Overview

The aim of of BSc Blood Bank technology course is to provide a high level educational process through formal didactic and state of art clinical and laboratory experiences that will render qualified , patient focused, compassionate blood transfusion services for the community who are engaged in acquiring a knowledge and expertise.

Title of course

BSc Blood Bank Technology

What is Blood bank Technology?

The program course of Blood Bank Technology is strategically designed to transmit expertise and nuances related to blood transfusion practises and organization. The comprehensive competency based curriculum would help the students to be proficient in both theoretical and practical skills. The teaching methodology employed would provide a good understanding of the aims and risks of transfusions. The students would be trained to assist physicians through best exposure in many areas of blood bank technology. Topics include a range of key subjects within transfusion medicine, such as blood banking, product management and use and adverse transfusion reactions. The fundamental principles of blood types and discussion on how and when to use compatibility testing to maximise transfusion efficacy.

1. Job opportunities after completion of course:

Career prospects

On completion of BSc Blood Bank technology, given the focus on the healthcare and the demand for allied health professionals, career opportunities for clinical lab professionals is expected to grow fast.

- **Scientific:** Work as blood centre technologists at hospital based and standalone Blood Centre
- **Managerial:** Supervisor and Quality Manager in Blood centre.

Higher Studies and Specialization

The course opens doors to entry-level positions, many graduates opt to pursue advanced degrees or specialized certifications to broaden their career prospects and enhance their expertise.

- Master's Degree in Transfusion Medicine/other aspects of Clinical Pathology
- Postgraduate diploma in Clinical research
- PhD in Laboratory Medicine and other aspects of Transfusion Medicine and Transplant.

2. Infrastructure

The Department of Transfusion at Amrita Institute of Medical Sciences, Faridabad is equipped with state of art facilities which not only caters to the need of patient in the quaternary care setup but also houses one of the largest blood centres in the country and provides round the clock facility with complete solutions to patients in need of blood component therapy, therapeutic apheresis, and immunohematology laboratory diagnostics through industry leading equipment and infrastructure.

3. Uniqueness of course (how are you different from other universities)

The blood centre checks all the pillars requires to provide safe transfusion to all patient. The department has incorporated latest cutting-edge technology to have distinctive facets in terms of RFID, Universal PAS and Whole blood automation.
The students would be trained in all the aspects of Transfusion Medicine including transplant immunology. The concept of RFID based transfusion traceability help not only at blood centre but also at the patient bed side which would help the candidates to understand the concept of Good Clinical Practices. The department is also equipped with whole blood automation for preparation of various blood components creating concept and importance of Good Manufacturing practices.

Duration of course

The minimum duration of the course will be 4 years (3+1), 6 semester followed by one year of compulsory internship.

First year

Thirteen subjects (common subjects)will be taught to all the students in 1st year irrespective of their course as given below. However ane day in a week subject speciality courses will be taught by the department.

1	Anatomy
2	Physiology
3	Biochemistry
4	Microbiology
5	Pathology
6	Introduction of computer application
7	BMW management & environmental safety
8	English & communication soft skills
9	Quality Assurance & Accrediation
10	Health care delivery system
11	Medical Law and Ethics
12	Research and Biostatistics
13	Seminar/Symposium

Second Year & Third Year

Introduction to Core Subject and Topics (As per rules of Amrita Vishwa Vidyapeetham)

	Lab Hematology related to transfusion medicine
Objective	The students will be able to understand the basics of laboratory hematology related to transfusion medicine including practical skills
1	Blood collection
2	Anticoagulants used in Haematology
3	Normal values in Haematology
4	Basic Haematological Techniques: RBC count, Haemoglobin estimation, Packed cell volume.
5	Calculation of absolute indices: WBC counts-Total and differential, Absolute eosinophil count, Platelet count, Erythrocyte sedimentation rate, Reticulocyte count
6	Preparation of blood films
7	Stains used in Haematology
8	Morphology of blood cells
9	Classification of Anaemia (Morphological & etiological), Definition, causes, classification & lab findings of Iron Deficiency Anaemia, Megaloblastic Anaemia, Haemolytic Anaemia
10	Bone Marrow: Cell composition of normal adult Bone marrow
11	Leukaemia: Classification
12	Examination of body fluids, cell counts
	Practical sessions:
	Demonstration on various laboratory equipment, preparation of smear, cell counts
	Blood centre Organization
Objective	Students should understand the organization of the blood transfusion services, storage blood centers, rules and regulation in blood banking.
1	History of transfusion medicine
2	Identify and relate the important features of the history of transfusion Medicine
3	Outline the scientific benchmarks in the evolution of transfusion medicine
4	Explain how specific innovations affected transfusion medicine practices
5	Describe recent trends in the practice of transfusion medicine
6	History of development of Transfusion Medicine in India. Whole Blood, components & Apheresis, Recent developments.
7	Organization of blood bank services regional blood transfusion Centre, blood centre, blood storage center. Infrastructure requirements, technical staff and role and function each technical staff.
8	Technical requirements: Accommodation and environmental conditions, Blood bank management system, Regulations for blood bank operation, drugs and cosmetics Law, National blood policy, Standards in blood banking, license procedures, ethical aspects of blood transfusion.
9	Statutory regulations for blood banking in India.
10	Indian Drug and cosmetic act
11	Indian pharmacopeia
12	Licensing norms, inspections and compliance
13	Terminologies used in blood banking including blood donation
14	Introduction to blood products
15	Introduction to blood bank Equipment

16	Weights, Volume, Specific gravity, Conversions of Weight to volume, Volume dilutions, Weight dilutions etc
17	Etiquette and discipline to be maintain is blood bank
18	Reporting formats and statistics.
	Practical Sessions • Demonstration of licensing procedure for blood centers, calculation of various formulas uses in blood banking

	Blood Donation and donor management
Objectives:	Student should be able to understand donor selection, phlebotomy, blood donor retention and assist in management of donor reactions
1	Donor Motivation, Motivational techniques, social awareness, Preparation of IEC Materials. Blood donation motivating factors for donation
2	Types of blood donors, Donor selection
3	Donor questionnaire and interview: Eligibility and deferral criteria ,medical interview and medical examination
4	Pre Donation Investigations-haemoglobin estimation & Blood grouping
5	Equipment & Reagent used in screening, investigations
6	Managing rejected blood donors, technique for conversion of first time donor into regular voluntary donor, donor felicitation
7	Donor recruitment & retention
8	Pre donation & Post donation donor counselling.
9	Medico-legal aspects, NACO & DGHS guidelines
10	Right to information ,Donor Consent, reports, Leave letters, certificates
11	Blood collection room equipment, their principles and use ,emergency medicines
12	Pre-donation counselling ,solutions 7 method for preparing phlebotomy site, test tube samples-method of accurately relating product to donor bleeding of the donor, post donation care
13	Mandatory emergency medicines to be made available and their uses. Donor reactions and their management.
14	Screening of blood units for mandatory tests, discarding infected units, post donation counselling
15	Blood donation drive: Awareness programs prior to blood donation drive, camp site, staff requirement ,management of camp, transportation of blood units from camp site to blood bank
16	Different types of Blood Collection-Autologous blood donation ,Therapeutic phlebotomy preservation of donated blood, blood preservation solutions, additive solutions
17	Blood salvaging
Practical Sessions • Preparation of phlebotomy site • Operation of blood collection monitor, tube sealer and sharp container • Donor Room Protocol, Donor Screening Qualifying Test For Blood Donation-Laboratory investigations • Donor Suitability /Selection • Selection of Bags for collection of blood • Blood Collection-Solutions & method for preparing phlebotomy site	

	Basic Immunohematology
Objectives:	The student should be able to understand principles of various Immunohematology tests including instrumentation .also ,student should be able to document and report the test results
1	Introduction to immunology, History ,Immunity, Cells of immune system: Phagocytic cells, Antigen presenting cells ,T cells ,T cell subsets ,B cells, CD Markers
2	Antigens : Immunogen ,allo-antigen, soluble antigen, red cell antigen, Epitopes immunoglobulins, characteristics of immunoglobulins, Complement systems, HLA systems
3	Antibodies: Polyclonal antibodies, development of antibodies, structure of Monoclonal antibodies; Hybridoma technology, Human monoclonal antibodies.
4	Antigen antibody reaction: Antigen concentration, antibody concentration, enhancing media, other factors influencing antigen antibody reaction.
5	Basic Principles of Immunohematology, application of blood groups
6	Application of blood groups:- Population Genettics, forensic medicine, Transfusion Medicine .ABO Blood of Group Systems: History ,genetics,ABH antigens, Biochemical synthesis of blood group antigens, Antigenic sites, weaker variants, Bombay Phenotype ,ABO antibodies
7	Red cell serology techniques, their advantages and disadvantages, Cell and serum grouping, detection of weak A and B antigens, trouble shooting in red cell serology.
8	Rh Blood Group Sytem: History,Genetcs ,Molecular Genetics, Nature of Rh Antigens, Partial D, Weak D, other variants of Rh ,Rh Null ,Rh antibodies factors influencing ,Rh immunization, Functional role of Rh antigens
9	Other Blood Group Sytems:Lewis,P,Li,MNSs,Kell,Duffy,Celano ,In, Private antigens, public antigens
10	Principle of Direct and indirect antiglobulin test technique, Weak Rh D Typing
11	Antenatal Serology, Haemolytic disease of the new born due to ABO incompatibility, Rh Incompatibility and other alloantibodies.
12	Pre transfusion testing-Patient specimen labelling requirements, Patient/Component identification requirement.
13	Different methods of cross matching ,saline Cross match, Saline replacement for rouleaux ,enzyme technique, albumins and techniques ,anti-globulin cross-matching

Practical Sessions

- Determination of ABO & Rh Blood Group(Reverse& Forward)-Tube method & CAT method
- Preparation of 3-5% red Cell Suspensions
- Ant globulin test-Direct and Indirect
- Antibody screening & identification
- Pre-transfusion testing(Cross matching)

	Transfusion transmitted infections
Objectives	Student should be able to understand the principle of mandatory infections screening, its instrumentation, quality control and documentation of test results.

1.	Study of major transfusion transmitted infection caused by viruses, Pathology, epidemiology Hepatitis B, Hepatitis C, Human immunodeficiency viruses 1 and 2, HTLV viruses I and II, and West Nile virus (WNV). Implications: Epstein-Barr virus, cytomegalovirus (CMV), parvovirus B19 and Creutzfeldt-Jakob disease.
2.	Transfusion associated parasites- Malaria & others. Syphilis and other pathogens. Malaria and syphilis by various methods and understand principals of testing. Understand and be able to interpret non treponemal and treponemal antibody test used to diagnose syphilis. Transfusion associated infections with other bacterial/ fungal / protozoal infections.
3.	Basic principles of ELISA test, various types of ELISA, Laboratory screening tests for TTI, spot tests, Limitation of various tests.
4.	Quarantine and recipient tracing, procedures fir look-back and recipient follow-up.
5.	Compare & contrast various methodologies such as ELISA, rapid & chemiluminescence used in screening of transfusion-transmitted infections. National policy on TTI testing of blood donors.
6.	Chemiluminescence, NAT, Western Blot, Automation in blood donor TTI screening. Confirmatory tests for TTI testing.
7.	Demonstrate proficiency in the preparation and use if internal control in transfusion transmitted infection screening.
8.	Quality control and documentation. Proficiency testing- IQUAS & EQUAS Pathogen reduction, Cellular components and plasma components.
9.	Discard of Blood Parts and Documentation of records, Universal precautions-Bio waste management.
10.	Disposal of reactive Bags, Its components. Demonstrate proficiency in the proper disposal of bio hazardous material as per recommended standards.

Practical:

- ELISA for HBsAg, HIV, HCV & Syphilis detection.
- Rapid test for HIV, HCV, HBsAg, Malaria and Syphilis detection.
- RPR test for Syphilis.
- Biomedical waste management exercises.

	Blood component preparation, storage and quality control
Objectives	Student should be able to understand the principle of blood component separation, its instrumentation, storage and quality control testing as per Drugs and Cosmetics Act India
1.	Basis step in component preparation & labelling.
2.	Composition & storage Composition: volume, cellular, plasma and clotting factor content.
3.	Equipment used for component preparation.
4.	Selection of blood bags for component preparation.
5.	Care and precautions to be taken during whole blood collection and before component preparation.
6.	Programming for component preparation, PRP & Buffy coat methods & other methods of component preparation.

7.	Preparation of red cell concentrate, Fresh Frozen plasma, other plasma products platelet concentrate, cryoprecipitate, washed red cells.
8.	Plasma Fractionation: Principles, manufacturing of different plasma derivatives.
9.	Storage conditions for components ''Storage lesions''- Metabolic changes in blood component during storage, release of cytokine during storage.
10.	Component Testing, Labelling, Transportation and storage of blood components.
11.	Inventory management and maintenance of blood stock.
12.	Modified blood components: Preparation of leukoreduced blood products, Leukocyte filters, Irradiated blood components, Blood substitutes, Washed/ plasma reduced blood components, frozen red cells.
13.	Specializes blood components- CMV free and HLA matched & Blood substitutes, Recombinant clotting & hematopoietic growth factors.
14.	Quality control of components: Measurement of factor VIII level in FFP, Measurement of fibrinogen level in FFP, Management of pH and other platelet parameters, Sterility test on platelet concentrates, Sterility test on whole blood and packed red blood cell concentrate.
15.	Plasma fractionation products & Pathogen inactivation methods.
16.	Management of Blood Bank Issue Counter, Criteria for acceptance of requisition form.

Practical Sessions

- Refrigerated centrifuge operation, various programs for preparing blood components.
- Preparation of packed red cells, FFP, Cryoprecipitate, RDP.
- Operation of Laminar Flow.
- Leukodepletion of red cell/ platelets.
- Learning blood component separation- Buffy Coat Method.
- Quality control of components.

	Haemotherapy
Objectives:	The aim of this course is to make the student aware of rational use of blood and blood components, various indicators and contraindications, their outcome after transfusion and monitoring adverse effects
1	Inspection and selection of blood component
2	Plan for transfusion .criteria for issue of blood and blood components
3	Use red cell components in of different types of anaemia ,Use of blood components in bleeding patient, Neonatal transfusion, and Transfusion practices in surgery, Selection of units for cross matching
4	Transfusion therapy for oncology and trans planation patients
5	Transfusion indications: Red blood cells, Platelets, Plasma/cryoprecipitate Granulocytes
6	Pre Transfusion strategies in special cases regarding samples, techniques and protocols in special patients circumstances-Paediatric/neonatal, Obstetric including intra uterine, cardiac surgery, burn patients & trauma patients.
7	Blood administration, transfusion filters, post transfusion care, maximal surgical blood order schedule.
8	Immune haemolytic anaemia, warm & cold type, drug induced haemolytic anaemia

9	Thrombocytopenia Immune thrombocytopenic purpura. Thrombotic thrombocytopenic pupura. Post transfusion purpura
10	Foetal and neonatal thrombocytopenia
11	Granulocyte transfusion
12	Platelet refractoriness Recognition and evaluation
13	Calculation of CCI an platelet count
14	Transfusion reactions Diagnosis, Pathophysiology, Investigations.
15	Haemolytic transfusion reaction-Immediate and delayed; immune and non-immune reaction path physiology; clinical signs and symptoms and laboratory investigation for HTR, Transfusion reaction work up.
16	Non-haemolytic transfusion reactions immediate and delayed, bacterial contamination, febrile reaction, allergic reaction, Transfusion related ling injury, PTP, Alloimmunization, Iron overload, Graft versus host disease.
17	Current risk & preventive strategies of transfusion reactions and rational use of blood components

Practical Sessions

- Work up transfusion reactions
- Demonstration of HIS for blood requisitions etc.

