



GOVERNMENT OF JAMMU & KASHMIR  
SHER-I-KASHMIR INSTITUTE OF MEDICAL SCIENCES  
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**Syllabus for Assistant Professor Posts of  
the Department of Blood Transfusion &  
Immunohematology,  
SKIMS, SOURA.**

# **Blood Transfusion Medicine & Immunohematology syllabus**

## **SECTION I: HISTORY, EVOLUTION AND ORGANIZATION OF TRANSFUSION SERVICES**

### **History of Transfusion Medicine**

- Scientific landmarks
- Discovery of blood groups
- Evolution of anticoagulants and preservatives
- Development of plastic blood bags
- Impact of World Wars
- Major milestones in transfusion medicine in India

### **Organization of Blood Transfusion Services**

- National Blood Policy
- National and State Blood Transfusion Councils
- Blood Centre hierarchy
- Hospital Blood Centre organization
- Regional Blood Centres
- Blood Storage Centres
- Networking of Blood Centres
- Disaster preparedness and emergency blood services

### **Blood Centre Administration**

- Human resource management
- Equipment procurement
- Financial planning
- Cost analysis of blood components
- Biomedical engineering support
- Information systems management

## **SECTION II: BASIC HEMATOLOGY FOR TRANSFUSION MEDICINE**

### **Hematopoiesis**

- Stem cell biology
- Bone marrow microenvironment
- Regulation of hematopoiesis

## **Red Blood Cells**

- Erythropoiesis
- Membrane physiology
- RBC metabolism
- Hemoglobin synthesis, structure, and function
- Iron metabolism
- Bilirubin metabolism
- RBC survival and senescence

## **White Blood Cells**

- Granulocytes
- Monocytes and macrophages
- Lymphocytes
- Functional immunology of leukocytes

## **Platelets**

- Thrombopoiesis
- Platelet structure and function
- Platelet kinetics
- Reticulated platelets

## **Hemostasis**

- Primary hemostasis
- Secondary hemostasis
- Coagulation cascade
- Natural anticoagulants
- Fibrinolysis
- Thromboelastography
- Platelet aggregation studies

## **Hemodynamics**

- Blood volume regulation
- Shock physiology
- Oxygen transport

## **SECTION III: IMMUNOLOGY, IMMUNOGENETICS AND TRANSPLANT IMMUNOLOGY**

### **Basic Immunology**

- Components of the immune system
- Innate immunity
- Adaptive immunity
- Antigens and epitopes
- Immunoglobulin structure and classes
- Antigen-antibody interactions Agglutination, Hemolysis, Neutralization, Precipitation
- Complement system
- Cytokines and chemokines
- Primary and secondary immune responses
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### **Cellular Immunology**

- T-cell biology
- B-cell biology
- NK cells
- Monocyte-macrophage system
- Immune regulation

### **Immunogenetics**

- Genetics of immune response
- Population genetics
- Hybridoma technology
- Immunogenetic polymorphism

### **Transplantation Immunology**

- Histocompatibility
- Graft rejection
- Tolerance
- Graft-versus-host disease

## **SECTION IV: IMMUNOHEMATOLOGY**

### **Blood Group Genetics**

- Principles of inheritance
- Molecular genetics of blood groups
- Gene regulation

### **ABO Blood Group System**

- Genetics and biochemistry
- ABH antigens
- Secretor status

- Subgroups of A and AB
- ABO antibodies
- Bombay and para-Bombay phenotypes
- Practical aspects of ABO grouping
- ABO typing techniques
- Molecular ABO typing
- Hemolysis
- Polyagglutination
- Mixed field agglutination
- Acquired B phenomenon
- Resolution of discrepancies

### **Rh Blood Group System**

- Clinical significance
- Discovery of Rh system
- Inheritance, Rh genes
- Rh phenotype and genotype
- Nomenclature Fisher-Race, Wiener, Rosenfield and ISBT
- Rh antigens
- Rh membrane complex
- Variants of D Antigen- weak D, partial D
- Del phenotype
- Rh-null syndrome
- Rh-mod phenotype
- Rh antibodies
- Reagents for Rh typing
- Rh typing techniques
- Rh typing Problems and Resolution

### **Other Blood Group Systems**

- Importance of Other blood group system
- Lewis system
- MNS system
- P system
- Kell system
- Duffy system
- Kidd system
- Lutheran system
- Ii blood group system
- Other minor blood group systems Summary of characteristics
- High-frequency antigens
- Low-frequency antigens
- Blood groups and disease associations

