blood Collection – Autologous blood donation, Therapeutic Phlebotomy Preservation of donated blood, blood preservation solutions, Additive solutions.

Part V

Blood donation, Blood salvaging. Criteria for autologous blood donation, Autologous blood donation advantages & disadvantages. Different types of Autologous blood donation.

Section B: General Biochemistry

- Carbohydrate chemistry: Monosaccharides, Disaccharides and Polysaccharides in health and disease
- Lipid chemistry: Simple, compound, and derived lipids, Lipoproteins in health and disease
- Protein chemistry: Amino acids, protein structure, protein denaturation

- Enzymes: Coenzymes, classification, Types of enzyme inhibition, Factors affecting enzyme activity; Clinical enzymology
- Nucleic acid chemistry: DNA, RNA
- Vitamins: Dietary sources, recommended dietary allowance, functions, and deficiency / toxicity of Vitamins
- Minerals: Dietary sources, recommended dietary allowance, functions, and deficiency / toxicity of Minerals
- Nutrition: basal metabolic rate, Protein Energy Malnutrition, Obesity, Food adulterants / additives
- Diabetes and Oral glucose tolerance test: Diagnosis and complications of diabetes,
- Renal and liver disease: RFT, LFT
- Myocardial infarction and Lipid profile: Cardiac markers

Practical

1. Preparation of phlebotomy site.
2. Operation of blood collection monitor, tube sealer and needle burner.
3. Donor Room Protocol, Donor Screening
4. Qualifying Test for Blood Donation- Laboratory investigations
5. Donor Suitability / Selection
6. Selection of Bags for Collection Of Blood
7. Blood Collection – Solutions & Method for Preparing Phlebotomy Site
8. Test Tube Samples – arrangement and requirement
9. Blood Collection – Method of Accurately Relating Product To Donor
10. Blood Collection Procedure
11. Post Blood Donation Care
12. Post donation instructions
13. Management Of adverse reaction
14. Study of Blood Collection- Collection of Autologous Blood From The Donor
15. Study of Outdoor Camps – Organization – Identifying needs
16. Study of Corporate camps – Management
17. Study of Social camps– Management
18. Study of College camps– Management

Text/Reference Books (Latest edition):

1. Modern Blood Banking and Transfusion practices by Denise M Harmening
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India
3. American Association of Blood Banks (AABB) Technical Manual.
4. Compendium of transfusion medicine, RN Makroo
5. Voluntary blood donation program NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi, 2007.
6. National guidebook in blood donor motivation. NACO, Ministry of Health and Family Welfare, Govt. of India.
7. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007
8. Indian & other Pharmacopeia pertaining to blood products
9. Indian Drugs and cosmetic act 1940 and Rules 1945 chapter related to Blood banking

Text/Reference Books (Latest edition): General Biochemistry

1. Medical laboratory Procedure Manual (T-M) by K.L. Mukerjee 1987, Vol.I, II & III Tata McGraw Hill Publication.
2. Textbook of Medical Biochemistry by Ramakrishna
3. Textbook of Clinical chemistry by Norbert Teitz.
4. Principles and Techniques of Practical Biochemistry by Wilson and Walker.
5. Clinical Chemistry - Principle and techniques by Rj Henry, Harper & Row Publishers.
6. Textbook Biochemistry by Vasudevan and Sree Kumari.

Phase II

Paper I: Basic Immunohematology & Immunology

Theory

Objective

This course is designed to teach the students basic concepts of general immunology with specific reference to Blood grouping, antibody screening and cross matching. Meticulous and sequential learning of these processes will enable the students to understand the basic concepts and minimizes or eliminates errors in blood grouping and compatibility testing.

Unit I

Introduction to Immunology, History, Immunity, Cells of immune system: Phagocytic cells, Antigen presenting cells, T cells, T cell subsets, B cells, CD Markers. Antigens: Immunogen, allo-antigen, soluble antigen, Red cell antigen, Epitopes immunoglobulins, characteristics of immunoglobulins, Complement System, HLA system.

Unit II

Antibodies: Polyclonal anti bodies, development of antibodies, structure of Monoclonal antibodies: Hybridoma technology, Human monoclonal antibodies. Antigen antibody reaction: Antigen concentration, antibody concentration, enhancing media, other factors influencing antigen antibody reaction.

Unit III

Basic Principles of immuno hematology, application of blood groups, population Genetics. **Application of Blood groups: -Population Genetics, Forensic medicine, Transfusion medicine.** ABO Blood of Group Systems: History, Genetics, ABH antigens, Biochemical Synthesis of blood group antigens, Antigenic sites, weaker variants, Bombay Phenotype, ABO antibodies. **Red cell serology techniques, their advantages and disadvantages, Cell and serum grouping.**

Unit IV

Blood group discrepancies, Sub groups of ABO, detection of weak A and B antigens, Trouble shooting in red cell serology

Unit V

Rh Blood Group System: History, Genetics, Molecular Genetics, Nature of Rh Antigens, Partial D, Weak D, other variants of Rh, Rh Null, Rh antibodies factors influencing Rh immunization, Functional role of Rh antigens. Introduction other Blood Group Systems: Lewis, P, Ii, MNSs, Kell, Duffy, Celano, In, Private antigens, Public antigens.

Unit VI

Principles of Direct and indirect antiglobulin test technique, Weak Rh D Typing. Antenatal Serology, Hemolytic disease of the newborn due to ABO Incompatibility, Rh Incompatibility and other allo-antibodies

Unit VII

Basic Immunohematology techniques – Adsorption, Elution, Lectins, Preparation of various reagents, principles, procedure and application

Unit VIII**Introduction to pretransfusion testing**

Pre transfusion testing - Patient specimen labelling requirements, Patient / component identification requirements. Different methods of cross matching, Saline Cross match, Saline replacement for rouleaux, enzyme technique, albumins technique, anti-globulin cross-matching. Cross matching in special circumstances, emergency cross matching, electronic cross matching. Abbreviation of compatibility testing in emergency. Micro plate techniques.

