MAHARASHTRA UNIVERSITY OF HEALTH SCIENCES, NASHIK

CURRICULUM FOR POSTGRADUATE COURSE

M.D. (IMMUNOHAEMATOLOGY & BLOOD TRANSFUSION)

The aim of this course is to train the students of Medicine in the field of Immunohaematology & Blood Transfusion (IH & BT). Knowledge and practical skills shall be acquired by the candidates in the field.

GOAL

The goal of postgraduate medical education in Immunohaematology & Blood Transfusion, shall be to produce competent specialist.

(i) Who shall recognize the health needs of the community and carry out professional obligation ethically and in keeping with the objectives of the national transfusion policy;

(ii) Who shall have mastered most of the competencies, retaining to the speciality that are required to be practiced at the secondary and tertiary levels of the healthcare delivery system.

(iii) Who shall be aware of contemporary advances and developments in the discipline of IH & BT.

(iv) Who shall have acquired a spirit of scientific inquiry and oriented to the principles of research methodology and epidemiology

(v) Who shall have acquired the basic skills in teaching of the medical and paramedical professionals.

(vi) organize health teams / transfusion camps to provide care during natural or man-made calamities

OBJECTIVES:

At the end of the course a candidate must be able to

(i) Understand and explain about the scientific basis of blood transfusion.

(ii) Understand the processes of blood collection, processing and component preparation.

(iii) Understand and explain the basis of pre transfusion testing.

(iv) Should be able to explain and diagnose the adverse effects of blood transfusion.

(v) Should be able to perform apheresis technique independently.

(vi) Should be able to carry out the antenatal and neonatal transfusion practice.

(vii) Should be able to plan, perform and report specific research projects.

(viii) Should be able to give advice on haemotherapy including stem cell transplantation and solve the immunohaematological discrepancies in blood transfusion.

COURSE CONTENT (SYLLABUS)

DURATION OF COURSE:

The minimum period of training shall be three calendar years and the candidates can be admitted to this training after their full registration with the Medical Council. No exemption shall be given from this period of training of three years either for doing housemanship or for any other experience or diploma.

TRAINING PROGRAM:

The candidates joining the course must work as full time residents during the whole period of their postgraduate training. They will be required to attend a minimum of 80% of training period. Candidate shall be given full time responsibility and assignments and their participation in all facets of the educational process assured. Postgraduate students must maintain a record book of the work carried out by them and the training undergone by them during the period of training. These record books shall be checked and assessed by the faculty.

TEACHING /LEARNING METHODS:

Learning in M. D. (Immunohaematology & Blood Transfusion) will essentially be self-learning.

Following teaching-learning methods shall be followed-

Group teaching sessions:

· Journal review

· Subject seminar presentation

· Group discussion

· Clinical case presentations pertaining to transfusion therapy.

· Presentation of the findings of an exercise on any of the sub-specialties

· Participation in CME programs and conferences

Hands on experience (practical training)

Practical training shall be imparted by posting the students in various sub -specialties (sections) as detailed in the intrinsic and extrinsic rotation. Student shall be actively involved in day to day working of all the sections.

He/she will be trained under the guidance of teachers in all the aspects of practice of transfusion therapy and basic blood banking techniques including blood collection, processing, storage of blood products, component preparation, pre transfusion testing, apheresis, screening of blood products and haemotherapy. Including stem cell transplantation.

Suggested schedule of rotation:

Intrinsic rotation:

The candidates will be rotated through various sections of the department as under:

A) Blood donor management **6 months**

Donor recruitment & motivation
Blood donor selection
Phlebotomy
Post donation care of donor
Outdoor blood donation camps

B) Component preparation, Aphereis & Quality Management **6 months**

Preparation of various blood components
PRBC, FFP, PC, Cryo, Leuco – poor
Irradiation of blood components
Storage & quality control