## **Human Platelet and Neutrophil Antigens**

- HPA systems
- HNA systems
- Clinical significance

## **SECTION V: IMMUNOHEMATOLOGY LABORATORY TECHNIQUES**

### **Antiglobulin Tests**

- Principle
- Applications of Antiglobulin test
- DAT
- IAT
- AHG reagents
- Control cells
- Test Techniques: Saline, Albumin, Enzyme techniques, PEG methods, LISS methods, Gel card technology, Solid phase testing, Microplate technology, Automated platforms
- Factors affecting sensitivity of Antiglobulin test
- Sources of error

### **Antibody Investigation**

- blood group system Panel interpretation
- Dosage effect
- Multiple antibodies
- Antibody titration

### **Advanced Techniques**

- Elution methods
- Adsorption methods
- Auto-adsorption
- Allo-adsorption
- ZZAP treatment
- Chloroquine dissociation
- Lectin studies
- Saliva studies

### **Molecular Immunohematology**

- Blood group genotyping
- Molecular blood grouping
- Next-generation sequencing

- Genotype-matched transfusion

## **SECTION VI: BLOOD DONOR MANAGEMENT**

### **Donor Recruitment**

- Voluntary donation
- Repeat donor retention
- Rare donor programmes
- Donor motivation
- Community awareness

### **Donor Selection**

- Eligibility criteria
- Medical assessment
- Deferral criteria
- Donor questionnaire
- Counseling

### **Blood Collection**

- Venepuncture techniques
- Blood collection systems
- Anticoagulants and preservatives
- Blood collection camps
- Special donations

### **Donor Reactions**

- Classification
- Vasovagal reactions
- Hematoma
- Nerve injury
- Citrate toxicity
- Donor hemovigilance

### **Seroreactive Donors**

- Notification
- Counseling
- Referral
- Look-back procedures

## **SECTION VII: BLOOD COMPONENT PREPARATION, STORAGE AND QUALITY CONTROL**

### **Component Preparation**

- Principles of component therapy
- Centrifugation principles
- PRP method
- Buffy coat method
- Automated extraction

### **Red Cell Components**

- PRBC
- Leukoreduced RBC
- Washed RBC
- Irradiated RBC
- Frozen RBC

### **Platelet Components**

- Random donor platelets
- Single donor platelets
- Platelet additive solutions

### **Plasma Components**

- FFP
- FP24
- Cryoprecipitate
- Cryosupernatant

### **Granulocyte Components**

- Preparation
- Indications
- Quality control

### **Storage and Preservation**

- CPD
- CPDA-1
- Additive solutions
- Storage lesions
- Cryopreservation

- Transportation
- Cold chain maintenance

### **Quality Control**

- Whole blood QC
- Component QC
- Reagent QC
- Equipment QC

## **SECTION VIII: APHERESIS MEDICINE**

### **Principles**

- Centrifugation
- Membrane filtration
- Cell separation technology

### **Donor Apheresis**

- Plateletpheresis
- Leukapheresis
- Plasmapheresis
- Double red cell collection

### **Therapeutic Apheresis**

- Therapeutic plasma exchange
- Red cell exchange
- Leukapheresis
- Platelet depletion
- LDL apheresis
- Immunoabsorption
- Extracorporeal photopheresis

### **Special Areas**

- Pediatric apheresis
- Anticoagulation
- Complications
- ASFA guidelines

## **SECTION IX: TRANSFUSION TRANSMISSIBLE INFECTIONS**

## **Viral Infections**

- HIV
- HBV
- HCV
- HEV
- HAV
- HTLV
- CMV
- EBV
- Parvovirus B19
- Viral inactivation

## **Bacterial Infections**

- Syphilis
- Detection
- Prevention

## **Parasitic Infections**

- Malaria
- Babesiosis
- Leishmaniasis

## **Emerging Pathogens**

- Dengue
- Chikungunya
- Zika
- West Nile Virus
- SARS-CoV-2

## **Laboratory Detection**

- ELISA
- CLIA
- CMIA
- NAT
- ID-NAT
- MP-NAT

## **Pathogen Reduction Technologies**

- INTERCEPT
- Mirasol

- Theraflex

## **SECTION**

### **~~SECTION~~ X: PRETRANSFUSION TESTING**

- Sample identification
- Patient identification
- Blood request protocols
- ABO and Rh grouping
- Antibody screening
- Antibody identification
- Crossmatching
- Electronic crossmatch
- Gel crossmatch
- Blood issue and labeling
- Return and reissue policies

### **SECTION XI: CLINICAL TRANSFUSION MEDICINE**

#### **Patient Blood Management**

- Principles
- Implementation

#### **Component Therapy**

- Red cells
- Platelets
- Plasma
- Cryoprecipitate

#### **Specialty Transfusion**

- Trauma
- Massive transfusion
- Obstetric hemorrhage
- Cardiac surgery
- Liver transplantation
- Renal transplantation
- ICU transfusion