Immunology**Part I**

General principles of Immunology, Antigens, Antibodies, Antigen and antibody reactions, Complement System, Types of Immunity, Classifications of immunological reactions and

Part II

HLA antigens, HLA antibodies, HLA Serology. HLA phenotyping and various Histocompatibility matching procedures- CDC, ELISA, chemiluminescence and Flow cytometry methods

Part III

Molecular methods. Molecular methods in Immunology. Establishment of HLA lab for transplantation of organs, Transplant Immunology

Practical

1. Determination of ABO & Rh Blood Group –slide method
2. Preparation of various red cell preparation
3. Determination of ABO & Rh Blood Group –tube method – cell group & Serum group
4. Determination of ABO group of red cells and serum – Microplate test
5. Reading, Grading and Recording Results
6. Performing Direct Anti-Globulin test
7. Performing Indirect Antiglobulin test
8. Saline cross match
9. Performing Anti-globulin Crossmatch
10. Anti A and anti B titre estimation
11. Weak D testing
12. Identification of antisera
13. Adsorption and Elution techniques

Text/Reference Books (Latest edition):

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India.
3. Blood transfusion in clinical medicine by PL Mollison
4. AABB Technical Manual, 17th ed, AABB
5. Compendium of transfusion medicine, RN Makroo
6. Practical Hematology, J A Dacie and S M Lewis
7. Basic Immunology, A K Abbas and A H Lichtman. Second ed, Saunders Elsevier.
8. Essential Immunology. I Roitt, Blackwell scientific publications
9. Basic molecular and cell biology. David Latchman. BMJ Publishing group, 1997.
10. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007.
11. Rossi's principles of Transfusion Medicine

Paper II: Haematology & Transfusion Microbiology**Haematology**

- General-Hematology: Origin, development, morphology, maturation, function and fate of blood cells, nomenclature of blood cells.
- Various methods of blood collection, anticoagulants-mechanism and uses.
- Counting chamber- hemocytometry. Enumeration of RBC including various counting Chambers, diluting fluids for RBC count.
- Hemoglobinometer. Principles and methods of quantitating Hb. Concentration of blood including knowledge of errors and quality control in various method. Abnormal hemoglobin and its investigation.
- Principles and methods of determining PVC calculation and interpretation of red cell Indices.
- ESR: introduction, factors affecting ESR, principles and methods of determining ESR, increasing and decreasing conditions of ESR.
- WBC: introduction, development of WBC, diluting fluids. Absolute eosinophil count, errors in sampling, mixing, diluting and counting.
- Cell counting, advantages and disadvantages, uses and mechanism of cell counting, quality control in cell counts.
- Preparation of peripheral smear and bone marrow smear. Thin smear, thick smear. Buffy coat smear, wet preparation. Romanowsky stain. Preparation advantages and disadvantages.
- Principle and methods of staining of Blood smears and bone marrow smears. Supravital stain. Reticulocyte count. Heinz bodies.
- Description of morphology of normal and abnormal red cells. Blood differential WBC counting. Recognition of abnormal cell. Anaemia – definition etiology classification and laboratory diagnosis.
- Hemolytic anaemia, definition, causatives, laboratory investigations. Auto hemolysis, acid hemolysis.
- Methods of identification of abnormal hemoglobin including spectroscopy. HB electrophoresis. Alkali denaturation Test. Sickle cell preparation.
- Various benign leucocyte reaction – Leukocytosis. Neutrophilia, Eosinophilia, Lymphocytosis. Infectious mononucleosis. Leucopenias.
- Leukemias – definition, causes, classification, detection of leukemia. Total leucocyte count in leukemias. Multiple myeloma.
- Blood Coagulation and disorders of hemostasis. Principles and methods of assessment of coagulation. BT, CT, Prothrombin time, partial thromboplastin time, thromboplastin regeneration time.

- Thrombocytopenia, thrombocythemias, platelet function test, platelet count. Clot Retraction test. Platelet factor III Test.
- LE cell – definition, morphology causative agents. Various methods of demonstrating LE cells. Blood parasites. Malaria, LD bodies, microfilaria and methods of Demonstration.

Textbooks Recommended (Latest edition):

1. Textbook Of Hematology Tejinder Singh
2. Essentials of Hematology by Haufbrand .
3. Practicals in Hematology by J.V. Dacie.
4. Medical Laboratory Technology by Lynch.
5. Wintrobe's clinical Hematology

Transfusion Microbiology**Objective**

To teach students the pathology, epidemiology of blood transfusion transmitted infections and to train students in laboratory diagnosis and quality assurance in screening for diseases transmitted through blood transfusion. To teach basic principles proper disposal of biomedical waste generated in the blood bank laboratory

Part I

Study of major transfusion transmitted infection caused by viruses, Pathology, epidemiology Hepatitis B,C , Human immunodeficiency viruses 1 and 2, HTLV viruses I and II, and West Nile virus (WNV). Implication of the other viral diseases for blood transfusions: Epstein-Barr virus, cytomegalovirus (CMV), parvovirus B19 and Creutzfeldt-Jakob disease .

Part II

Transfusion associated parasites – Malaria & others. Syphilis and other pathogens. Malaria and syphilis by various methods and understand principles of testing. Understand and be able to interpret nontreponemal and treponemal antibody tests used to diagnose syphilis. Transfusion associated infections with other bacterial / fungal / protozoal infections.

Part III

Basic principles of ELISA test, various types of ELISA, Laboratory screening tests for TTI, Spot tests, Limitation of various tests. Quarantine and recipient tracing, procedures for look-back and recipient follow-up. Compare & contrast various methodologies such as ELISA, rapid & chemiluminescence used in screening of transfusion transmitted infections. National policy on TTI testing of blood donors.

Part IV

Chemiluminescence, NAT, Western Blot, Automation in blood donor TTI screening. Confirmatory tests for TTI testing. Demonstrate proficiency in the preparation and use of internal control in transfusion transmitted infection screening. Quality control and documentation. Proficiency testing – IQUAS & EQUAS Pathogen reduction, Cellular components and plasma components.

Part V

Discard of Blood Parts and Documentation of records, Universal precautions –Bio waste management. Disposal of Reactive Bags, its components. Demonstrate proficiency in proper disposal of bio hazardous material as per recommended standards.

Practical

1. Haematology

- Collection of blood – finger prick, venous blood.
- Hb estimation
- RBC count and estimation of packed cell volume.
- Total WBC count and absolute eosinophil count.
- Differential count of WBC, staining of blood smears.
- Platelet count by various methods.
- Erythrocyte sedimentation rate by various methods.
- Preparation of Leishman stain.
- Osmotic fragility of RBC.
- Clot retraction test and reticulocyte count.
- Preparation of reagents of coagulant studies.
- Preparation of Hemolysate
- Preparation of bone marrow smears.
- Preparation of LE cell smears.
- Comment on peripheral smear.
- Supervision of cleaning of glass wares and entry in register.
- Screening of donors.
- Preparation of anticoagulant fluids

2. Transfusion Microbiology

- ELISA for HBsAg detection.

- Rapid tests for HBsAg detection.
- HCV antibody detection by ELISA.
- HCV antibody detection by Rapid tests.
- HIV (1+2) antibody detection by ELISA.
- HIV (1+2) antibody detection by Rapid Tests.
- Rapid test for Syphilis.
- RPR test for Syphilis.
- Malaria Parasite detection: Peripheral smear, QBC & Rapid Method.
- Interpretation of Elisa charts
- Other tests
- Writing flow chart for testing HIV 1 & 2 and hepatitis testing

Text/Reference Books (Latest edition):

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India.
3. Blood transfusion in clinical medicine by PL Mollison
4. AABB Technical Manual, 17th ed, AABB
5. Compendium of transfusion medicine, RN Makroo
6. Practical Hematology, J A Dacie and S M Lewis
7. Basic Immunology, A K Abbas and A H Lichtman. Second ed, Saunders Elsevier.
8. Essential Immunology. I Roitt, Blackwell scientific publications
9. Basic molecular and cell biology. David Latchman. BMJ Publishing group, 1997.
10. Cambridge press Transfusion Microbiology Ed: John B & Flona R
11. Screening donated blood for TTI – Recommendations WHO publication
12. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007.

Paper III: Blood components & Transfusion Therapy**Blood Components****Objective**

To teach students optimal use of blood by separating blood into various components. To train students in the principles of use of blood bank equipments and preparation of blood component optimal yield of the components.

Part I

Basic steps in component preparation & labeling. Composition & storage Composition: volume, cellular, plasma and clotting factor content. Equipments used for component preparation. Selection of blood bags for component preparation. Care and precautions to be taken during whole blood collection and before component preparation. Programming for component preparation. PRP & Buffy coat methods. Other methods of component preparation.

Part II

Preparation of red cell concentrate, Fresh Frozen plasma, other plasma products platelet concentrate, cryoprecipitate, washed red cells. Plasma Fractionation: Principles, manufacturing of different plasma derivatives.

Part III

Storage conditions for components “Storage lesions”- Metabolic changes in blood components during storage, release of cytokine during storage. Component Testing, Labelling, Transportation, and storage of blood components. Inventory management and maintenance of blood stock.

Part IV

Modified blood components: Preparation of leukoreduced blood products, Leukocyte filters, Irradiated blood components, Blood substitutes, Washed /plasma reduced blood components, frozen red cells. Specialized blood components –CMV free and HLA matched & Blood substitutes, Recombinant clotting & hematopoietic growth factors

Part V

Quality control of components: Measurement of factor VIII level in FFP, Measurement of fibrinogen level in FFP, Measurement of pH and other platelet parameters, Sterility test on platelet concentrates, Sterility test on whole blood and Packed red blood cell concentrate.

Part VI

Plasma fractionation products & Pathogen inactivation methods

Transfusion Therapy

Objective

To teach the use of various blood components in different clinical situations. To teach students about safe blood administration and principles of blood ordering practices.

Theory:

Part I

Management of Blood Bank Issue Counter, Criteria for acceptance of requisition form. Inspection and selection of blood component. Plan for transfusion. Criteria for issue of blood and blood Components.

Part II

Use red cell components in of different types of anemia, Use of blood components in bleeding patient, Neonatal transfusion, and Transfusion practices in surgery, Selection of units for cross matching, Transfusion therapy for oncology and Trans plantation patients. Transfusion indications Red blood cells, Platelets, Plasma / cryoprecipitate, Granulocytes. Pre Transfusion strategies in special cases regarding samples, techniques and protocols in special patients circumstances -Paediatric / neonatal, Obstetric including intra uterine, cardiac surgery with CPB. Burn patients & Trauma patients.

Part III

Blood administration, transfusion filters, post transfusion care, Maximal surgical blood order schedule. Immune haemolytic anaemia Warm, Cold, Drug induced haemolytic anaemia. Thrombocytopenia Immune thrombocytopenic purpura. Thrombotic thrombocytopenic purpura. Post transfusion purpura. Fetal and neonatal thrombocytopenia. Granulocyte transfusion. Platelet refractoriness Recognition and evaluation. Calculation of CCI and platelet recovery

Part IV

Introduction to Special Transfusion therapies

Intrauterine transfusions. Cardiac surgeries. Massive transfusion protocols. Switching ABO / Rh types.

Part V

Transfusion reactions Diagnosis, Pathophysiology, Investigations. Hemolytic transfusion reaction - immediate and delayed; immune and non-immune reaction path physiology; Clinical signs and symptoms and laboratory investigation for HTR, Transfusion reaction work up. Non- hemolytic transfusion reactions Immediate and delayed, bacterial contamination, febrile reaction, Allergic reaction, Transfusion related lung injury, PTP, Alloimmunization, Iron overload, Graft versus host disease. Infectious complications Bacterial, parasitic, viral, prions. Current risk & Prevention strategies of transfusion reactions and rational use of blood components

Blood Components – Practical

1. Refrigerated centrifuge operation, various programs for preparing of blood components
2. Preparation of packed red cells
3. Preparation of FFP
4. Preparation of Washed Packed cells
5. Preparation of Cryoprecipitate and Cryo depleted plasma
6. Preparing random donor platelets
7. Operation of Laminar Flow
8. Leukodepletion of red cells
9. Leukodepletion of platelets
10. Learning blood component separation-Buffy Coat Method
11. Quality control of Components

Transfusion Therapy – Practical

1. Labelling and documentation during Issue of blood components
2. Type of component required, and no. of units required as per variety of clinical conditions and assessment
3. Post transfusion investigations to study of efficacy of transfused components
4. Sample collection in a case of suspected of blood transfusion reaction
5. Visual inspection of serum and plasma for hemolysis and investigations done to demonstrate hemolysis
6. Investigation of a Transfusion reaction
7. Reporting transfusion reaction work up
8. Transfusion reaction case studies - Charts.

Text/Reference Books (Latest edition):

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India, Second edition, 2003
3. Indian Drugs and cosmetic act and rules 1945 pertaining to Blood bank
4. AABB Technical Manual, AABB
5. Rossi Principles of Transfusion Medicine
6. Compendium of transfusion medicine, RN Makroo
7. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007
8. Indian & other Pharmacopeia pertaining to blood products

Phase III**Paper I: Advanced Immunohaematology & Apheresis****Advanced Immunohaematology****Objective**

Knowledge of blood groups is expanding. Student will learn importance of other blood groups and understand the principles of blood grouping, antibody screening, cross mating and criteria for blood compatibility in various conditions. Learn about newer concepts such as automation in blood banking, advanced blood bank techniques cord blood banking etc.