Apheresis

Donor apheresis

Therapeutic plasma exchange

C) Transfusion transmitted infection screening **5 months**

Screening of various markers

HIV, HCV, HBsAg, Syphilis Methodology

ELISA, Spot, Rapid, Automated analyzer

Molecular techniques

D) Immunohematology **6 months**

Diagnosis & Transfusion support in

AIHA

PNH

Transfusion reaction

Antenatal serology

Multi – transfused patients

Secretor status

Minor red cell antigen typing

Antibody screening

E) Pre transfusion testing & Cross matching **6 months**

ABO grouping & Rh typing

Du testing, genotyping

Irregular antibody screening & identification

Cross – matching

F) Quality control / computers / records **1 month**

G) PBSCT, Umbilical cord stem cells, Bone marrow stem cells **1 month**

Harvest

CD 34 counts

Cryopreservation

Total **31 months**

Training in allied departments

A) Dept of Pathology (Haematology division)	**1 month**
Complete haemogram	
Reading of peripheral smear	
Coagulation work up	
B) Dept of Virology	**1 month**
Isolation of lymphocytes	
CD4 / CD8 counts	
Special molecular techniques	
C) Dept of Microbiology	**2 weeks**
Bacterial culture	
Grams staining	
D) Dept of Anesthesiology	**2 weeks**
Intra-operative haemodilution	
Operation of cell saver	
Intra operative transfusion	
E) Dept of Clinical Haematology & BMT	**2 weeks**
F) Institute of Immunohaematology, Mumbai	**1 month**
HLA typing	
Immunophenotyping incl flowcytometry	
Immunofluoresence	
G) National Plasma Fractionation Centre, Mumbai	**2 weeks**
Fractionation	
Advanced Serology	
Total	**5 months**
GRAND TOTAL	**36 months**

Emergency duty:

Student shall be posted for managing emergency transfusion services in the department. He/she will deal with all the emergency investigations in transfusion medicine.

Training in research methodology:

Training in research methodology shall be imparted by planning of a research project by the student under the guidance of a recognized guide to be executed and submitted in the form of a dissertation. The dissertation is aimed at training the candidate in research methods and techniques. It will include identification of a research question, formulation of a hypothesis, search and review of relevant literature, getting acquainted with recent advances, designing of research study, collection of data, critical analysis of the results and drawing conclusions. The topic shall be communicated to the university within six months of registration and at least 12 months should be spent on the research project. The dissertation shall be completed and submitted by the student six months before appearing for the final university examination.

Teaching experience:

Student shall be actively involved in the teaching of undergraduate students / paramedical staff. He/she will be trained in teaching methods and use of audiovisual aids.

BROAD AREAS OF STUDY

I. HISTORY OF TRANSFUSION MEDICINE

1.1. Scientific landmarks in its development
1.2. Impact of world wars on its development
1.3. 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 Haemoglobin 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

10. Immunology

10.0 Principles of Basic Immunology
- 10.1 Antigen, Antibody, Complement, Immunoglobulin
- 10.2 Antigen/antibody reaction
- 10.3 Lymphocytes in Humoral & Cellular immunity

11.0 Role of Hybridoma technology in Immunology

12.0 Immunology of transplantation

13.0 HLA & genetic control of immune response

1. Genetics

14.0 Principles of basic genetics

15.0 Genetics of Blood groups
- 15.1 Phenotypes & genotypes
- 15.2 Principles of blood group inheritance
- 15.3 Population genetics of blood groups

III ANTIGEN SYSTEMS IN FORMED ELEMENTS OF BLOOD

16.0 Red cell antigens

17.0 Leucocyte antigens

18.0 Platelet antigens

IV BLOOD COLLECTION, PROCESSING, COMPONENT PREPARATION

1. Management of blood donation

19.0 Donor recruitment
- 19.1. Voluntary blood donation system
- 19.2. Categories of blood donors
- 19.3. Education & awareness of prospective donors

20.0 Acceptability criteria of blood donor

21.0 Care of blood donors
- 21.1 Pre-donation
- 21.2 Mid-donation
- 21.3 Post-donation
- 21.4 Prevention & management of complications of blood donation

22.0.Blood collection
- 22.1. Anticoagulants & preservatives
- 22.2.1 Procedure
- 22.2.2 Blood donation camps

2. Blood Components

23.0. Components
- 23.1 Types
- 23.2 Methods of preparation
- 23.3 Indications, dosage & administration
- 23.4 Leuco-depletion
  - 23.4.1.Various Methods
  - 23.4.2.Quality Control

24.0 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 cells
  - 24.6.2.Cord blood stem cells

25. 0 Plasma fractionation

V PRE-TRANSFUSION TESTING

26.0 Compatibility testing
- 26.1 ABO grouping & Rh typing
- 26.2. Antibody screening
- 26.3. Methods of cross matching
- 26.4. Newer methods of cross matching
  - 26.4.1. Solid phase
  - 26.4.2. Gel technology

27.0 Screening for Transfusion Transmitted Infections
- 27.1. Methodology
- 27.2 Nucleic acid amplification techniques
- 27.3 Newer emerging pathogens
  - 27.3.1.1 Prions
  - 27.3.1.2 C J disease
  - 27.3.1.3 Lyme disease
  - 27.3.1.4 Others

28.0 Selection of blood, components & plasma products for transfusion

VI ADVERSE EFFECTS OF BLOOD TRANSFUSION

29.0 Clinical presentation, pathophysiology, investigations, management
- 29.1. Hemolytic transfusion reaction
- 29.2. Non hemolytic transfusion Reaction

30.0. Transfusion Transmitted Infections

31.0. Transfusion Associated- Graft versus Host Disease(TA-GVHD)

32.0. Transfusion Related Acute Lung Injury (TRALI)

33.0 Others
- 33.1. Haemosiderosis
- 33.2. Volume overload

VII APHERESIS

34.0. Technology of apheresis and various machines

35.0 Haemapheresis (platelets, granulocytes, plasma)
- 35.1. Donor selection
- 35.2. Procedure
- 35.3. Complications

36.0 Therapeutic apheresis
- 36.1 Indications, procedure & Complications
- 36.2 Plasma exchange, red cell Exchange
- 36.3 Newer methods of Immunoadsorption

VIII AUTOLOGOUS TRANSFUSION

37.0. Basic principles, indications, contra-indications
- 37.1. Pre-deposit
- 37.2. Haemodilution
- 37.3. Intra-operative blood salvage including equipment
- 37.4. Directed donation

IX ANTENATAL & NEONATAL TRANSFUSION PRACTICE

38.0 Pathophysiology, diagnosis & management 1
- 38.1. Rh incompatibility
- 38.2. ABO & other blood group incompatibility

39.0 Exchange transfusion
- 39.1. Indications, methodology & complications
- 39.2. Intrauterine transfusion

40.0. Neonatal transfusion practice

X IMMUNOHEMATOLOGY

41.0 Classification, diagnosis and management
- 41.1 Immune haemolytic anaemia
- 41.2 Immune thrombocytopenia
- 41.3 Immune neutropenia

42.0. Immunohaematological problems in multi-transfused patients

XI HEMOTHERAPY

43.0. Pathophysiology, diagnosis and management of anaemia
- 43.1 Anaemia
- 43.2 Iron deficiency anaemia
- 43.3 Megaloblastic anaemia
- 43.4 Aplastic anaemia
- 43.5 Haemolytic anaemia including fragmentation syndrome
- 43.6 Anaemia of chronic diseases – liver disease, uremia, thyroid disease

44.0. Haemoglobinopathies
- 44.1 Thalassaemia
- 44.2 Sickle cell anaemia
- 44.3 Other haemoglobinopathies

45.0. Pathophysiology, diagnosis and management of haemostatic disorders
- 45.1 Haemophilia
- 45.2 Von willebrands disease
- 45.3 Platelet disorders
- 45.4 Qualitative disorders
- 45.5 Quantitative disorders
- 45.6 DIC

46.0. Pathophysiology, diagnosis and transfusion support in acute blood loss
- 46.1 Shock
- 46.2 Massive transfusion

47.0. Transfusion support in cardiac surgery

48.0 Classification & transfusion support in Oncology
- 48.1 Leukaemia
- 48.2 Lymphoma
- 48.3 Marrow failure

XII TRANSPLANTATION

46.0 Transfusion support in transplantation

48.1 Peripheral blood stem cell transplantation
- 46.1.1 Harvesting
- 46.1.2 Cryopreservation
- 46.1.3 CD34 counting

48.2 Bone marrow transplantation
- 48.2.1 Processing
- 48.2.2 Harvesting
- 48.2.3 Immunohaematological problems in ABO mismatched BMT

48.3. Transfusion support in specialized conditions

- 48.3.1. Renal transplantation
- 48.3.2. Liver transplantation
- 48.3.3. Umbilical cord blood transplantation
  - 48.3.3.1. Collection
  - 48.3.3.2. Processing
  - 48.3.3.3. HLA typing & cross matching

49.0 Irradiation of blood products

49.1. Indications, dosage, adverse effects 1

50.0 Tissue banking

XIII BLOOD SUBSTITUTE & HEMOOOIETIC AGENTS

51.0 Crystalloids & colloids

52.0 Oxygen carrying compounds

53.0 Haemopoietic growth factors

54.0 Albumin

55.0

XIV MEDICOLEGAL CONSIDERATIONS IN TRANSFUSION

55.0 Ethical & legal considerations pertaining to transfusion practice

56.0 Identification of blood stains

57.0 Paternity testing

58.0 Donor notification and counselling

59.0 Look back programme

60.0 Drugs & Cosmetics act, Accreditation

XV TOTAL QUALITY MANAGEMENT

61.0 Development of Standard Operating Procedures (SOP) manual

62.0 Quality control

- 62.1. Reagents
- 62.2. Instruments
- 62.3. Personnel
- 62.4. Blood & Components

63.0 Quality assurance

- 63.1. Internal quality control
- 63.2. External quality control

64.0 Medical audit

65.0 Hospital transfusion committee

66.0 Good manufacturing practice (GMP)

67.0 Turnaround time

68.0 ISO 9000

XVI ORGANISATION & MANAGEMENT OF TRANSFUSION SERVICES

69.0 Organisation & function of blood services & hospital transfusion practice

- 69.1. Donor recruitment & motivation
- 69.2 Operation of blood mobile units
- 69.3 Development of transfusion services
- 69.4 Inventory control
- 69.5 Development of forms, labels, records etc.
- 69.6 Reports & Returns

70.0 National Blood Transfusion Policy

XVII BLOOD SAFETY

71.0 Sterilization

72.0 Disposal of bio-hazardous material

XVIII MODERN BIOLOGICAL TECHNIQUES

73.0 Principles, methods, relevance in transfusion medicine

73.1 Western blot
73.2 Polymerase chain reaction
73.2.1 SSCP
73.2.2 SSOP

73.3 Dot blot hybridization

XIX AUTOMATION & COMPUTERIZATION

74.0 Automated blood grouping & processing

75.0 Instrumentation & use of bar codes

76.0 Use of computers in blood banking including Implementation of blood banking software

RECOMMENDED MINIMUM TEXT BOOKS AND JOURNALS

Books:

1. Mollison P.L, Blood transfusion in clinical medicine, published by Oxford, ELBS & Blackwell Scientific Publication.
2. Saran R.K., Transfusion medicine technical manual, published by WHO.
3. Jeffrey McCullough, Transfusion Medicine, published by McGraw-Hill Professional
4. Paul D. Mintz, Transfusion Therapy: Clinical Principles and Practice, publilshed by AABB.
5. Christopher D. Hillyer, Leslie E. Silberstein, Paul M. Ness, Blood Banking and Transfusion Medicine: Basic Principles and Practice, published by Churchill Livingstone.

6. Sally V. Rudmann, Textbook of Blood Banking and Transfusion Medicine, published by Saunders.
7. Denise M, Harmening, Modern Blood Banking and Transfusion Practices, published by Jaypee Brothers.
8. Mary Louise Turgeon, Fundamentals of Immunohematology, Theroy and Technique, published by Williams & Wilkins.
9. Lawrence D. Petx, Scott N. Swisher, steven Kleinman,et al. Clinical Practice of Transfusion Medicine, published by Churchill Livingstone.
10. Technical manual of American Association of Blood Banks, published by AABB.
11.Michael F. Murphy, Derwood H, Pamphilion, Practical Transfusion Medicine, published by Blackwell Publishing.
12. Bruce D. Spiess, Richard K. Spence, Aryeh Shander, Perioperative Transfusion Medicine, published by lIppincott Williams & Wilkins.
13. Robert M. Winslow, Blood Substitutes. Published by Academic Press.
14. Kerry Atkinson, Richard Champlin, Jerome Ritz, Willem E. Fibbe, et al. Clinical Bone marrow and Blood stem cell transplantation, published by Cambridge University Press.
15. Hal E. Broxmeyer, Cellular Characteristics of Cord Blood and Cord Blood Transplantation, publishsed by AABB Press.
16. Harold B. Anstall, Paul M. Urie, A manual of Hemotherapy, published by John Wiley & Sons.
17. A.B.Dutta, Blood Banking and Transfusion, published by CBS Publishers & Distributeres.
18. Gundu HR Rao, Ted Eastlund, Latha Jagannathan, Handblook of Blood Banking & Transfusion Medicine, published by Jaypee Brothers.
19. Toby L Simon, Walter N Dzik, Edward L Snyder et al. Rossi's Principles of Transfusion Medicine, published by Lippincott Williams & Wilkins.
20. The clinical Use of Blood Handbook, Published by WHO.
21. Eva D Quinley, Immunohematology: Principles and Practice, published by Lippincott Williams & Wilkins.

22. Mark E. Brecher, Larry C. Lasky, Linda A. Issitt, Hematopoietic Progenitor Cells: Processing, Standards and Practice, published by S Karger Pub.

Journals:

1. Transfusion, published by Blackwell Synergy.
2. Vox Sanguinis, published by Blackwell Synergy .
3. Transfusion Medicine, published by Blackwell Publishing.
4. Stem Cells, published by AlphaMed Press.
5. Immunohematology, published by American Red Cross.
6. Current Issues in Transfusion Medicine, published by The University of Texas M. D. Anderson Cancer Center.
7. Journal of Clinical Apheresis, published by Wiley InterScience.
8. Bone marrow transplantation, published by Nature publishing group.
9. Blood, published by American Society of Haematology.

EVALUATION SYSTEM

A. DISSERTATION

a) Thesis / Dissertation is compulsory. Every candidate is required to carry out the work on a selected research project under the guidance of a recognized post graduate teacher. The results of such work shall be submitted in the form of a Dissertation.

b) The Dissertation is aimed at training the candidate in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of relevant literature, getting acquaintance with recent advances, designing of research study , collection of data , critical analysis of results and drawing conclusions.

c) The last date for submission will not be extended without prior permission from the University. In case of delay in submission of topic of Dissertation and plan of work , the period of training of the candidate will be proportionately extended for which the entire responsibility shall be upon the candidate .

d) The volume of the Dissertation should be reasonable and may vary depending on the topic. The bibliography should be as per Vancouver system.

e) The identity of the candidate/ teacher/ Department /College / Place should not be disclosed in the Dissertation .Acknowledgement should not be included in the Dissertation.

f) Certificates issued by guide, countersigned by Head of the Department and the Dean certifying therein that the work done by the candidate has been carried out under the supervision of the guide to his/her entire satisfaction, should be submitted separately to the University.

B. LOG BOOK (Work diary)

The postgraduate students should include all their activites in the log book. The annual assessment based on the work diary shall be done by the guide, teacher in charge of postgraduate teaching programme and HOD.

C. UNIVERSITY EXAMINATION

The university examination will comprise of theory and practical. To be eligible to be declared as successful in the PG Degree examination it is compulsory for the candidate to pass in theory and practical examination separately in the same attempt.

I) THEORY EXAMINATION: (TOTAL 400 Marks)

a) PAPER – I (Duration – 3 hours) 100marks

Topics covered

General and Basic Immunohaematology and Blood Transfusion including History of Transfusion Medicine and Scientific basis of Transfusion.

Q.No.	Nature of Questions	Division of Marks	Total Marks
1.	Long Answer Question	1X25	25 Marks
2.	Long Answer Question	1X25	25 Marks
3.	Attempt any 5 SAQs out of Six (a), (b), (c), (d), (e), (f)	5X10	50 Marks

b) PAPER – II (Duration – 3 hours) 100marks

Topics covered

Systemic Immunohaematology and Blood Transfusion including Antigen systems, Blood collection/processing/Component preparation, Pre-Transfusion testing, Adverse effects of Blood Transfusion, Apheresis, Autologous Transfusion, Antenatal and Neonatal Transfusion practice, Immunohaematology, Haemotherapy, Medicolegal Considerations in Transfusion Medicine, Organisation and Management of Transfusion Services, Blood Safety.

Q.No.	Nature of Questions	Division of Marks	Total Marks
1.	Long Answer Question	1X25	25 Marks
2.	Long Answer Question	1X25	25 Marks
3.	Attempt any 5 SAQs out of Six (a), (b), (c), (d), (e), (f)	5X10	50 Marks

c) PAPER – III (Duration – 3 hours) 100marks

Topics covered

Newer concepts of Immunohaematology and Blood Transfusion including Stem cell Transplantation, Blood Substitutes & Haemopoietic agents, Total Quality Management, Modern Biological techniques and Automation & Computerisation.

Q.No.	Nature of Questions	Division of Marks	Total Marks
1.	Long Answer Question	1X25	25 Marks
2.	Long Answer Question	1X25	25 Marks
3.	Attempt any 5 SAQs out of Six (a), (b), (c), (d), (e), (f)	5X10	50 Marks

d) PAPER – IV (Duration – 3 hours) 100marks

Topics covered

Recent advances in Immunohaematology and Blood Transfusion.

Q.No.	Nature of Questions	Division of Marks	Total Marks
1.	Long Answer Question	1X25	25 Marks
2.	Long Answer Question	1X25	25 Marks
3.	Attempt any 5 SAQs out of Six (a), (b), (c), (d), (e), (f)	5X10	50 Marks

II) PRACTICAL EXAMINATION: (Total 200 Marks)

Duration – 2 days (if candidates are more than 6 , then the days of practical examination should be increased proportionately)

1st DAY

1. **Long Immunohaematology exercise: (One) – Total 100 marks**

   Shall include following.

   Antenatal serology, Alloantibody & Autoantibnody detection & identification, Transfusion reaction work-up, Massive transfusion and their management.

   This will be followed by viva-voce.

2. **Short exercises (Two of 50 marks each) – Total 100 marks**

   Shall consist of the following:

   a) Operation of Blood Transfusion Services (Donor management, inventory, apheresis, Transfusion Transmitted Infections Screening)

   b) Short exercise (Reagents, Blood group discrepancy, Component Preparation, Quality Control,)

   Both exercises will be followed by viva-voce.

3. **Clinical discussion (Two of 25 marks each): Total 50 marks**

Haemotherapy exercises

2nd DAY

1. **Short exercises (total 2) – Total 30 marks**

consisting of:

a) Basic haematology – Hb, Hct, Platelet count, PBS examination, WBC Count

BT/CT, PT/APTT etc.

b) Specialized techniques – component preparation, stem cell isolation, preservation, automation etc.

Both exercises will be followed by viva-voce.

2. **SPOTS – Total 20 marks**
3. **Grand Viva + Thesis discussion – Total 100 marks**

Student will be examined by all the examiners together, about students' subject knowledge, comprehension , analytical approach , expression and interpretation of data , and will include discussion related to dissertation.

Note: The Thesis/ Dissertation evaluation or discussion should be deleted from the marking components of Practical Examination

III) INTERNAL ASSESSMENT OF THE CANDIDATE

Periodic internal assessment of the candidate by the department.

Final marking scheme for MD examination in Immunohaematology & Blood Transfusion

Heads of Passing	Maximum Marks	Minimum marks for passing
Theory	400	200
Practical and viva-voce	400	200
Total marks	800	400

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