#### **Disease-Specific Transfusion**

- Thalassemia
- Sickle cell disease
- AIHA
- Hemophilia
- DIC
- HIT
- G6PD deficiency

### **Therapeutic Phlebotomy**

- Indications
- Procedures
- Monitoring

## **SECTION XII: TRANSFUSION REACTIONS AND HEMOVIGILANCE**

### **Acute Reactions**

- Acute hemolytic
- FNHTR
- Allergic
- Anaphylactic
- Hypotensive

### **Pulmonary Complications**

- TRALI
- TACO

### **Delayed Complications**

- Delayed hemolytic reactions
- Alloimmunization
- Iron overload
- PTP
- TRIM

### **Investigation**

- Root cause analysis
- Imputability assessment
- Severity grading

### **Hemovigilance**

- Donor vigilance
- Recipient vigilance
- National Haemovigilance Programme
- Reporting systems

### **SECTION XIII: FETAL, NEONATAL AND PEDIATRIC TRANSFUSION**

- HDFN
- Rh alloimmunization
- ABO-HDFN
- Antenatal assessment
- Intrauterine transfusion
- Exchange transfusion
- Neonatal transfusion
- Pediatric transfusion support

### **SECTION XIV: STEM CELL TRANSPLANTATION AND CELLULAR THERAPY**

- PBSC collection
- Bone marrow harvest
- Cord blood banking
- CD34 enumeration
- Cell processing
- Cryopreservation
- T-cell depletion
- CliniMACS
- FACS
- HSCT
- CAR-T therapy
- Gene and cellular therapies

### **SECTION XV: HLA AND HISTOCOMPATIBILITY**

- HLA genetics
- HLA nomenclature
- HLA typing
- PCR-SSP
- PCR-SSOP
- RFLP
- Luminex
- CDC crossmatch

- Flow cytometric crossmatch
- Virtual crossmatch
- HLA antibodies
- Platelet transfusion support

## **SECTION XVI: PLASMA FRACTIONATION AND HEMOTHERAPEUTICS**

- Plasma fractionation
- Albumin
- IVIG
- Anti-D
- PCC
- Factor VIII
- Factor IX
- Fibrinogen concentrates
- Recombinant coagulation factors
- Plasma substitutes
- Colloids
- Crystalloids

## **SECTION E XVII: QUALITY MANAGEMENT SYSTEMS**

- Quality system essentials
- Quality assurance
- Quality control
- Validation
- Qualification
- Calibration
- CAPA
- Risk management
- Levey-Jennings charts
- Westgard rules
- Internal audit
- External audit
- EQAS
- Proficiency testing
- Accreditation standards

## **SECTION XVIII: REGULATORY, ETHICAL AND MEDICOLEGAL ASPECTS**

- Drugs and Cosmetics Act
- Schedule F
- CDSCO regulations
- Licensing procedures

- GMP
- NABH
- NABL
- ISO 15189
- Ethics in transfusion medicine
- Informed consent
- Donor confidentiality
- Consumer Protection Act
- Medico-legal issues

## **SECTION XIX: BIOSAFETY, WASTE MANAGEMENT AND DISASTER MEDICINE**

- Biosafety
- Universal precautions
- Occupational exposure management
- Biomedical waste management
- Blood supply during disasters
- Emergency preparedness
- Business continuity planning

## **SECTION XX: RESEARCH METHODOLOGY, BIostatISTICS AND ACADEMICS**

- Study designs
- Clinical trials
- Systematic reviews
- Meta-analysis
- Sample size calculation
- Descriptive statistics
- Inferential statistics
- Relative risk
- Odds ratio
- P value
- Confidence intervals
- Regression analysis
- SPSS
- Scientific writing
- Thesis writing
- Research ethics
- Publication ethics
- Bibliometrics
- Impact factor
- h-index
- Citation metrics

## **SECTION XXI: DIGITAL TRANSFUSION MEDICINE AND FUTURE DIRECTIONS**

- Blood bank information systems
- NAT Testing
- e-RaktKosh
- ISBT 128
- RFID
- Automation
- Artificial intelligence
- Machine learning
- Precision transfusion medicine
- Molecular blood grouping & diagnostics
- Genotype-Matched Transfusion
- Pathogen reduction technologies
- Artificial blood substitutes
- Personalized transfusion support
- Cell and gene therapy
- CAR-T Cell Therapy
- Regenerative medicine
- AI-based Blood Inventory Management
- Digital Blood Banking
- Precision Transfusion Medicine
- Patient Blood Management
- Regenerative Medicine