Part I

Solving ABO grouping and Rh typing discrepancies, Subgroups of ABO, Polyagglutination.

Part II

Other Blood Group Systems: Lewis, P, Ii, MNSs, Kell, Duffy, Celano, In, Private antigens, Public antigens, antibody identification, use of enzymes in blood banking, potentiators in blood grouping and cross matching, investigation of autoimmune hemolytic anaemia.

Part III

Antibody screening. Antibody identification- 11 cell & extended cell panel. Detection of blood group antibodies, identification of their Specificity, clinical significance of antibody detection, differentiation between auto and allo-antibodies Gel Technology

Antenatal Serology, Rh Incompatibility and other allo-antibodies, Kleihauer test, Erythrocyte resetting test and other tests.

Part IV

Preparation Red Cell panels. Elution & Adsorption Procedures. Reagents used in advanced immunohematology. Cryopreservation & thawing techniques of cell Panels and Red blood cells

Part V

Gel technology, Plate technology, Virtual Crossmatch, Molecular blood grouping, Automaton in blood grouping. Saliva testing

Apheresis, Regenerative Medicine & Recent concepts

1. Apheresis procedures, Apheresis products, preparation of multiple products on cell separators, Maintenance of cell separator equipment. Apheresis procedures, Apheresis products, preparation of multiple products on cell separators- Plateletpheresis, Plasmapheresis (Single donor & TPE), Leukapheresis (Granulocyte & Peripheral hematopoietic blood stem)
2. Latest trends in blood banking- Donor screening, retention, Blood collections, components etc. Recent advances in Automation of Blood Banking. Nucleic Acid Testing. Stem Cells & Cord stem cell banking.
3. Stem cell- Cord blood, Peripheral blood Haematopoietic stem cell and Stem cell banking and application. Procedures of collection of stem cell and calculation of stem cell collected. Quality control of products. Cryopreservation, maintenance, QC and thawing procedures in stem cell banking. Regenerative medicine.

Practical-Advanced Immunohematology & Immunology–

1. Detecting weak A and B antigens and antibodies by cold temperature enhancement
2. Confirming weak A or weak B subgroup by adsorption and elution
3. Preparing Check cells
4. Testing saliva for A, B and H antigens
5. Confirming anti-A1 in an A2 or weak A subgroup
6. Testing for weak D
7. Removing autoantibody by saline washes
8. Immediate spin compatibility testing
9. Detecting antibodies to red cell by indirect antiglobulin test
10. Saline indirect antiglobulin test
11. LISS additive indirect antiglobulin test
12. PEG indirect antiglobulin test
13. Differentiating agglutination from rouleaux - saline replacement
14. Direct antiglobulin test
15. Testing for fetomaternal hemorrhage – Rosette test
16. Modified Kleihauer Betke test for demonstration of fetal cells
17. Antibody screening and detection by using various number of red cell panel.
18. Elution & Adsorption Procedures

Practical Apheresis

Donor Apheresis

1. Donor screening, selection, and Investigations
2. Apheresis procedures Mainly Platelet apheresis, sometimes Leukapheresis etc.-
3. Daily Checks, Kit installation, trouble shooting and entire procedure.
4. Labelling and Quality control of various apheresis products.

Therapeutic apheresis

1. Patient screening, and Kit installation, trouble shooting and entire procedure.
2. Labelling and disposal of various apheresis products including management of patient during procedure

Reference Books:

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India, Second edition, 2003
3. Blood transfusion in clinical medicine by PL Mollison
4. AABB Technical Manual, AABB
5. AABB Apheresis principles & practice
6. Compendium of transfusion medicine, RN Makroo
7. Voluntary blood donation program NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi, 2007.
8. National guide book in blood donor motivation. NACO, Ministry of Health and Family Welfare, Govt. of India.
9. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007.
10. Indian Drugs and cosmetic act and rules 1945 pertaining to Blood bank
11. Practical Hematology, J A Dacie and S M Lewis
12. Basic Immunology, A K Abbas and A H Lichtman. Second ed, Saunders Elsevier.
13. Essential Immunology. I Roitt, Blackwell scientific publications
14. Basic molecular and cell biology. David Latchman. BMJ Publishing group, 1997.
15. Indian & other Pharmacopeia pertaining to blood products

Paper II: Blood bank Equipment

Equipment Management system of all Blood centre equipment (Whole blood, Blood component separation unit, Apheresis unit) and Laboratory equipment including & Advanced techniques as detailed.

Equipment: Plan for requirement, Design, specifications, Types of Procurement, Procurement, Installation, Operations, Validation, Calibration, Performance, Maintenance, Documentation

General Lab equipment

- Colorimeters & Elisa readers, washers
- Thermometers
- Weighing devices
- Refrigerators
- Platelet agitators & Incubators
- Deep freezers
- Thawing bath & devices
- Plasma expressers
- Sterile connecting devices
- Apheresis equipments
- Computers
- Software & Hardware
- Temperature regulating devices (Incubators, Hot air oven)
- Autoclaves
- Cell washers
- HIS
- Automation platforms
- Blood serology: Various reagents & Kits ordering, specifications & Documentation
- TTI Kits- Ordering, specifications and documentation

Advanced Lab equipment

- Molecular Laboratory equipment
- Transplant Lab equipment
- Regenerative Medicine

Practical:

1. Calibration of various equipment- Daily. Half yearly.
2. Daily maintenance and Log book maintenance
3. Procurement of equipment and Installation exercises
4. HIS entry of all particulars with generation of Inventory, Master register and documentation
5. Working or demonstration of semi-automated and fully automated Platforms

Reference Books:

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India, Second edition, 2003
3. Blood transfusion in clinical medicine by PL Mollison
4. AABB Technical Manual.
5. Compendium of transfusion medicine, RN Makroo
6. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007.
7. Indian Drugs and cosmetic act and rules 1945 pertaining to Blood bank
8. Indian & other Pharmacopeia pertaining to blood products
9. World Health Organization. -Manual on the management, maintenance and use of blood cold chain equipment

Paper III: Biomedical waste management (BMW) , Infection control & Quality management system (QMS)**Quality Control & Documentation****Objective**

To teach students total quality management in blood banking. Student will be taught National standards for blood banking as prescribed by DGHS, NACO and regulatory acts.

Part I

Quality control, assurance and management systems. Quality control of empty blood bags. Quality control of different blood bank Components, sterility test on component. Quality control of blood bags, Quality Assurance Hb & PCV, Quality control of blood grouping reagents, QC of anti-human globulin reagent, bovine albumin, Normal saline, Antisera etc., QC of TTI test kits – Elisa & Rapid

Part II

Quality control of all equipments, Calibration, validation and maintenance of blood bank equipment. QC of blood bank techniques Quality Assurance - Temperature Records, Sterility Testing. Internal QC and External QC

Part III

Quality parameters of various blood components, Quality Assurance blood components – red cells, FFP, cryoprecipitate, platelets, Red Cell and WBC contamination. Calibration, validation and maintenance of blood bank equipment, QC of blood bank technique.

Part IV

Documents, Registers, Records & Formats to be kept. Licensing, Drug authorities' inspection and compliance. Registers forms, Documentation and Standard operating procedures (SOP or GMP) , Blood bank management system, Regulations for blood bank operation, Drugs and cosmetics Law, National blood policy, standards in Blood Banking, licensing procedures, ethical aspects of blood transfusion.

Recruitment and training of blood bank personnel, Proficiency testing. Hospital Transfusion Committee. Blood Bank Accreditation- . ISBT, NABL, NABH standards and accreditation. Legal and ethical aspects, Regulatory Acts, Bio hazard Waste Disposal Act, National blood policy.

Biomedical waste management & Infection control

- Definition
- History: Salient points in 1998 rules. Difference between 1998 & 2016 BMW rules, Latest amendments
- Need for Biomedical waste management
- Present scenario
- BMW rules 2016

- Monitoring of implementation- Prescribed authority, Procedure for authorisation and advisory committee
- Application of BMW rules, Duties of the Health care facilities & responsibility of each health care worker. Need of biomedical waste management in
- Hospitals & other Health care facilities. Liability of the Health care providers in noncompliance of BMW and operator of a facility (out sourced) with penalties and punishments.
- Classification of Bio-Medical Waste, Sources of Biomedical Waste, Biomedical Waste Management Process, treatment and disposal including radiation wastes.
- Various treatment methods and disposal including spill management.
- Labelling various BMW materials
- Functions of Health care provider including Hospitals, Blood banks & Laboratories for BMW
- Development of supervision and management structures to prevent the risks associated with BMW, define various BMW generated, specific management of non- hazardous, hazardous, sharps, infectious etc. BMW, protective measures for staff and the environment including vaccination, Post exposure prophylaxis and treatment
- Maintenance of records
- Accident reporting
- Personal protection & Personal protection equipments
- Management of transfusion infections- Viral, Bacterial, protozoal , fungal etc.
- Bacterial contamination of blood products and further investigation
- Biosafety levels and cabinets
- Environmental sanitization of blood bank
- Prevention to infections and Post exposure prophylaxis

Quality Control & Legal Aspects of Blood Banking – Practical

1. Quality control of AB antiseras and ABO Cells-
2. Quality control of Rh antisera, coombs controlled cells and Rh Genotype determination
3. Titer of anti-D reagents with Homozygous and Heterozygous Rh positive cells
4. Titer determination
5. Empty Blood bags Quality control
6. Quality control of various other consumables like- Normal saline, Oxygen cylinder
7. Quality of AHG reagents.
8. Quality control of 22% bovine albumin
9. Quality control of Papain Cysteine.
10. Quality control of Copper sulphate solution
11. Quality control in various blood Components products.

12. Quality control in various apheresis products.
13. Quality control in whole blood.
14. Writing standard operating procedures.
15. Validation of refrigerators, cold room, incubator etc.
16. SOP writing for simple lab tests

BMW & Infection control – Practical

1. Preparation of various dilutions of Sodium Hypochlorite solution and documentation
2. Environmental sanitization of Bleeding and components storage areas
3. Sanitization of various equipments
4. BMW segregation and documentation
5. Spill management of Blood and Mercury
6. Disposal of all types of waste- Non-hazardous, Hazardous, Radioactive, etc. and documentation
7. Needle Stick injury prevention
8. Post exposure prophylaxis and treatment

Reference Books:

1. Modern Blood Banking and Transfusion practices by Denise M Harmening.
2. Transfusion Medicine technical manual-DGHS, Ministry of Health and Family Welfare, Govt. of India, Second edition, 2003
3. Blood transfusion in clinical medicine by PL Mollison
4. AABB Technical Manual.
5. Compendium of transfusion medicine, RN Makroo
6. Standards for blood banks and blood transfusion services, NACO, Ministry of Health and Family Welfare, Govt. of India, New Delhi 2007.
7. Indian Drugs and cosmetic act and rules 1945 pertaining to Blood bank
8. Indian & other Pharmacopeia pertaining to blood products
9. BMW act 2016 and latest amendments Government of India Gazette notification
10. NACO publications -QMS manuals for Blood banks

COURSE AND EXAMINATION REGULATIONS

Attendance:

- Students are required to attend 75% or more of all theory classes held, and 75% or more of practical in each subject to be eligible to appear in the final examination. Under no condition will a student with less than the prescribed attendance in any subject in theory and practical separately shall be allowed to appear in the Annual examination of that subject.
- Students with less than 75% attendance in theory and practical separately at the end of any year must start afresh by joining the junior batch of students. No extra classes will be arranged to make such students eligible for the final annual examinations. The attendance accrued in the previous academic year in those subject(s) will not be transferred. The student will need to secure 75% attendance afresh in theory and practical/laboratory postings after joining the junior batch to become eligible to appear in the final summative examination.
- The 25% leverage in attendance includes all types of leaves (including leave on medical grounds). For absence because of illness or any medical condition, a duly approved medical leave from Dean (Academic) with medical and fitness certificate issued/verified by authorized JIPMER clinical faculty member is mandatory. Certificate must be submitted before or within 10 days after availing medical leave.
- Students who are detained in all the subjects of a year due to lack of attendance should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes commence, whichever is earlier.
- Students who are detained in one or more subject(s) because of lack of attendance but are eligible to appear for final Annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last final theory/practical examination or when classes, whichever is earlier. Attendance will be calculated from the date of joining.
- A show cause notice will be issued to students on continuous unauthorized absence without prior permission for two weeks or more. If such absence extends to a period more than one month for any reason, the student is liable for termination for the course. The decision of the competent authority is final.
- There is **no condonation permissible** for shortage of attendance.

Internal Assessment (IA)

- A minimum of three notified internal assessments will be held periodically in each year (in a one-year period) and one model examination before the final annual examination.
- Each of the notified IA tests will carry 20% weightage and the model examination will carry 40% weightage. The sum of notified IA tests and model examination will decide the eligibility to appear in the examination and for contribution to aggregate marks.

- A student must secure at least 30% of the maximum marks fixed for internal assessment in theory and practical/clinical separately in a particular subject to be eligible to appear for the final annual examination in that subject.
- Of the final total aggregate marks in each subject, internal assessment marks will contribute 40% and annual examination marks will contribute the remaining 60%. This will apply to both theory and practical/clinical papers separately.
- If a student misses up to one notified test because of illness, marks of the remaining notified tests can be considered for calculating the internal assessment, ignoring the absence on medical grounds. To avail this concession, the student should submit a valid medical certificate signed by the treating clinical faculty member of JIPMER before or within 10 days after the missed test. This exemption will not apply to model examination. This is applicable only up to one missed notified internal assessment test.
- No repeat/additional notified internal assessment or model examination will be conducted.
- Students who are detained in all the subjects of a year because of lack of sufficient internal assessment marks should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes of the year commence, whichever is earlier.
- Students who are detained in one or more subject(s) due to lack of sufficient internal assessment marks but are eligible to appear in the annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last annual theory/practical examination or when classes of the year commence, whichever is earlier.
- The internal assessment marks accrued in the previous year will not be transferred to the next year.

Annual Examinations

Number and timing of examinations

- Annual examinations will be held at the end of each academic year. The Institute shall conduct not more than two annual examinations in an academic year, a regular annual and a supplementary examination in each subject. The supplementary examinations will be held within 6 weeks after publication of the result of the regular annual examination.
- Practical Examinations shall be jointly conducted by one internal and one external examiner duly appointed by the Professor of Examinations.
- Students should obtain a minimum of 40% in the annual examination and a minimum of 50% in the final total aggregate (total of internal assessment and annual examination marks) in a subject (theory and practical separately) to be declared as pass in that subject.

Marks scheme:

	Maximum marks
Theory	200
Practical	100
Total	300

Theory

	Maximum marks
Internal Assessment test 1 (weighted)	16
Internal Assessment test 2 (weighted)	16
Internal Assessment test 3 (weighted)	16
Model Examination	32
Annual Theory Examination	100
Viva-voce Examination	20
Total Theory marks	200

Practical

	Maximum marks
Internal Assessment test 1 (weighted)	7
Internal Assessment test 2 (weighted)	7
Internal Assessment test 3 (weighted)	7
Model Examination	14
Record marks	5
Annual Practical Examination	60
Total Practical marks	100

Question paper pattern

	Maximum marks
Section A	50
Section B	50
Total	100

Each section

		Marks
Answer in detail	1 X 10	10
Short notes	5 X 5	25
Brief answers	5 X 3	15
		50

Number of attempts and Training Period

- The academic program of the BSc Allied Health Sciences courses must be completed within 6 years from the date of joining (excluding internship). Maximum permissible duration for each year shall be four years and a maximum four attempts (including the annual and supplementary examinations) in any subject will be permitted.
- If a student does not appear in both theory and practical final examination, it will NOT be considered as an attempt for the purpose of calculation of maximum number of attempts in a subject.
- If a student appears for theory in the Annual Examination but does not appear for Practical Examination or vice-versa, his/her theory or practical appearance shall be counted as an attempt. In the next attempt, the student will have to appear for both Theory and Practical Examinations. Mere submission of application form for examination will not be considered as an attempt.
- Passing in the exams of all the previous year subjects is compulsory before proceeding to the classes of next phase.
- A student who fails in theory and/or practical papers of one or more subjects in the regular annual examinations at the end of each year can appear in the supplementary examination (to be held within 6 weeks of announcement of the regular annual examination results) in those subjects.
- If he/she passes these subjects in the supplementary examination, he/she should join the regular batch within 7 days of declaration of supplementary examination results or when classes commence, whichever is earlier. Attendance calculation for students who join after passing supplementary examination will begin from their date of joining of that year.
- Students who fail in theory and/or practical in one or more subjects in the supplementary examination and those who do not appear in the supplementary examination should join classes with the junior batch within 7 days of declaration of supplementary examination results or when classes, whichever is earlier. These students should secure 75% attendance and 30% internal assessment afresh to be eligible to appear in the final regular annual examination of that year along with the junior batch. Attendance calculation for students who join after failing in supplementary examination will begin from their date of joining the year with junior batch.
- A maximum of four attempts in any subject is allowed. If a student fails even in the 4th attempt, no further chances will be given, and his/her name will be struck off the rolls of JIPMER.
- No grace marks will be awarded for either theory or practical examinations under any circumstances.

Model Question paper**Phase I - Paper I: Foundation course**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Describe in detail healthcare delivery system in India at the primary, secondary, and tertiary levels.

2. Write short notes on the following: 5 x 5 = 25

- a. What is the role of processor and RAM in a computer?
- b. Describe the types of networks in computing.
- c. Write a short note on right to healthcare.
- d. What is medical negligence? What are the laws governing medical negligence in India?
- e. Write in brief about the importance of informed consent and the process.

3. Answer the following questions briefly: 5 x 3 = 15

- a. What are the components of a medical term?
- b. What are the input and output devices of a computer?
- c. What is paralanguage? What are its implications?
- d. Describe the characteristics of good communicator.
- e. What are the alternative medicine systems recognised by the Government of India?

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Explain the concepts of quality of care. Describe various approaches to quality improvement.

2. Write short notes on the following: 5 x 5 = 25

- a. Describe the principles of management with suitable examples.
- b. Describe the methods of disinfection in biomedical waste management.
- c. Describe the methods of prevention & control of common healthcare associated infections.
- d. Classify the types of antibiotic resistance and describe each of them.
- e. Write a short note on research study designs.

3. Answer the following questions briefly: 5 x 3 = 15

- a. What are the components of cardiopulmonary resuscitation?
- b. What is integrity and what is its importance of integrity in healthcare practice?
- c. What are the qualities of a good leader?
- d. What are the different types of data?
- e. Describe the concept of ethics and its relevance in healthcare practice.

Model Question paper**Phase I - Paper II: Anatomy and Physiology**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A - Anatomy

- 1. Answer the following question in detail:** 1 x 10 = 10
- a. Describe the position, parts, structure, blood supply and supports of uterus.
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Parts and blood supply of stomach
b. Simple epithelium
c. Histology of lymph node
d. Chambers and valves of heart
e. Surfaces and lobes of lung
- 3. Answer the following questions briefly:** 5 x 3 = 15
- a. Name three major salivary glands.
b. Mention two contents of spermatic cord
c. Name two paranasal air sinuses
d. Name the parts of small intestine
e. Name two upper limb muscles

Section – B - Physiology

- 1. Write essay answer on the following:** 1 x 10 = 10
- a. Define immunity. Mention the different types of immunity. Write briefly about the different types of immunity. (2+2+6)
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Active transport
b. Movements of small intestine
c. Factors affecting glomerular filtration rate
d. Oxygen haemoglobin (Oxy-Hb) dissociation curve
e. Factors regulating cardiac output
- 3. Write very short answers on the following:** 5 x 3 = 15
- a. Name the hormones secreted from Adrenal gland
b. Mention the Indicators of ovulation
c. Define tidal volume. Mention its normal value.
d. Draw a labelled diagram of lead II ECG.
e. List four functions of hypothalamus.

Model Question paper**Phase I - Paper III: Pathology and Microbiology**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A - Pathology**1. Answer the following question in detail:** 1 x 10 = 10

- a. What is inflammation? What are the cardinal signs of inflammation? Mention the difference between acute and chronic inflammation. Add a note on granuloma with example. (1+2+4+3)

2. Write short notes on the following: 5 x 5 = 25

- a. Define necrosis (1). Give examples of different types of necrosis (2). Differences between necrosis and apoptosis (2).
- b. What is thrombosis (1)? Explain Virchow's triad (4).
- c. Define neoplasia (1). What are the differences between benign and malignant tumours (2)? List the different routes of metastasis (2).
- d. Mention the differences between wound healing by primary and secondary intention (5).
- e. Principles and procedures of blood grouping (3) and cross-matching (2).

3. Answer the following questions briefly: 5 x 3 = 15

- a. Define anemia. Give any two causes of anemia.
- b. What is jaundice? Give the classification based on pathophysiology.
- c. What is atherosclerosis? Give some of its risk factors.
- d. What is nephrotic syndrome? Give any two examples.
- e. How will you do urine analysis?

Section – B - Microbiology**1. Write essay answer on the following:** 1 x 10 = 10

- a. Define sterilization. Draw a labelled diagram of autoclave. Write principle of autoclave and its application in hospital. (1+3+3+3)

2. Write short notes on the following: 5 x 5 = 25

- a. Enumerate vector borne diseases. Add a note on the laboratory diagnosis of malaria
- b. What do you understand by segregation of biomedical waste? How is it done in your hospital?
- c. Describe in detail about various method of urine sample collection
- d. Enumerate sexually transmitted microorganisms. Write laboratory diagnosis of HIV
- e. Describe laboratory diagnosis of Mucormycosis.

3. Write very short answers on the following: 5 x 3 = 15

- a. Name two transport media
- b. Name two foodborne pathogens
- c. Enumerate four Personal Protective Equipment (PPE)
- d. Name two nosocomial pathogens
- e. List two opportunistic fungal infection

Model Question paper**Phase I - Paper IV: Blood banking organization & Blood donation management and Biochemistry**

Maximum marks: 100 Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Discuss Mandatory technical staffing pattern with education & experience as per Indian drugs & cosmetic act & rules.

2. Write short notes on the following: 5 x 5 = 25

- a. Role of Regional blood transfusion centre
- b. Different Apheresis technology prevalent presently.
- c. Four important Historical aspects in transfusion medicine
- d. Explain criteria of Platelet concentrate as per USP- 4 marks
- e. Name all the mandatory rooms required for whole blood collection.

3. Answer the following questions briefly: 5 x 3 = 15

- a. What is minimum area required for whole blood collection and component processing?
- b. Define specific gravity.
- c. Name four equipment in blood bank which must be calibrated daily.
- d. Two advantages of pure voluntary blood collection.
- e. Rule 122 G (2) of the Drugs & Cosmetics Act, 1940.

Section B - Biochemistry**1. Answer the following question in detail:** 1 x 10 = 10

- a. Describe in detail the sources, biochemical functions, and deficiency manifestation of calcium.

2. Write short notes on the following: 5 x 5 = 25

- a. Explain the working principle of gel filtration chromatography.
- b. Mention the biochemical tests for assessment of iron status and briefly describe them.
- c. Describe the mechanisms of action of enzymes.
- d. Describe the biochemical functions of Vitamin K.
- e. What is basal metabolic rate and what is its significance?

3. Answer the following questions briefly: 5 x 3 = 15

- a. How is 1M of NaCl prepared?
- b. What is Bohr effect?
- c. Name and briefly describe a test to detect protein in urine.
- d. Name any two richest sources of vitamin C and describe its role in the human body.
- e. Describe various types of pipettes and their applications.

Model Question paper**Phase II - Paper I: Basic Immunohematology & Immunology**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Discuss ABO blood group system in relation to genetics, biochemistry, antigens, and antibodies

2. Write short notes on the following: 5 x 5 = 25

- a. Rh antigens
- b. Samples required for cross matching and labelling Red cell preparation.
- c. Two indications of Indirect Coombs testing and Direct coombs testing each
- d. HLA system
- e. Haemolytic disease of Newborn and fetus

3. Answer the following questions briefly: 5 x 3 = 15

- a. Monoclonal Antibody.
- b. Name two blood group systems other than ABO and Rh
- c. Name two quality control parameters of ABD reagents.
- d. Natural Antibodies of Bombay group
- e. Name four types of Immunoglobulins

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Classify Blood group discrepancies with examples

2. Write short notes on the following: 5 x 5 = 25

- a. Different test controls in ICT
- b. Minor crossmatch
- c. Platelet issue
- d. Fresh frozen plasma thawing.
- e. Bovine Albumin 22%.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Expand 'CAT'
- b. Saline replacement technique
- c. Uses of LISS.
- d. Four checks before issuing blood component
- e. Expand 'FNHTR'

Model Question paper**Phase II - Paper II: Haematology & Transfusion Microbiology**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Describe the principles of Hemoglobinometer and discuss the merits and demerits of various methods

2. Write short notes on the following: 5 x 5 = 25

- a. ESR.
- b. Osmotic fragility.
- c. Sickling test.
- d. Peroxide staining.
- e. Buffy Coat Preparation.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Give an example of RBC diluting fluid and give its compensation.
- b. Name the disadvantages of Sahli's method of Hb estimation
- c. What is supravital staining? Give examples.
- d. Write any two conditions when PVC is increased.
- e. Name any two types of anaemia.

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Define ELISA and mention different types and principle involved in ELISA testing

2. Write short notes on the following: 5 x 5 = 25

- a. Different test controls in ELISA testing
- b. Proper Disposal of infected shrapnel's
- c. Post exposure prophylaxis
- d. Name four parasites that can be transmitted by blood transfusion.
- e. External quality assurance system.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Cut off value
- b. E ratio
- c. Proficiency testing
- d. Enumerate all Hepatitis B virus antigens.
- e. Proper disposal of TTI reactive blood bags

Model Question paper**Phase II - Paper III: Blood components & Transfusion therapy**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Describe blood component separation and storage by Platelet rich plasma method from Whole blood.

2. Write short notes on the following: 5 x 5 = 25

- a. Cryoprecipitate composition
- b. Blood irradiation
- c. Storage and expiry schedule of any four blood components.
- d. Name five plasma fractionation products
- e. Thawed plasma

3. Answer the following questions briefly: 5 x 3 = 15

- a. Name two quality control parameters of Platelet concentrate
- b. Laminar flow
- c. Types of blood bags used for component preparation
- d. Minimum Haematocrit levels of Packed red cells
- e. Name four blood substitutes

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Define transfusion trigger. Discuss various indications for Packed red blood cell concentrate transfusion

2. Write short notes on the following: 5 x 5 = 25

- a. Maximum surgical blood order schedule
- b. Four causes of foetal and neonatal thrombocytopenia
- c. Define Massive transfusion protocol
- d. Emergency issues of blood units
- e. Four causes of platelet refractoriness

3. Answer the following questions briefly: 5 x 3 = 15

- a. Blood group switch for PRBC in AB positive patients
- b. Formula for estimating CCI
- c. What care should be taken when blood products are issued to Transplant patients?
- d. Name any four criteria's for accepting request for cross matching
- e. Name any two indications for FFP transfusion

Model Question paper**Phase III - Paper I: Advanced Immunohematology & Apheresis**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Classify and explain Rh blood group system in relation to genetics, biochemistry, antigens, and antibodies.

2. Write short notes on the following: 5 x 5 = 25

- a. Antigens of MNS system.
- b. Two Causes of Polyagglutination.
- c. Kleihauer test
- d. Peroxide staining.
- e. Define Alloantibody.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Natural antibodies of Bombay blood group.
- b. Name two lectins used in blood grouping serology
- c. Name two reagents used in cryopreservation.
- d. What is thawing?
- e. Saline replacement technique.

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Define Apheresis and mention different principle involved in apheresis procedure

2. Write short notes on the following: 5 x 5 = 25

- a. Define Therapeutic plasma exchange.
- b. Name four products that are collected by donor apheresis procedure.
- c. Define Regenerative medicine
- d. Advantages of NAT testing
- e. Labelling of apheresis products.

3. Answer the following questions briefly: 5 x 3 = 15

- a. Criteria of Donor to undergo Plasmapheresis procedure.
- b. Documentation in apheresis procedure
- c. Name two reagents used in cryopreservation.
- d. Cryo preservatives used in blood banking.
- e. Thawing of cryopreserved product

Model Question paper**Phase III - Paper II: Blood bank equipment**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A**1. Answer the following question in detail:** 1 x 10 = 10

- a. Enumerate Blood bank storage equipment required for Blood component separation unit and add a note on various maintenance checks done daily & weekly basis.

2. Write short notes on the following: 5 x 5 = 25

- a. Name various programs of Refrigerated centrifuge.
- b. Working of Laminar airflow bench.
- c. Transfusion transmitted screening kits used for HIV
- d. Technical specifications of single blood bag for collecting whole blood
- e. Principle of working of colorimeter

3. Answer the following questions briefly: 5 x 3 = 15

- a. Uses of Cryobath or thawing bath
- b. Use of thermometers in blood bank
- c. Types of Micro pipettes.
- d. Syphilis screening kits
- e. Calibration of Human weighing machine.

Section B**1. Answer the following question in detail:** 1 x 10 = 10

- a. Describe types of equipment used for Apheresis procedure along with the principle.

2. Write short notes on the following: 5 x 5 = 25

- a. Bar code reader
- b. Radio frequency identification device
- c. Name any four modules of Blood bank software
- d. Types Bins (color) used in biomedical waste management
- e. Rotor and its relation to RCF- relative centrifugal force (g)

3. Answer the following questions briefly: 5 x 3 = 15

- a. Uses of Gel cards
- b. Name two automation platforms available for blood grouping
- c. Name two specifications for portable tube sealer
- d. Use of Hot air oven
- e. Name the types of incubators.

Model Question paper**Phase III - Paper III: Biomedical waste management (BMW), Infection control & Quality management system (QMS)**

Maximum marks: 100

Maximum duration: 3 hours

Answer all the questions. Draw suitable diagrams where necessary

Section A

- 1. Answer the following question in detail:** 1 x 10 = 10
- a. Discuss the daily Internal Quality control mandatory checks done in blood bank
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Calibration of Refrigerated centrifuge
b. Thermograph
c. Quality control parameters of Whole blood
d. Entries to be recorded Blood bag stock register
e. Potency
- 3. Answer the following questions briefly:** 5 x 3 = 15
- a. Types of Anti human globulin antisera
b. Two differences between Monoclonal & Polyclonal antisera
c. Name different forms used for licensing blood bank as per Drugs and cosmetic act
d. Name any four criteria's for establishing blood storage center
e. Qualifications essential for Blood bank Medical officer

Section B

- 1. Answer the following question in detail:** 1 x 10 = 10
- a. Classify Bio medical waste (BMW) with examples
- 2. Write short notes on the following:** 5 x 5 = 25
- a. Duties of the Occupier as per BMW rules, 2016
b. Give four examples of Recyclable waste
c. How Transfused blood bags are disposed
d. Role of staff nurse in blood bank about Biomedical waste management
e. Deadlines for filing Annual report
- 3. Answer the following questions briefly:** 5 x 3 = 15
- a. Name two precautions to be taken during waste handling
b. Name two biomedical wastes that need autoclaving
c. Two methods of avoiding needle prick injury
d. Define bio-medical waste
e. What should be minimum stack height?