	Blood Bank Equipment, Documentation and Quality Control
Objectives:	The aim of this course is to make the student aware of various national guidelines blood transfusion services in India such as Drugs and Cosmetic Act, National Blood Policy, documentation and record keeping, student should be able to understand principles of quality management in blood transfusion services
1	General lab equipment
2	Colorimeters & ELISA reader washers
3	Thermometers
4	Weighing devices
5	Refrigerators
6	Platelet agitators & incubators
7	Deep freezers
8	Thawing bath & devices
9	Plasma expressers
10	Sterile connecting devices
11	Apheresis' equipment's
12	Computers
13	Software & Hardware
14	Temperature regulating devices(Incubators & Hot air oven)
15	Autoclaves
16	Cell Washers
17	HIS
18	Automation platforms
19	Blood serology: Various reagents & kits ordering, specification & documentation
20	TTI Kits-Ordering specification and documentation
21	Quality control ,assurance and management systems

22	Quality control of empty blood bags, quality control of different blood bank components, sterility test on component
23	Quality control of blood bags ,quality assurance Hb & PCV ,quality control of blood grouping reagents ,QC of anti-human globulin reagent bovine albumin, Normal saline, Antisera etc,QC of TTI test kits-ELISA,CLIA & Rapid
24	Quality control of all equipment's, calibration, validation and maintenance of blood equipment.
25	QC of blood bank techniques Quality Assurance-Temperature Records, sterility Testing. Internal QC and external QC
26	Quality parameters of various blood components, Quality assurance blood components-red cells, FFP, cryoprecipitate, platelets, Red Cell and WBC contamination
27	Calibration, validation and maintenance of blood bank equipment, QC of blood bank technique.
28	Documents, registers, Records & Formats to be kept, Licensing, drug authorities inspection And compliance.
29	Registers forms, documentation and Standard operating procedure (SOP or GMP), Blood bank management system, regulations for blood bank operation, Drugs and cosmetics law, National Blood policy, and standards in Blood Banking, Licensing procedures, and ethical aspects of blood transfusion.
30	Hospital Transfusion Committee, Blood Bank Accreditation-ISBT, NABL, NABH standards and accreditation.
31	Legal and ethical aspects Regulatory Acts, Bio hazard Waste disposal Act, National Blood Policy
Practical Sessions • Work up transfusion reactions	

	Apheresis
Objective	The student should be able to understand the principles of cell separation using automated apheresis equipment. Should be able to load the consumables on the cell separator and monitor the procedure.
1	Principles of Apheresis procedures, Apheresis products,
2	Apheresis donor selection - investigations, physical
3	Loading of consumables
4	Principles of separation of components by apheresis
5	Quality control of apheresis products
6	Maintenance of cell separator equipment.
7	Preparation of multiple products on cell separators-
	a. Plateletpheresis,
	b. Plasmapheresis (Single donor & TPE),
8	c. Leukapheresis (Granulocyte & Peripheral hematopoitic stem cells
9	Rationale of therapeutic plasma exchange
10	Indications of plasma exchange
	Practical Sessions • Demonstration of various apheresis procedure and post donation care.

	Recent advances

Objective	The aim of this section is to make the student understand various advances taking in the field of Transfusion Medicine all over the world.
1	Latest trends in in blood banking
	a. Donor screening, retention,
	b. Blood collections, components etc.
	c. Recent advances in Automation of Blood Banking.
2	Nucleic Acid Testing.
3	Stem Cells & