



**MAHATMA GANDHI UNIVERSITY**  
*of*  
**MEDICAL SCIENCES & TECHNOLOGY**  
JAIPUR

# **Syllabus**

## **MD – IMMUNOHAEMATOLOGY AND BLOOD TRANSFUSION (MD19)**

**(3 Years Post Graduate Degree Course)**

## **Notice**

1. Amendment made by the National Medical Council of India in Rules/Regulations of Post Graduate Medical Courses shall automatically apply to the Rules/Regulations of the Mahatma Gandhi University of Medical Sciences & Technology (MGUMST), Jaipur.
2. The University reserves the right to make changes in the syllabus/books/guidelines, fees-structure or any other information at any time without prior notice. The decision of the University shall be binding on all.
3. The Jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.

**RULES & REGULATIONS**  
**MD Immunohematology and Blood Transfusion (MD19)**  
**(3 Years Post Graduate degree course)**

**TITLE OF THE COURSE:**

It shall be called Doctor of Medicine.

**ELIGIBILITY FOR ADMISSION:**

No candidate of any category (including NRI quota) shall be eligible for admission to MD/MS courses, if he or she has not qualified NEET PG (MD/MS) conducted by National Board of Examinations or any other Authority appointed by the Government of India for the purpose.

**(1) General Seats**

- (a) Every student, selected for admission to postgraduate medical course shall possess recognized MBBS degree or equivalent qualification and should have obtained permanent Registration with the National Medical Council of India, or any of the State Medical Councils or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.
- (b) Completed satisfactorily one year's rotatory internship or would be completing the same before the date announced by the University for that specific year as per MCI rules after passing 3rd professional MBBS Part II Examination satisfactorily.
- (c) In the case of a foreign national, the National Medical Council of India may, on payment of the prescribed fee for registration, grant temporary registration for the duration of the postgraduate training restricted to the medical college/institution to which he/she is admitted for the time being exclusively for postgraduate studies; however temporary registration to such foreign national shall be subject to the condition that such person is duly registered as medical practitioner in his/her own country from which he has obtained his basic medical qualification and that his degree is recognized by the corresponding Medical Council or concerned authority.

**(2) NRI Seats**

- (a) Students from other countries should possess passport, visa and exchange permits valid for the period of their course of study in this Institution and should also observe the regulations of both Central and State Governments regarding residential permits and obtain no-objection certificate from the same.
- (b) The candidate should have a provisional "Student Visa". If he/she comes on any other visa and is selected for admission, he/she will have to first obtain a student visa from his country and then only he will be allowed to join the course. Therefore, it is imperative to obtain provisional student visa before coming for Counseling.
- (c) This clause is applicable to NRI/Foreign Students only.

**CRITERIA FOR SELECTION FOR ADMISSION:**

**(1) NRI Quota**

15% of the total seats are earmarked for Foreign National / PIO / OCI/ NRI / Ward of NRI/NRI sponsored candidates who would be admitted on the basis of merit obtained in NEET PG or any other criteria laid down by Central Government/NMC.

**(2) Remaining Seats (Other than NRI Quota Seats)**

- (a) Admissions to the remaining 85% of the seats shall be made on the basis of the merit obtained at the NEET conducted by the National Board of Examinations or any other Authority appointed by the Government of India for the purpose.
- (b) The admission policy may be changed according to the law prevailing at the time of admission.

**COUNSELING/INTERVIEW:**

- (1) Candidates in order of merit will be called for Counseling/Interview and for verification of original documents and identity by personal appearance.
- (2) Counseling will be performed and the placement will be done on merit-cum-choice basis by the Admission Board appointed by the Government of Rajasthan.

**RESERVATION:**

Reservation shall be applicable as per policy of the State Government in terms of scheduled caste, scheduled tribe, back ward class, special back ward class, women and handicapped persons.

**ELIGIBILITY AND ENROLMENT:**

Every candidate who is admitted to MD/MS course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself enrolled and registered with the Mahatma Gandhi University of Medical Sciences & Technology after paying the prescribed eligibility and enrolment fees.

The candidate shall have to submit application to the MGUMST through Principal of College for the enrolment/eligibility along with the following original documents with the prescribed fees within two months of his/her admission or upto November 30 of the year of admission whichever is later without late fees. Then after students will have to pay applicable late fees as per prevailing University Rules.

- (a) MBBS pass Marks sheet/Degree certificate issued by the University (1<sup>st</sup> MBBS to Final MBBS)
- (b) Certificate regarding the recognition of medical college by the Medical Council of India.
- (c) Completion of the Rotatory Internship certificate from a recognized college.
- (d) Migration certificate issued by the concerned University.
- (e) Date of Birth Certificate
- (f) Certificate regarding registration with Rajasthan Medical Council / Medical Council of India / Other State Medical Council.

## **REGISTRATION**

Every candidate who is admitted to MD/MS course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself registered with the Mahatma Gandhi University of Medical Sciences & Technology after paying the prescribed registration fees.

The candidate shall have to submit application to the MGUMST through Principal of College for the enrolment/eligibility along with the following original documents with the prescribed fees within two months of his/her admission or upto November 30 of the year of admission whichever is later without late fees. Then after students will have to pay applicable late fees as per prevailing University Rules.

## **DURATION OF COURSE:**

The course shall be of 3 years duration from the date of commencement of academic session.

## **PERIOD OF TRAINING:**

The period of training for obtaining Post graduate degrees (MD/MS) shall be three completed years including the period of examination.

## **MIGRATION:**

No application for migration to other Medical Colleges will be entertained from the students already admitted to the MD/MS course at this Institute.

## **METHODS OF TRAINING FOR MD/MS:**

Method of training for MD/MS courses shall be as laid down by the National Medical Council of India.

## **ONLINE COURSE IN RESEARCH METHODS**

- i. All postgraduate students shall complete an online course in Research Methods to be conducted by an Institute(s) that may be designated by the National Medical Council of India by way of public notice, including on its website and by Circular to all Medical Colleges. The students shall have to register on the portal of the designated institution or any other institute as indicated in the public notice.
- ii. The students have to complete the course by the end of their 2nd semester.
- iii. The online certificate generated on successful completion of the course and examination thereafter, will be taken as proof of completion of this course
- iv. The successful completion of the online research methods course with proof of its completion shall be essential before the candidate is allowed to appear for the final examination of the respective postgraduate course.
- v. This requirement will be applicable for all postgraduate students admitted from the academic year 2019-20 onwards

## **ATTENDANCE, PROGRESS AND CONDUCT:**

### **(1) Attendance:**

- (a) 80% attendance in each course is compulsory. Any one failing to achieve this, shall not be allowed to appear in the University examination.
- (b) A candidate pursuing MD/MS course shall reside in the campus and work in the respective department of the institution for the full period as a fulltime student. No candidate is permitted to run a clinic/work in clinic/laboratory/ nursing home while studying postgraduate course. No candidate shall join any other course of study or appear for any other examination conducted by this University or any other University in India or abroad during the period of registration. Each year shall be taken as a unit for the purpose of calculating attendance.
- (c) Every candidate shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, CCR, case presentation, clinics and lectures during each year as prescribed by the department and not absent himself / herself from work without valid reasons. Candidates should not be absent continuously as the course is a full time one.

**(2) Monitoring Progress of Studies- Work diary/Log Book:**

- (a) Every candidate shall maintain a work diary in which his/her participation in the entire training program conducted by the department such as reviews, seminars, etc. has to be chronologically entered.
- (b) The work scrutinized and certified by the Head of the Department and Head of the Institution is to be presented in the University practical/clinical examination.

**(3) Periodic tests:**

There shall be periodic tests as prescribed by the National Medical Council of India and/ or the Board of Management of the University, tests shall include written papers, practical/clinical and viva voice.

**(4) Records:**

Records and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University when called for.

**THESIS:**

- (1) Every candidate pursuing MD/MS degree course is required to carry out work on research project under the guidance of a recognized post graduate teacher. Then such a work shall be submitted in the form of a Thesis.
- (2) The Thesis is aimed to train a postgraduate student in research methods & techniques.
- (3) It includes identification of a problem, formulation of a hypothesis, designing of a study, getting acquainted with recent advances, review of literature, collection of data, critical analysis, comparison of results and drawing conclusions.
- (4) Every candidate shall submit to the Registrar of the University in the prescribed format a Plan of Thesis containing particulars of proposed Thesis work within six months of the date of commencement of the course on or before the dates notified by the University.
- (5) The Plan of Thesis shall be sent through proper channel.
- (6) Thesis topic and plan shall be approved by the Institutional Ethics Committee before sending the same to the University for registration.

- (7) Synopsis will be reviewed and the Thesis topic will be registered by the University.
- (8) No change in the thesis topic or guide shall be made without prior notice and permission from the University.
- (9) The Guide, Head of the Department and Head of the institution shall certify the thesis. Three printed copies and one soft copy of the thesis thus prepared shall be submitted by the candidate to the Principal. While retaining the soft copy in his office, the Principal shall send the three printed copies of the thesis to the Registrar six months before MD/MS University Examinations. Examiners appointed by the University shall evaluate the thesis. Approval of Thesis at least by two examiners is an essential pre-condition for a candidate to appear in the University Examination.
- (10) Guide: The academic qualification and teaching experience required for recognition by this University as a guide for thesis work is as laid down by National Medical Council of India/Mahatma Gandhi University of Medical Sciences & Technology, Jaipur.
- (11) Co-guide: A co-guide may be included provided the work requires substantial contribution from a sister department or from another institution recognized for teaching/training by Mahatma Gandhi University of Medical Sciences & Technology, Jaipur/Medical Council of India. The co-guide shall be a recognized postgraduate teacher.
- (12) Change of guide: In the event of a registered guide leaving the college for any reason or in the event of death of guide, guide may be changed with prior permission from the University.

#### **ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION:**

The following requirements shall be fulfilled by every candidate to become eligible to appear for the final examination:

- (1) Attendance: Every candidate shall have fulfilled the requirement of 80% attendance prescribed by the University during each academic year of the postgraduate course. (as per NMC rules)
- (2) Progress and Conduct: Every candidate shall have participated in seminars, journal review meetings, symposia, conferences, case presentations, clinics and didactic lectures during each year as designed by the department.
- (3) Work diary and Logbook: Every candidate shall maintain a work diary for recording his/her participation in the training program conducted in the department. The work diary and logbook shall be verified and certified by the Department Head and Head of the Institution.
- (4) Every student would be required to present one poster presentation, to read one paper at a National/State Conference and to have one research paper which should be published/accepted for publication/ sent for publication to an indexed journal during the period of his/her post graduate studies so as to make him/her eligible to appear at the Post Graduate Degree Examination.
- (5) Every student would be required to appear in and qualify the Pre-University Post graduate degree Mock examination. Post graduate students who fail to appear in or do not qualify

the Pre-University Post graduate degree Mock examination shall not be permitted to appear in the final examination of the University.

The certification of satisfactory progress by the Head of the Department/ Institution shall be based on (1), (2), (3), (4) and (5) criteria mentioned above.

**ASSESSMENT:**

- (1) The progress of work of the candidates shall be assessed periodically by the respective guides and report submitted to the Head of the Institution through the Head of the Department at the end of every six months. The assessment report may also be conveyed in writing to the candidate who may also be advised of his/her shortcomings, if any.
- (2) In case the report indicate that a candidate is incapable of continuing to do the work of the desired standard and complete it within the prescribed period, the Head of the Institution may recommend cancellation of his/her registration at any time to the University.
- (3) Formative Assessment:
  - (a) General Principles
    - i. The assessment is valid, objective, constructive and reliable.
    - ii. It covers cognitive, psychomotor and affective domains.
    - iii. Formative, continuing and summative (final) assessment is also conducted.
    - iv. Thesis is also assessed separately.
  - (b) Internal Assessment
    - i. The internal assessment is continuous as well as periodical. The former is based on the feedback from the senior residents and the consultants concerned. Assessment is held periodically.
    - ii. Internal assessment will not count towards pass/fail at the end of the program, but will provide feedback to the candidate.
    - iii. The performance of the Postgraduate student during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student.
    - iv. Marks should be allotted out of 100 as under
      - 1) Personal Attributes - 20 marks
        - a. Behavior and Emotional Stability: Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
        - b. Motivation and Initiative: Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
        - c. Honesty and Integrity: Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
      - 2) Clinical Work - 20 marks
        - a. Availability: Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.



- b. Diligence: Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.
  - c. Academic Ability: Intelligent, shows sound knowledge and skills, participates adequately in academic activities and performs well in oral presentation and departmental tests.
  - d. Clinical Performance: Proficient in clinical presentations and case discussions. Preparing documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.
- 3) Academic Activities - 20 marks
- a. Performance during presentation at Journal club/ Seminar/Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.
- 4) End of term theory examination - 20 marks
- a. End of term theory examination conducted at end of 1st, 2nd year and after 2 years 9 months.
- 5) End of term practical examination - 20 marks
- a. End of term practical/oral examinations after 2 years 9 months.
  - b. Marks for personal attributes and clinical work should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.
  - c. Marks for academic activity should be given by the all consultants who have attended the session presented by the resident.
  - d. The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.
  - e. Yearly (end of 1st, 2nd & 3rd year) theory and practical examination will be conducted by internal examiners and each candidate will enter details of theory paper, cases allotted (2 long & 2 short) and viva.
  - f. Log book to be brought at the time of final practical examination.

**APPOINTMENT OF EXAMINERS:**

Appointment of paper setters, thesis evaluators, answer books evaluators and practical & viva voce examiners shall be made as per regulations of the National Medical Council of India.

**SCHEME OF EXAMINATION:**

Scheme of examination in respect of all the subjects of MD/MS shall be as under :

- (1) The examination for MD/MS shall be held at the end of three Academic Years.

- (2) Examinations shall be organized on the basis of marking system.
- (3) The period of training for obtaining MD/MS degrees shall be three completed years including the period of examination.
- (4) The University shall conduct not more than two examinations in a year for any subject with an interval of not less than 4 months and not more than 6 months between the two examinations.
- (5) The examinations shall consist of:

(a) Thesis :

- i. Thesis shall be submitted at least six months before the main Theory examinations.
- ii. The thesis shall be examined by a minimum of three examiners – one Internal and two External examiners who shall not be the examiners for Theory and Clinical/Practical.
- iii. In departments where besides the two earmarked practical/clinical examiners no one else is a qualified P.G. teacher, in that case the Thesis shall be sent to the third external examiner who shall actually be in place of the internal examiner.
- iv. Only on the acceptance of the thesis by any two examiners, the candidate shall be eligible to appear for the final examination.
- v. A candidate whose thesis has been once approved by the examiners will not be required to submit the Thesis afresh, even if he/she fails in theory and/or practical of the examination of the same branch.
- vi. In case the Thesis submitted by a candidate is rejected, he/she should be required to submit a fresh Thesis.

(b) Theory papers:

- i. There shall be four theory papers as below:
  - Paper I: Basic Applied Aspects related to Transfusion Medicine (Hematology and Immunology).
  - Paper II: Immunohematology; Immunogenetics and applied Serology (Including Molecular biology and HLA).
  - Paper III: Blood Donor Organization, Technology of components, Clinical Hemotherapy.
  - Paper IV: Recent Advances & Technology.
- ii. Each theory paper examination shall be of three hours duration.
- iii. Each theory paper shall carry maximum 100 marks.
- iv. The question papers shall be set by the External Examiners.
- v. There will be a set pattern of question papers.
  - Each question paper will have following pattern
    - Ten short answer questions (10 each) of which four questions will be Problem Based Analysis /Interpretation.
- vi. The answer books of theory paper examination shall be evaluated by two External and two internal examiners. Out of the four paper setters, the two paper setters will be given answer books pertaining to their papers and the answer books of the remaining two papers will be evaluated by two Internal Examiners. It will be

decided by the President as to which paper is to be assigned to which Internal Examiner for evaluation.

- vii. A candidate will be required to pass theory and practical examinations separately in terms of the governing provisions pertaining to the scheme of examination in the post graduate regulations. The examinee should obtain minimum 40% marks in each theory paper and not less than 50% marks cumulatively in all the four papers for degree examination to be cleared as “passed” at the said Degree examination.

(c) Clinical/ Practical & Oral examinations:

- i. Clinical/Practical and Oral Examination of 400 marks will be conducted by at least four examiners, out of which two (50%) shall be External Examiners.
- ii. A candidate will be required to secure at least 50% (viz. 200/400) marks in the Practical including clinical and viva voce examinations.

- (6) If a candidate fails in one or more theory paper(s) or practical, he/she shall have to reappear in the whole examination i.e. in all theory papers as well as practical.

**GRACE MARKS**

No grace marks will be provided in MD/MS examinations.

**REVALUATION / SCRUTINY:**

No Revaluation shall be permitted in the MD/MS examinations. However, the student can apply for scrutiny of the answer books as per University Rules.

**GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING  
PROGRAMME FOR MD IN IMMUNOHAEMATOLOGY AND BLOOD  
TRANSFUSION (MD19)**

**Preamble:**

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

Transfusion medicine is a unique multi-dimensional speciality that incorporates elements of Blood Centre , immunohematology, coagulation, and haematology and integrates science technology, medicine, public health administration and the community as a whole. Because transfusion therapy has strong interrelationship with several other disciplines, particularly haematology and immunology, training programmes in transfusion medicine must include appropriate knowledge and skills in these subjects. Transfusion medicine specialists must (a) monitor transfusion practices of fellow clinicians and advise them on the management of patients needing sophisticated transfusion services, (b) be well versed with Regulatory requirements, (c) be competent to establish transfusion services commensurate with international standards, (d) be equipped to manage an adequate and safe blood supply and (e) interact closely with clinicians in the hospital to ensure optimal and appropriate use of blood and blood components as well as availability of transfusion alternatives.

The goal of these Guidelines is to enable the post graduate student to acquire the skills and knowledge to be a competent transfusion medicine specialist. This document will provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

***SUBJECT SPECIFIC OBJECTIVES***

On completion of the MD programme, the post graduate student would have achieved the following objectives and be able to:

1. Organize Blood Centre activities including blood donations, component separation and storage, appropriate use of blood and blood components.
2. Understand the importance of blood and blood components as a precious , life saving resource and be competent in the judicious use of this resource.

3. Understand the need for transfusion safety and its importance in all aspects of medical Care.
4. Act as the medical expert in providing advice and clinical decision making with regard to the need for blood transfusion and work with clinical colleagues in formulating evidence based guidelines.
5. Function as a member of the health care team and coordinate with the team in critical situations, like working with surgeons and colleagues in anaesthesia to ensure that optimal care is given to all patients, especially with the support of blood and its products in resuscitation and haemostasis.
6. Understand the national and public health importance of safe blood components including a sound knowledge in the area of transfusion transmitted Diseases (TTDs) and their testing methods.
7. Acquire up to date knowledge of immunohematology and its application to ensure safe transfusion practices.
8. Acquire knowledge in laboratory haematology, automation and quality control and be able to interpret haematological tests in the clinical context and provide consultative services to clinicians for effective patient care.
9. Able to offer expert advice in histocompatibility and immunogenetics for stem cell and organ transplantation and to provide laboratory support to transplant team.
10. Incorporate comprehensive and evidence-based medicine into all areas of its discipline.
11. Apply knowledge of molecular biology in transfusion medicine.
12. Apply knowledge of transfusion haematology to patient management.
13. Contribute to the education of students, physicians, other health care professionals, and patients and their families.
14. Communicate effectively with public and media in matters relating to national blood supply.
15. Effectively use information technology for the smooth functioning of blood centres.
16. Undertake accurate self-appraisal, develop a personal continuing education strategy and pursue lifelong mastery of transfusion haematology.

17. Learn the diagnostic techniques required in the practice of haematology.
18. Appreciate the value of research, audit and team working, which underpin haematology and transfusion practice.
19. Understand the need for research and development in transfusion alternatives, molecular immunology and cellular therapy.

During the course of the transfusion medicine training programme, the post graduate student must undergo a broad range of practical, clinical, laboratory and management experiences including on call for transfusion medicine and haematology consults. The training, especially in the laboratory will also be “hands on” bench work. She/he will attend a programme of formal education activities and have exposure to and involvement with current research activities.

### ***SUBJECT SPECIFIC COMPETENCIES***

**The functioning of an Immuno hematologist is based on ten core principles as listed below:**

1. Person centred care
2. Blood Safety
3. Comprehensive care in collaboration with Clinicians
5. Laboratory Care
6. Safe Transfusion Practices and disease prevention
7. Collaborative, coordinated team-based care
8. Resource management and use of ICT
9. Research aptitude in Immuno hematology and Immunogenetics
10. Lifelong self-learning

**By the completion of the course, the student must demonstrate the ability to:**

1. Identify the need for appropriate blood and blood components for transfusion.
2. Perform all necessary laboratory investigations to ensure safety of blood products and absence of Transfusion Transmissible Diseases, before blood and its components are used.
3. Diagnose a case of mismatched blood transfusion.
4. Manage a case of mismatched blood transfusion.
5. Identify the need for Immunogenetics and its applications in Transfusion Medicine.
6. Conduct Blood Donation Camps.
7. Demonstrate Professionalism by maintaining patient autonomy and Confidentiality.
8. Demonstrate knowledge and skills required to carry out research.
9. Investigate for Haematological conditions like Anaemia, Haemophilia , ITP etc.
10. Demonstrate knowledge and skills for Quality control and assurance of Blood centres quality as per the Standard guidelines.

11. Communicate effectively with the public and media in matters relating to national blood supply and to create awareness about blood donation & blood safety.
12. Use information technology for the smooth functioning of blood centres.
13. Undertake accurate self-appraisal, develop a personal continuing education strategy and pursue lifelong mastery of transfusion haematology.
14. Function efficiently as a member of a Health care team to support Clinical Transfusion services.

**By achieving the above competencies, the training must enable him/her to play the following major roles:**

1. Clinician
2. Communicator
3. Leader & member of a team
4. Professional and
5. Lifelong learner

### ***SPECIFIC LEARNING OBJECTIVES***

**At the end of the course, the student should have acquired knowledge in the following:**

#### **A. Cognitive Domain**

##### **I. Basic Sciences (Immunology, Medical Genetics, Haemostasis & Physiology of Formed Elements of blood)**

- Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof. The student should be able to demonstrate understanding of the basic principles of immunoglobulins, antigen, antibody and complement system, antibody development after immunization and infection.
- Understand the basic concepts and their clinical relevance of the following:
  - Mechanisms of acute inflammation
  - Healing and repair
  - Physiology of Immune System
  - Hypersensitivity reactions
  - Autoimmunity
  - Transplantation Immunology
- Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of important procedures employed in clinical and experimental studies relating to immunology – this is inclusive of but not limited to:
  - ELISA techniques
  - Radioimmunoassay
  - HLA typing
  - Hybridoma technology

- Isolation of T & B lymphocytes
  - CD4 / CD8 count
  - Micro lymphocytotoxicity test
  - Cellular assays
  - Electrophoresis and Immunofluorescence
- Understand the principles of basic genetics with regard to Mendelian Laws of Inheritance, phenotype / genotype and population genetics.
  - Know the nomenclature, organization and polymorphism of the human major histocompatibility complex, including HLA class I, II, and III genes. Understand the role of HLA typing in organ and bone marrow/stem cell transplantation and association with disease.
  - Understand the basic concept of haematopoiesis and bone marrow kinetics.
  - Understand the basic physiology and biochemistry of red cells, platelets and leukocytes in terms of their kinetics, function, life span and antigenic systems. Know the membrane structure and function of red cells, platelets and leukocytes and be able to apply their implication in transfusion medicine.
  - Understand haemoglobin structure, synthesis, function, its aberrations and degradation including iron and bilirubin metabolism, laboratory diagnosis anemia and management.
  - Learn the disorders of white blood cells, their laboratory diagnosis and management and the role of transfusion medicine in the management of these disorders.
  - Understand the composition and function of plasma constituents.
  - Know the pathophysiology and laboratory features of intravascular and extravascular haemolysis.
  - Understand the physiology of haemostasis with regard to role of platelets, coagulation pathway and fibrinolysis, its aberrations and mechanisms thereof such as coagulopathy of liver disease, vitamin K deficiency, disseminated intravascular coagulation & haemophilia (A, B, and C) etc.
  - Understand haemodynamic of blood flow and shock; estimation of blood volume and be able to interpret the application of radionuclides tagging for blood volume estimation.
  - Should understand the principles of Molecular Biology especially related to the understanding of disease processes and its use in various diagnostic tests.

## **II. Blood Collection/Blood Centre/Component Processing**

The student should be able to demonstrate understanding of the processes associated with Blood Donor motivation (motivation strategies), recruitment, selection and proper donor care in blood centre as well as in outdoor blood donation camps and be able to understand importance of cold chain maintenance. The student should:

- Be able to understand donor counselling and notification (Pre- and Post-donation).



- Be familiar with various categories of blood donors including autologous and directed donors and be able to know their clinical relevance.
- Understand the process of apheresis and demonstrate proficiency in selection of apheresis machine, apheresis donor and be able to obtain apheresis product meeting quality standards.
- Understand the mechanisms of adverse effects of blood / apheresis donation, its clinical features, management and prevention.
- Demonstrate understanding of various anticoagulants / preservatives used for collection and storage of blood and components.
- Be familiar with various “storage lesions” in blood components, factors affecting the storage lesions and its prevention.
- Be able to demonstrate understanding of various plasticizers used in blood centres and their clinical relevance.
- Understand the principles of component preparation by various methods, be familiar with preparation of modified components such as leukofiltered , irradiated or saline washed, pooled or volume reduced components following aseptic conditions.
- Be able to demonstrate understanding of the basic principles of preparation and composition of recombinant products such as Factor VII, Factor VIII , Factor IX , concentrate and hematopoietic growth factors.
- Understand the factors influencing quality of blood and blood components including quality of blood bag / apheresis.
- Be able to understand maintenance of quality of blood components as per recommended standards by various agencies (DGHS, DCGI, NABH, NACO, AABB, EC).
- Be able to identify problems in the blood/apheresis collection and component preparation area and offer viable solutions.

### **III. Transfusion transmitted infection**

- Be able to understand various strategies for improving blood safety in general and TTI testing in particular pertaining to Indian conditions.
- Be able to understand the typical time course of appearance and disappearance of serum antigens and antibodies used in screening of major transfusion transmitted infections including HIV, hepatitis B, hepatitis C, syphilis and malaria and others.
- Be able to demonstrate understanding the principles of blood safety including testing for various transfusion transmitted infection (TTI), proper disposal of infectious waste, laboratory safety, personnel safety.
- Demonstrate understanding of newer technologies that are being introduced in the field of TTI testing. Understand the feasibility of NAT (Nucleic acid testing) in Indian blood transfusion services.
- Demonstrate understanding of the new emerging threats (including Prions, v CJD, Lyme Disease, West Nile Virus, Dengue, Chikungunya etc.) to blood supply in the country including bacterial contamination, their detection and prevention.

#### **IV. Immunohematology / Blood Group Serology / Compatibility testing**

- Demonstrate understanding of the knowledge of various major and minor blood group systems including their biosynthesis, antigen/antibodies, phenotype/genotype frequency, clinical significance.
- Demonstrate understanding of the various Immunohematological laboratory tests including its quality essentials.
- Demonstrate knowledge of principle of pretransfusion testing, including ABO/Rh testing, RBC antibody screen, and antibody identification. The student should also demonstrate understanding of resolution of discrepant results in ABO/Rh grouping and pretransfusion testing and be able to provide solutions for the management of such cases.
- Demonstrate understanding of use of various potentiators and their applications in solving immunohematological problems such as polyagglutination, subgroups of ABO system, red cell antibody detection
  - Enzymes
  - Lectins
  - LISS / Albumin
  - Others
- The student should have knowledge of various advances in this field including automation and computerization.
- Be able to understand the pathophysiology, clinical features, lab diagnosis & management of various clinical conditions requiring immuno hematological and transfusion support including
  - Multi-transfused patients such as thalassemia, sickle cell disease etc
  - Allo immunized antenatal cases (HDN)
  - Transfusion reactions
  - Immune hemolytic anemia
  - ABO mismatched transplants (BMT / Solid organ)
- Be able to understand the pathophysiology, clinical features, lab diagnosis & management of Rh, ABO and other blood group incompatibility in antenatal patients including exchange transfusion / intra-uterine transfusion.
- Demonstrate knowledge regarding “rare blood group donor” including identification, cryo-preservation of rare blood and making their registry.

#### **V. Clinical Transfusion Service**

Demonstrate knowledge of the principles of patient/ unit identification and its importance in blood safety.

- Understand the principles of blood inventory management.
- Demonstrate understanding of the rational use of blood and components in various clinical conditions including monitoring of transfused patients.
- Recognize the symptoms and signs of hemolytic and non-hemolytic transfusion reactions and demonstrate knowledge of the pathophysiology, treatment, and prevention of these complications.

- Demonstrate understanding of the major non-infectious complications of blood transfusions, including red cell alloimmunization, transfusion-related acute lung injury, transfusion associated graft versus host disease, volume overload, post transfusion purpura, iron overload etc. and the risk of these complications, and strategies to prevent them. Student should have knowledge of pathophysiology, clinical features, diagnosis and management of these conditions.
- Demonstrate knowledge of pathophysiology, diagnosis & management of anemia
  - Iron deficiency anemia
  - Megaloblastic anemia
  - Aplastic anemia
  - Anemia of chronic diseases
  - Neonatal anemia
- Demonstrate understanding of pathophysiology, clinical / laboratory diagnosis and treatment of patients with bleeding disorders such as Hemophilia, von Willebrand's disease, thrombophilia, acquired coagulation disorders including DIC, liver disease etc.
- Demonstrate understanding of the pathophysiology, clinical features, lab diagnosis and platelet support in thrombocytopenic conditions such as aplastic anemia, ITP, NAIT, hematological malignancies etc. The student should also demonstrate understanding of complications of platelet transfusion including refractoriness to platelets, its diagnosis and management.
- Demonstrate understanding of the basic principles of neonatal transfusions including serological testing, type of transfusion support, exchange transfusion, intra uterine transfusion and monitoring.
- Demonstrate knowledge of the pathophysiology, diagnosis and transfusion support in acute blood loss including massive transfusion protocols, complications of massive transfusion and their prevention.
- Demonstrate understanding of the knowledge of various methods of blood conservation, including pre- and peri-operative autologous blood collection, and approaches to "bloodless" surgery.
- Demonstrate knowledge of the use of various point-of-care tests (TEG, ROTEM) for hemostasis & recommend component therapy depending on the results.
- Demonstrate knowledge of principles of transfusion support in general surgery and special procedures such as cardiac surgery or oncological surgery.
- Demonstrate knowledge of the principles of hematopoietic stem cell transplantation, including collection, processing, and storage of these stem cell products, and the indications for use (e.g., bone marrow, peripheral blood, and cord blood).
- Demonstrate understanding of guidelines for stem cell research by regulatory agencies like ICMR, DBT etc.

## **VI. Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis**

- Understand the principles of apheresis technology, including centrifugation, filtration, and immunoadsorption.

- Demonstrate knowledge of the indications for therapeutic apheresis including cytappheresis and of the appropriate replacement fluids to be used in various situations.

## **VII. Regulatory Skills / Quality Assurance/ Quality Control in blood transfusion**

- Demonstrate knowledge concerning the requirements and applications of all applicable regulatory and accrediting agencies. [e.g., DCGI, NABH, AABB].
- Become familiar with the patient / blood donor privacy and data security requirements, including the use of Institutional Review Board (IRB) protocols for conducting clinical research, for conducting stem cell research- ICSCRT (Institutional Committee for Stem Cell Research and Treatment).
- Understand training, certification, licensing, and competency assessment standards for transfusion laboratory professionals, including medical laboratory technicians.
- Understand the importance of a comprehensive transfusion laboratory safety policy and programme.
- Understand how SOPs are used, developed, authored, and reviewed and their importance in mandatory laboratory inspection by various accrediting agencies.
- Understand development of quality manual.
- Understand the role of quality assurance, quality management, and process improvement principles in laboratory operation and planning.
- Understand the role of risk management in the transfusion laboratory and become familiar with the nature of, patient safety initiatives, and forensic testing such as paternity testing.
- Demonstrate understanding of the elements of current good manufacturing practices as they apply to the collection, processing, and storage of all blood components / products.
- Understand the principles & objectives of total quality management in transfusion service including premises, personnel, instruments / reagents, biosafety and external / internal quality control.
- Operational aspects: Understand the importance of EQAS in blood transfusion services.
- Understand the principles and objectives of equipment management including specification, equipment selection, installation, calibration/standardization / validation, and preventive maintenance.
- Know the fundamental concepts of medical statistics. Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies e.g., correlation coefficients, expected versus observed, etc. and their interpretation.
- Understand principles of specimen collection (e.g., phlebotomy technique, safety, and specimen tubes) and specimen processing and traceability.
- Demonstrate understanding of knowledge of error management in blood centres including root cause analysis and CAPA.
- Demonstrate knowledge of various records and their maintenance as per regulatory requirements.

## **B. Affective Domain**

### **I. Basic Sciences (Immunology, Medical Genetics, Hemostasis & Physiology of Formed Elements of blood)**

#### **The student should:**

- Demonstrate honesty and integrity in all interactions.
- Demonstrate responsibility and trustworthiness in the execution of all duties.
  
- Demonstrate the ability to accept criticism and to understand the limitations of one's own knowledge and skills.
- Demonstrate a commitment to excellence and ongoing professional development.
- The student should demonstrate professionalism in taking a bleeding history from a patient.

### **II. Blood Collection/Blood Centre/Component Processing**

#### **The student should:**

- Be able to function as a part of a team that is essential for the selection and management of a blood donor. She / He should therefore develop an attitude of cooperation with colleagues so necessary for this purpose. It is implied that she/he will, whenever necessary, interact with the blood donor, patient, clinician and other colleagues to provide the best possible blood transfusion support, diagnosis or opinion.
- Demonstrate compassion and sensitivity in the care of patients and respect for their privacy and dignity.
- Show respect for donor / patient autonomy.
- Demonstrate professionalism during blood donor selection, counselling and notification. Always adopt ethical principles and maintain proper etiquette in her/his dealings with blood donors, outdoor camp organizers and other health personnel.
- Be able to obtain informed consent from donor.
- Respect the rights of the blood donor including the right to information and maintaining confidentiality.
- Develop communication skills not only to word reports and professional opinions but also to interact with blood donors, outdoor camp organizers, peers and paramedical staff.
- Always adopt principles of laboratory / personnel safety and respect documentation required as per law.

### **III. Transfusion transmitted infection**

#### **The student should:**

- Respect the rights of the seropositive blood donor including confidentiality, right to information.
- Adopt ethical principles and maintain proper documentation while interacting with other inter related labs such as ICTCs, counselor, state AIDS Control Societies etc.

- Follow all safety policies and adhere to the department's laboratory safety plan and personal hygiene plan.

#### **IV. Immunohematology / Blood Group Serology / Compatibility testing**

##### **The student should:**

- Should be able to interact with clinical colleagues in professional manner to provide best possible transfusion support and opinion in immunohematological problems.
- Demonstrate improvement in the affective traits of organizational skills, work habits, attitude, interpersonal skills, and problem-solving ability.
- The student should maintain a clean and orderly work area.

#### **V. Clinical Transfusion Service**

##### **The student should:**

- Be able to function as a part of a team that is essential for the diagnosis and management of a patient. She/he should therefore develop an attitude of cooperation with colleagues so necessary for this purpose.
- Be able to interact with clinical colleagues in professional manner to provide best possible transfusion support and opinion.
- Demonstrate improvement in the affective traits of organizational skills, work habits, attitude, interpersonal skills, and problem-solving ability.
- Maintain a clean and orderly work area.
- Accept constructive criticism as a learning process. Utilize constructive criticism to correct deficiencies and improve performance.
- The student should demonstrate inquisitiveness by asking necessary questions concerning practical performance or theoretical application of laboratory procedures.

#### **VI. Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis**

- **The student should** communicate effectively with clinicians and patients regarding emergent or scheduled therapeutic apheresis procedures through conversations and writing of consult notes.

#### **C. Psychomotor Domain**

##### **At the end of the course, the student should acquire the following skills:**

- Demonstrate competency in performing & interpretation of various methods of hemoglobin estimation and complete hemogram.
- The student should be able to demonstrate competency in preparation and interpretation of peripheral blood smear in health and disease conditions – inclusive of but not limited to:
  - Nutritional (Iron deficiency/Vit B12 and Folic acid deficiency) anemia
  - Hemolytic anemia (Immune , Sickle Cell, Thalassemia, Microangiopathic)
  - Thrombocytopenia
  - Acute leukemia
  - Chronic leukemia

- Hemoparasites
- Myelodysplastic syndromes
- Myeloproliferative disorders
- Demonstrate competency in performing and interpretation of laboratory tests in coagulation and thrombosis such as prothrombin time, activated partial thromboplastin time (APTT), fibrinogen, thrombin time, platelet function testing, mixing tests, factor assays, investigations in DIC etc.
- Demonstrate competency in interpretation of Hb electrophoresis/HPLC
- Demonstrate proficiency in performing and interpreting various laboratory immunological tests pertaining to transfusion science such as
  - Isolation of T & B lymphocytes
  - Immuno electrophoresis
  - Flow cytometry
  - CD4 / CD8 counts
- Demonstrate proficiency in HLA typing techniques, including serological methods, micro-cytotoxicity assays, nucleic acid assays and lymphocyte culture.
- Should be conversant with the steps of a Polymerase Chain Reaction (PCR) and should demonstrate competence in the steps and interpretation of Western Blot and Hybridization procedures.

### **Blood Collection/Blood Centre/Component Processing**

#### **The student should:**

- Be able to compare and contrast the eligibility requirements for allogeneic, autologous & apheresis blood donations.
- Demonstrate proficiency in selection of whole blood donors (minimum 500) and apheresis donors (minimum 25).
- Demonstrate competency in various types of autologous blood collection and their application in clinical transfusion services.
- Demonstrate proficiency in collection of whole blood with regard to preparation of phlebotomy site, proper volume and sample collection in minimum 500 donors.
- Demonstrate proficiency in evaluating and managing minimum 25 adverse reactions associated with blood donation/phlebotomy (whole blood and apheresis donations).
- Demonstrate the proficiency in organization of at least 10 outdoor blood donation camps and demonstrate skills to motivate blood donors / organizers.
- Demonstrate knowledge of the indications for therapeutic phlebotomy and demonstrate proficiency in at least 05 cases.
- Demonstrate proficiency in preparation of following components 500 each as per department SOP
  - Packed red blood cells
  - Fresh Frozen Plasma
  - Platelet Concentrate
  - Cryoprecipitate (Minimum 25)

- Understand the significance of storage of blood components at appropriate temperature and demonstrate proficiency in compatibility, labelling requirements of various components.
- Proficient in donor notification and counselling (Pre- and Post- donation) and the donor look-back process.
- Demonstrate proficiency in various modifications of blood components such as irradiation, cell washing, volume depletion and leukodepletion
- Demonstrate proficiency in performing leuko-filtration in at least 05 blood components.
- Demonstrate proficiency in selection of apheresis machine, blood donor and be able to obtain apheresis product meeting quality standards in at least 25 procedures.
- Demonstrate proficiency in performing quality control tests on at least 25 each blood components such as PRBC, FFP, Platelets, Cryoprecipitate.

### **Transfusion transmitted infection**

#### **The student should be able to:**

- Compare & contrast various methodologies such as ELISA, rapid & chemiluminescence used in screening of transfusion transmitted infections.
- Demonstrate proficiency in performing, interpretation, documentation of at least 500 blood donor screening tests for TTIs as per departmental SOP.
- Demonstrate proficiency in preparation and interpretation of LJ Chart (5 nos.) and root cause analysis (RCA) and Corrective and Preventive action (CAPA) as and when required.
- Perform and be able to interpret non-treponemal and treponemal antibody tests used to diagnose syphilis.
- Demonstrate proficiency in proper handling and disposal of biohazardous material as per regulatory requirements.
- Demonstrate proficiency in the preparation and use of in-house external controls in transfusion transmitted infection screening.
- Demonstrate proficiency in Gram staining in at least 10 samples of biological fluids.

### **Immunohematology / Blood Group Serology / Compatibility testing**

#### **The student should be able to:**

- Demonstrate proficiency in preparation of cell suspensions of appropriate concentration following cell washing techniques correctly & grade and interpret antibody-antigen reactions according to the established criteria.
- Demonstrate proficiency in performing ABO/Rh grouping in at least 500 donor / patient samples using department SOP.
- Demonstrate proficiency in performing, interpretation and resolving discrepant results in pre-transfusion testing, ABO/Rh grouping, red cell antibody screen, and antibody identification.



- Compare and contrast conventional cross matching versus type and screen using various advanced technologies. Demonstrate proficiency in performing at least 50 cross matches as per department SOP.
- Student should be able to differentiate between the direct and indirect antiglobulin tests and identify appropriate uses for each. The student should be able to perform direct and indirect antiglobulin test on appropriate specimens, grading and recording the results appropriately with the use of "check cells".
- Student should be able to identify sources of error in antiglobulin testing.
- Using a cell panel, perform antibody identification procedures and correctly interpret the results. Identify clinically significant RBC antibodies from an antibody panel including multiple alloantibodies and mixtures of alloantibodies and autoantibodies; determine how difficult it will be to obtain blood for this patient, and effectively communicate these results to clinicians.
- Demonstrate proficiency in performing & interpretation of various immunohematological tests
  - Direct Antiglobulin test (50 tests)
  - Indirect Antiglobulin test (50 tests)
  - Red cell antibody detection and identification (25 tests)
  - Titration of Anti D and Anti A and Anti B (25 tests)
  - Elution (10 tests)
  - Adsorption
  - Minor blood group typing
  - Saliva Inhibition Test
  - Resolution of ABO discrepancy
- Demonstrate proficiency in selection of blood unit for a patient with auto immune haemolytic anemia in at least 5 cases.
- Demonstrate proficiency in cryopreservation of reagent red cells in minimum 5 cases.

### **Clinical Transfusion Service**

#### **The student should be able to:**

- Demonstrate proficiency in evaluating and recommending treatment plans for minimum of 10 transfusion reactions.
- Be able to identify irregular antibodies in pregnant patients that are clinically significant and make appropriate recommendations for blood products. Demonstrate proficiency in preparation and transfusion of blood for intrauterine transfusion / exchange transfusion.
- Choose appropriate blood components and derivatives based on a thorough knowledge of the indications for transfusion.
- Demonstrate proficiency in the evaluation and appropriate transfusion therapy of thrombocytopenic patients (both adult and pediatric) including neonatal alloimmune thrombocytopenia.

- Demonstrate proficiency in provision of transfusion support in special patient populations (e.g., hematology / oncology, paediatrics , thalassemia, haemophilia , transplantation, cardiac surgery and burn/trauma).
- Demonstrate proficiency in the appropriate use of blood components in several clinical conditions such as (inclusive of but not limited to) hemoglobinopathies, haemophilia , autoimmune hemolytic anemia, massive transfusion, obstetric conditions etc.
- Demonstrate familiarity with the appropriate use of highly specialized blood products (e.g., granulocytes, donor lymphocyte infusions, HLA-matched platelets, and coagulation factor concentrates).
- Demonstrate competence in the management of blood inventory and the ability to communicate effectively the hospital's needs to the blood donor recruiters, Triage and screen requests for blood components appropriately during inventory shortages.
- Demonstrate proficiency in evaluating effectiveness of platelet transfusion including patient's with refractoriness to platelet transfusions. Outline the principles of histocompatibility testing and platelet cross-matching and apply this knowledge in selecting appropriate platelet products when indicated.
- Demonstrate competency in providing transfusion and immunohematological support to patients with bone marrow / stem cell transplantation including cryo-preservation of stem cell, quality control and infusion.

### **Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis**

#### **The student should be able to:**

- Demonstrate proficiency in evaluating and preparing patients for therapeutic apheresis, including discussion with the patient of the risks and benefits associated with apheresis procedures and obtaining informed consent.
- Should be able to perform plasma exchange including calculation & type of replacement fluid to be used and monitoring patient for complications and efficacy of the procedure.
- Demonstrate proficiency in evaluating and treating adverse reactions associated with therapeutic apheresis.
- Demonstrate proficiency in the treatment of patients using specialized methods (e.g., photopheresis and immunoadsorption columns).

### **Regulatory Skills / Quality Assurance/ Quality Control in blood transfusion**

#### **The student should be able to:**

- Demonstrate proficiency in preparing at least 05 SOP for the department.
- Be able to understand proper use of instrumentation and computerization in a transfusion laboratory.
- Compare and contrast the various means of performing blood utilization reviews.
- Explain the logistics required in determining appropriate blood inventory for a geographic region and the process of meeting daily, weekly and monthly collection goals.

- Recognize sources of pre-analytical variation and the role of biological variability in laboratory assessment.
- Be able to calculate means, standard deviation and standard error from the given experimental data.
- Demonstrate the proficiency in preparedness for getting accreditation.
- Ability to generate various reports required for the various regulatory authorities.
- Be able to perform root cause analysis in at least 5 cases.

### *Syllabus*

#### **Course contents:**

#### **I. HISTORY OF TRANSFUSION MEDICINE**

- I.1 Scientific landmarks in its development
- I.2 Impact of world wars on its development
- I.3 Development of PVC bags.

#### **II. SCIENTIFIC BASIS OF TRANSFUSION**

##### A. Biochemistry & physiology of elements of blood

- 2.0 Process of cell production and life span
- 2.1 red cells
- 2.2 white blood cells
- 2.3 platelets
- 3.0 Red cells
- 3.1 Hemoglobin structure & function
- 3.2 Metabolic pathways
- 3.3 Membrane structure & function
- 4.0 White cells
- 4.1 Structure, function & kinetics
- 5.0 Platelets
- 5.1 Structure, function & kinetics
- 6.0 Physiology of haemostasis
- 6.1 Role of platelets
- 6.2 Coagulation pathways
- 6.3 Fibrinolysis
- 7.0 Hemodynamics of blood flow & volume
- 8.0 Iron metabolism
- 9.0 Bilirubin metabolism

##### B. Immunology

- 10. Principles of basic immunology
- 10.1 Antigen, antibody, complement, immunoglobulin
- 10.2 Antigen antibody reaction

- 10.3 Lymphocytes in humoral & cellular immunity
- 11. Role of hybridoma technology in Immunohematology
- 12. Immunology of transplantation
- 13. HLA and genetic control of immune response

*C. Genetics*

- 14. Principles of basic genetics
- 15. Genetics of blood groups
  - 15.1 Phenotype & genotype
  - 15.2 Principles of blood group inheritance
  - 15.3 Population genetics of blood groups

**III. ANTIGEN SYSTEMS IN FORMED ELEMENTS OF**

- 16. Red cell antigens
- 17. Leucocyte antigens
- 18. Platelet antigens

**IV. BLOOD COLLECTION , PROCESSING , COMPONENTPREPARATION**

*A. Management of blood donation*

- 19. Donor recruitment
  - 19.1 Voluntary blood donation systems
  - 19.2 Categories of blood donors
  - 19.3 Education, awareness & information of prospective donor
  - 19.4 Use of Information Technology for donor recruitment
  - 19.5 Donor information programmes
  
- 20. Acceptability criteria of blood donor
- 21. Care of blood donor
  - 21.1 Pre-donation
  - 21.2 Mid-donation
  - 21.3 Post-donation
  - 21.4 Prevention & management of complications of blood donation
  
- 22. Blood collection
  - 22.1 Anticoagulants & preservatives
  - 22.2 Procedure
  - 22.3 Blood donation camps

*B. Blood components*

- 23. Components
  - 23.1 Types
  - 23.2 Methods of preparation
  - 23.3 Indications, dosage & administration

23.4 Leucodepletion

23.4.1 Various methods

23.4.2 Quality control

24. Storage of blood & components

24.1 Whole blood

24.2 Red cell concentrate

24.3 Plasma

24.4 Granulocyte

24.5 Cryoprecipitate

24.6 Stem cells

24.6.1 Peripheral blood stem cell

24.6.2 Cord blood

24.6.3 Dendritic cell

25. Plasma fractionation

25.1 Viral inactivation

25.1.1 Single donor

25.1.2 Pooling

25.2 Newer methods

## **V. PRE – TRANSFUSION TESTING**

26. Compatibility testing

26.1 ABO grouping & Rh typing

26.2 Antibody screening

26.3 Cross matching methods

26.4 Newer methods of cross matching

26.4.1 Solid phase

26.4.2 Gel technology

27. Screening for transfusion transmitted infections

27.1 Methodology

27.2 Nucleic acid amplification techniques

27.3 Newer emerging pathogens

27.3.1 Prions

27.3.2 CJ disease

27.3.3 Lyme disease

27.3.4 Others

28. Selection of blood, components & plasma products for transfusion

## **VI. ADVERSE EFFECTS OF BLOOD TRANSFUSION**

29. Clinical presentation, pathophysiology, investigations, management

29.1 Haemolytic transfusion reaction

29.2 Non- Haemolytic transfusion reaction

29.3 Allergic, anaphylactoid and anaphylactic reactions

29.4 Alloimmunization to various elements of blood

30. Transfusion transmitted infections

30.1 Bacterial

30.2 Viral

30.3 Parasitic

31. Transfusion associated graft versus host disease

32. Transfusion related acute lung injury

33. Others

33.1 Hemosiderosis

33.2 Volume overload

33.3 Post transfusion purpura

## **VII. APHERESIS**

34. Technology of apheresis, various equipment & disposables

35. Haemapheresis (platelets, granulocytes, plasma, stem cells)

35.1 Donor selection

35.2 Procedure

35.3 Complications

36. Therapeutic apheresis

36.1 Indication, procedure & complications

36.2 Plasma exchange, red cell exchange

36.3 Newer methods for immunoadsorption

## **VIII. Autologous transfusion**

37. Basic principles, indication & contra indications

37.1 Pre-deposit

37.2 Haemodilution

37.3 Intra operative blood salvage including equipment

37.4 Post-operative blood salvage

37.5 Directed donation

## **IX. ANTENATAL AND NEONATAL TRANSFUSION PRACTICE**

38. Pathophysiology, diagnosis & management

38.1 Rh incompatibility

38.2 ABO & other blood group incompatibility

39. Exchange transfusion

39.1 Indications, methodology & complications

40. Neonatal transfusion practice

40.1 Strategies to reduce donor exposure

40.2 Organised donor selection

40.3 Intra uterine transfusion

## **X. IMMUNOHAEMATOLOGY**

41. Classification, diagnosis & management

41.1 Immune hemolytic anemia

41.2 Immune thrombocytopenia

41.3 Immune neutropenia

42. Immunohaematological problems in multi transfused patients.

## **XI. HEMOTHERAPY**

43. Pathophysiology, diagnosis & management of anemia

43.1 Anemia

43.1.1 Iron deficiency anemia

43.1.2 Megaloblastic anemia

43.1.3 Aplastic anemia

43.1.4 Anemia of chronic diseases

43.1.5 Neonatal anemia

43.2 Hereditary anemia

43.2.1 Thalassemia

43.2.2 Sickle cell anemia

43.2.3 Enzymopathy

43.2.4 Others

44. Pathophysiology, diagnosis and management of hemostatic disorders

44.1 Hemophilia 44.2 Von Willebrand disease

44.3 Platelet disorders

44.3.1 Qualitative disorders

44.3.2 Quantitative disorders

44.4 DIC/TTP/HIT

44.5 Acquired disorders

44.5 Others

45. Pathophysiology, diagnosis and transfusion support in acute blood loss

45.1 Shock

45.2 Massive transfusion

46. Transfusion support in surgery

46.1 General surgery

46.2 Specialised surgery – Cardiopulmonary bypass/hemodialysis

47. Classification, diagnosis & transfusion support in oncology

47.1 Hemopoietic malignancy

47.2 Non-hemopoietic malignancy

## **XII. TRANSPLANTATION**

48. Transfusion support in transplantation

48.1 Stem cell transplantation

48.1.1 Harvesting

48.1.2 Cryopreservation

48.1.3 CD34 counting & quality control

48.1.4 Infusion

48.2 Bone marrow transplantation

48.2.1 Harvesting

48.2.2 Processing

48.2.3 Immunohaematological problems in ABO mismatched BMT

48.2.4 Transfusion support BMT patients

48.3 Transfusion support in specialized conditions

48.3.1 Renal transplantation

48.3.2 Liver transplantation

48.3.3 Others

49. Irradiation of blood products

49.1 Indications, dosage, adverse effects

50. Tissue centre

51. Cord blood centre

## **XIII. BLOOD SUBSTITUTES AND HEMOPOIETIC AGENTS**

52. Crystalloids & colloids

53. Oxygen carrying compounds

54. Use of hematinics

55. Hemopoietic growth factors

56. Plasma products

## **XIV. MEDICOLEGAL CONSIDERATIONS IN TRANSFUSION MEDICINE**

57. Ethical and legal considerations pertaining to transfusion practice

58. Identification of blood stains

59. Paternity testing

60. Donor notification & counselling

61. Look back programme

62. Drugs & Cosmetics Act, Accreditation

63. Consumer protection Act

64. Others



## **XV. TOTAL QUALITY MANAGEMENT**

65. Development of Standard Operating Procedures (SOP) manual.

66. Quality control

66.1 Reagents & diagnostic kits

66.2 Instruments

66.3 Personnel

66.4 Blood & components

67. Quality assurance

67.1 Internal quality control

67.2 External quality control

Proficiency testing

68. Hospital Transfusion Committee

69. Medical audit

70. Turnaround time

71. ISO certification/GMP

## **XVI. ORGANIZATION & MANAGEMENT OF TRANSFUSION SERVICES**

72. Organisation & function of blood services & hospital transfusion practice

72.1 Recruitment & motivation

72.2 Operation of blood mobile

72.3 Development of transfusion service

72.4 Inventory control

72.5 Development of forms, labels, records, etc.

## **XVII. BIOSAFETY**

73.1 Personnel

73.2 Laboratory

73.3 Equipment

73.4 Sterilization

73.5 Disposal of waste material

## **XVIII. MODERN BIOLOGICAL TECHNIQUES**

74. Principle, methods, relevance in transfusion medicine

74.1 Western blot

74.2 Polymerase chain reaction

74.2.1 SSCP

74.2.2 SSOP

74.3 Dot blot hybridization

74.4 Others – Animal experiments, museum techniques

- 74.5 Microarrays
- 74.6 Proteomics
- 74.7 Other new technique in Transfusion medicine

## **XIX. AUTOMATION & COMPUTERISATION**

- 75. Instrumentation
- 76. Automated blood group & processing
- 77. Automated infectious screening
- 78. Use of bar codes
- 79. Use of computer
- 80. Laboratory and hospital information system

**General orientation-** Bio-statistics, computers, medical ethics, scientific presentations, publications, leadership qualities, cost effectiveness, preparation of reagents, handling equipments, educational technology.

## **TEACHING AND LEARNING METHODS**

### **Teaching methodology**

Teaching methodology includes:

1. Didactic lectures
2. **Seminar/journal club presentation (once a fortnight).**

Evaluation sheets may be incorporated for the purpose of assessment of presentations. The following points may be considered in the scheme for evaluation of presentations.

- Topic selection
- Completeness of presentation
- Clarity of presentation
- Understanding of the subject and ability to convey the same
- Whether relevant references have been consulted
- Ability to convey points in favor and against the subject under discussion
- Proper use of audio-visual aids
- Ability to answer questions

3. **Case presentation, case work up, case handling/management (once a week)**

Each post graduate student in transfusion medicine presents an interesting case in clinical transfusion practice or in laboratory exercise of his or her choice.

4. **Attending clinical grand rounds / clinic-pathological conference**

The post graduate students are encouraged to attend lectures and grand rounds offered by other clinical and basic science departments of the hospital.

5. **Attendance at Scientific meetings, CME programmes**

The post graduate students are expected to attend meetings related to transfusion medicine present papers/posters in these meetings.

**6. Quality performance meetings:**

The post graduate students should attend meetings of hospital transfusion/blood usage committee, meetings to review transfusion service errors, variances, and incidents, mortality meetings, audit related meetings.

**7. Paper/poster presentation:**

A postgraduate student of a postgraduate degree course in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

**8. Teaching skills:**

The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.

9. A **logbook** should be maintained recording the duration of posting, the period of absence, if any, skills performed, and remarks if any by the teacher/faculty member. The logbook should also record journal clubs, seminars attended and partaken as well as undergraduate teaching activities the post graduate student has participated and should be signed by the faculty in charge.

10. Department should encourage e-learning activities

**11. Rotation:**

<b>Title</b>	<b>Content of training activities</b>	<b>Learning objective</b>
Orientation [1 month]	Brief orientation to computer system, blood centres activities, teaching program	Be conversant with computer system & operation of blood centres activities
Blood donation [3 months]	Donor recruitment & motivation, Donor Selection Phlebotomy, Post donation care of donor, outdoor blood donation.	Should be able to select the donor, perform phlebotomy with aseptic precautions, and manage donor reactions

<p>Apheresis – donor and therapeutic [2 months]</p>	<p>Access evaluation, donor suitability, selection of machine, product manipulation, QC of product, donor observation for adverse effects and its management Indications, contra indications, replacement fluids, frequency, monitoring of TPE</p>	<p>Should be able to perform the procedure independently, obtain quality product and manage any adverse effects. Should be able to select proper patient, machine, plan TPE, select replacement fluids and monitor the patient.</p>
<p>Component preparation &amp; QC [5 months]</p>	<p>Preparation of blood components. Product manipulation such as Leucocyte removal or Irradiation. Storage &amp; quality control</p>	<p>Should be able to understand factors affecting quality of Components.</p>
<p>Immunohaematology [4 months]</p>	<p>Diagnosis &amp; transfusion support in AIHA, PNH. Evaluation of transfusion reaction. Investigations in antenatal serology. ABO-Rh typing, antibody screening, identification, evaluation of positive DAT</p>	<p>Should be able to interpret immune hematological tests. Should be able to provide consultation to physicians regarding transfusion management.</p>
<p>Pretransfusion testing &amp; cross match [4 months]</p>	<p>Investigation of difficult cross match, formal consultation on transfusion support in complex cases, checking indications &amp; dosage for blood components, emergent issue of blood, transfusion in special cases such as massive transfusion, organ transplantation, platelet refractoriness.</p>	<p>Should be able to provide consultation on transfusion therapy. Should be able to resolve difficult &amp; complex cross matching problems. Ensure appropriate and judicious use of blood and components</p>
<p>Transfusion Transmitted infection screening</p>	<p>Screening for various markers such as HIV, HCV, HBs Ag, Syphilis.</p>	<p>Should be able to understand blood screening principles and disposal of reactive</p>

[4 months]	Methodology such as Elisa, spot, rapid, automated analyzer NAT techniques such as PCR, TMA. Laboratory safety	units. Should be able to validate ELISA, maintain QC
Quality control/ records [1 months]	Quality control of components, equipment, reagents. Quality assurance. Development of documents, SOPs, Regulatory compliance	Should be able to understand QC principles, Recognize common management & regulatory issues, identify management strategies.
PBSCT [1 month]	Processing, storage, thawing, infusion of PBSC. Immunohematological monitoring of ABO mismatch transplants, Transfusion support – irradiation, CMV issues	Describe common procedures and basic concepts behind PBSC processing and cellular product therapies.

**Training in allied departments:**

Students should be sent for training for 8 months in allied laboratory and clinical departments, as below:

**Laboratory areas subjects:**

<b>Section</b>	<b>Content</b>
<b>Haematology: 3months</b>	Complete hemogram Work up of hemolytic anemias Reading peripheral smear Bone marrow aspiration
<b>Coagulation Laboratory: 2 months</b>	Coagulation tests – screening tests and special tests procedure, interpretation, trouble shooting
<b>HLA Laboratory: 1 month</b>	HLA typing
<b>Flow cytometry Lab: 1 month</b>	Isolation of lymphocytes, CD4/ CD8 / CD 34 counts using flow cytometry, Immunofluorescence
<b>Microbiology laboratory: 1 month</b>	ELISA, Western blot, PCR Bacteriology – Basic stains, Blood culture-

	aerobic, anaerobic, fungal
<b>Molecular Biology Lab: 1 month</b>	Basics of molecular testing PCR NAT testing
<b>Clinical Department subjects: 6 weeks</b> (Paediatrics, neonatal, medicine, ICU, Anaesthesia)	Transfusion support for thalassaemia, haemophilia, leukemia, solid organ transplantation. Platelet transfusion therapy and its monitoring Neonatal exchange transfusion Bed side management of transfusion reactions. Intraoperative hemodilution , Use of Cell saver, Intraoperative Blood salvage.

**During the training programme, patient safety is of paramount importance, therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of skills laboratories in medical colleges is mandatory.**

### *ASSESSMENT*

A standardized scheme of evaluation is necessary to train post graduate students in any teaching program. Both formative and summative evaluations are therefore mandatory.

#### **Formative Assessment, during the training**

**Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.**

#### **Quarterly assessment during the MD training should be based on:**

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

**The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).**

#### **SUMMATIVE ASSESSMENT, ie, at the end of training**

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The examination shall be in three parts:

### **1. Thesis**

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

### **2. Theory Examination:**

There shall be four papers each of three hours duration. These are:

#### **Theory papers:**

Paper I: Basic applied aspects related to Transfusion Medicine (including Haematology and Immunology)

Paper II: Immunohaematology, immunogenetics, and applied serology (Including Molecular biology and HLA)

Paper III: Blood donor organization, Technology of components, clinical hemotherapy.

Paper IV: Recent advances & technology

#### **Pattern of question paper**

##### **Option I:**

Each question paper will have following pattern

- One Structured Essay Question
- Six short answer questions
- Two Problem Based Analysis /Interpretation

##### **Option II:**

Each question paper will have following pattern

- Ten short answer questions (10 each) of which four questions will be Problem Based Analysis /Interpretation

### **3. Practical/clinical and oral examination: shall be carried out for two days Laboratory and clinical skills:**

Minimum of 6 exercises (*stations*) covering all aspects of Transfusion Medicine (inclusive of but not limited to).

- Blood donor / apheresis donor selection
- Component processing
- Immunohematology
- Antenatal serology

- Transfusion reaction management
- Quality control of reagents, equipment, components
- Coagulation testing,
- Basic hematology tests
- Transfusion transmitted infection screening
- Stem cell transplantation **autologous and allogenic for benign and malignant conditions**
- Interpretation of Flow cytometry/HPLC/TEG/ROTEM
- Clinical hemotherapy
- **HLA Typing , HLA Antibody screening and Next generation sequencing.**

Minimum of 6 exercises shall be given to each post graduate student. The duration of each exercise shall vary from 30 minutes to 90 minutes. Each exercise or *Station* shall be followed by Viva on the particular exercise. Laboratory performance of the student is evaluated using the following criteria:

- Familiarity with the procedure.
- Setting up and performing the procedure (organizational skills).
- Appropriate specimens and reagents are obtained and utilized.
- Proper use of equipment, reagents, supplies and specimens.
- Proper labelling, handling and disposal of specimens, tubes, etc.
- Organization and performance of individual tasks.
- Completion of tests within a reasonable amount of time.
- Clean up of work area.
- Correct interpretation of results with recognition of discrepancies or abnormal results.
- Results are recorded and reported in proper format.
- Ability to correlate clinically

#### **Clinical case discussion** (6 per post graduate student)

There shall be minimum 06 Hemotherapy exercises and administrative issues for each post graduate student. The post graduate student is required to make his own assessment of the problem and come out with solutions.

#### **Communication / presentation skills**

The post graduate student will be required to present a topic of his/her dissertation/thesis in Power point format for 10 minutes. The post graduate student will be examined on the presentation style, communication skill, slide design and content.

#### **Spots** (10 per post graduate student)

The post graduate student will be required to answer 05 clinical/ laboratory situations and 05 OSPE. For example, post graduate student may be shown picture of chest X-ray with pulmonary edema developing after FFP infusion. The post graduate student will be asked to give different possibilities and their investigations.



## **Log book discussion**

### **Oral/Viva Voce examination**

Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject.

### **Recommended reading:**

#### **Books (latest edition)**

1. Technical Manual, Mark E Brecher, AABB Bethesda, Maryland.
2. Transfusion Medicine Technical manual, R. K. Saran, Directorate General of Health Services, Ministry of Health and Family Welfare. Govt. of India, New Delhi.
3. Mollison's Blood Transfusion in Clinical Medicine. Harvey G. Klein. David J. Anstee, Blackwell publishing, Oxford.
4. Rossi's Principles of Transfusion Medicine, T. L. Simon, W.H. Dzik, E. L. Snyder, C. P. Stowell, R.G. Strauss, Lipincott Williams and Wilkins.
5. Modern Blood Centres & Transfusion Practices, Denise M Harmening, FA Davis Company, Philadelphia.
6. Blood Transfusion Therapy, Gotschall J. L. AABB press, Maryland.
7. Donor recruitment: Tips, Techniques and Tales, Perkins S, AABB Press, Maryland.
8. Transfusion therapy: Clinical Principles and Practice, Mintz P.D. AABB Press, Maryland.
9. Blood Centres and Transfusion Medicine: Basic Principles and Practices, C.D. Hillver. L.L. Silberstejn. P.M. Ness, K.C. Anderson, Churchill Livingstone.
10. Practical Transfusion Medicine, M.F. Murphy. D.H. Pamphilton, Blackwell Science.
11. Human Blood Groups, Geoff Daniels, Blackwell Science.
12. Dacie and Lewis's Practical Hematology, S.M. Levis. BJ. Bain. I. Bales, Churchill Livingstone.
13. Apheresis: Principles and Practices, B.C. McLeod. R. Weinstein, AABB Press Bethesda, Maryland.
14. Transfusion Medicine, Jeffrey McCullough, Churchill Livingstone.
15. Applied Blood Group Serology, P.D. Issit, Anstee, D.J. Winters, Montgomery Scientific Publication.
16. Immunohematology: Principles and Practices, Eva D. Quinley, Lippincott Williams and Wilkins.

## **B. JOURNALS**

Three International and 02 national journals (all indexed).

### **Standards and Regulatory documents**

- DGHS Standards
- Drugs and Cosmetic Act 1940, Amended Drug Rules 1945
- NACO Standards for Blood Centres
- NABH Standards for Blood Centres
- NABH Standards for Storage Centres
- AABB Standards
- NACO Training Modules

**Annexure I**

**Postgraduate Students Appraisal Form  
Clinical Disciplines**

**Name of the Department/Unit:**

**Name of the PG Student:**

**Period of Training: FROM.....TO.....**

Sr. No.	Particulars	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1.	Journal based / recent advances learning				
2.	Patient based /Laboratory or Skill based learning				
3.	Self directed learning and teaching				
4.	Departmental and interdepartmental learning activity				
5.	External and Outreach Activities / CMEs				
6.	Thesis / Research work				
7.	Log Book Maintenance				

**Publications: Yes/ No**

**Remarks\*** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**\*REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.**

**SIGNATURE OF ASSESSEE    SIGNATURE OF CONSULTANT    SIGNATURE OF HOD**

## MODEL PAPER

MD19301

IHBT.-I

**MD Examination Month, Year**  
**IMMUNOHAEMATOLOGY AND BLOOD TRANSFUSION**  
Paper – I

**Basic Applied Aspects related to Transfusion Medicine (Haematology and Immunology)**

Time : Three Hours  
Maximum Marks: 100

Attempt all questions  
All questions carry equal marks. Draw diagrams wherever necessary.

- Q.1 What are Regulatory T cells and discuss their role in Immune Tolerance. 10
- Q.2 Describe pathophysiology of shock and discuss the role of various plasma expanders in its management. 10
- Q.3 Discuss Iron metabolism and biochemical markers of iron deficiency. 10
- Q.4 Describe molecular structure of Hepatitis B Virus. 10
- Q.5 Describe mechanism of coagulation and natural anticoagulants. 10
- Q.6 Describe applied aspects of Type I Hypersensitivity reaction in Transfusion Medicine. 10
- Q7. What is reticulated platelet? Describe methods of its detection and its relevance in Transfusion Medicine. 10
- Q8. Discuss Pathophysiology of DIC. 10
- Q.9 Discuss role of flow cytometry in diagnosis of Haematological malignancies. 10
- Q.10 Discuss scientific landmarks in the history of Transfusion Medicine. 10

**MODEL PAPER**

**MD19302**

**IHBT-II**

**MD Examination Month, Year**  
**IMMUNOHAEMATOLOGY AND BLOOD TRANSFUSION**

Paper – II

**Immunohaematology; Immunogenetics and applied serology (Including Molecular biology and HLA)**

Time : Three Hours

Maximum Marks : 100

Attempt all questions

All questions carry equal marks. Draw diagrams wherever necessary.

- |      |   |    |
|------|---|----|
| Q.1  | Molecular basis of Bombay Phenotype.  | 10 |
| Q.2  | Resolution of a case of incompatible cross match with negative auto control.  | 10 |
| Q.3  | Describe causes and resolution of ABO discrepancies.  | 10 |
| Q.4  | Discuss gene frequency of ABO blood groups and discuss its significance in population genetics.                         | 10 |
| Q.5  | Investigations in case of suspected neonatal alloimmune thrombocytopenia.   | 10 |
| Q.6  | Discuss requirements for reagents Red Blood cell panels for antibody detection and identification in blood donors.      | 10 |
| Q.7  | Discuss role of Blood groups in paternity testing.  | 10 |
| Q.8  | Discuss hemolytic disease of newborn.   | 10 |
| Q.9  | Enumerate serological investigations and its significance to be performed for diagnosis of autoimmune hemolytic anemia. | 10 |
| Q.10 | Discuss HLA typing in transfusion medicine.   | 10 |

**MODEL PAPER**

**MD19303**

**IHBT.-III**

**MD Examination Month, Year**

**IMMUNOHAEMATOLOGY AND BLOOD TRANSFUSION**

Paper – III

**Blood Donor Organization, Technology of components , Clinical hemotherapy**

Time : Three Hours

Maximum Marks : 100

Attempt all questions

All questions carry equal marks. Draw diagrams wherever necessary.

- Q.1 Define the triggers for Intrauterine transfusion. How will you select a unit of Blood for intrauterine transfusion. 10
- Q.2 Write a note on photopheresis. 10
- Q.3 Discuss role of Levy Jennings chart in Quality management of Blood Centre. 10
- Q.4 Discuss utility of Donor lymphocyte infusion. 10
- Q.5 Current preservation techniques in Blood Centres. 10
- Q.6. Discuss Principle and use of cell separators. 10
- Q.7 Cryoprecipitate: Indications and Preparation. 10
- Q.8 Discuss about Quality Indicators in Blood Centre. 10
- Q.9 Current preservation techniques used in Blood Centres. 10
- Q.10 Donor notification and referral policy in India. 10

**MODEL PAPER**

**MD19304**

**IHBT.-IV**

**MD Examination Month, Year**  
**IMMUNOHAEMATOLOGY AND BLOOD TRANSFUSION**

Paper – IV

**Recent Advances & Technology**

Time : Three Hours

Maximum Marks : 100

Attempt all questions

All questions carry equal marks. Draw diagrams wherever necessary.

- |   |    |
|---|----|
| Q.1 Discuss about Red cell exchange in Sickle cell disease.   | 10 |
| Q.2 Anti HNA antibodies and its clinical significance.  | 10 |
| Q.3 Describe principle of plasmapheresis using cascade filtration and its applications.   | 10 |
| Q.4 Elusion techniques used in Blood Centre.  | 10 |
| Q.5. Gene therapy: Principle and methods  | 10 |
| Q6. Hemovigilance action plan in India.   | 10 |
| Q.7. Types of Stem cell transplant and indications.   | 10 |
| Q.8 Discuss Next generation sequencing and its role in transplant   | 10 |
| Q.9. Patient Blood management in adult cardiac surgery.   | 10 |
| Q.10 “Fresh whole blood is a better option than components for transfusion support in a trauma patient” Critically analyze the statement. | 10 |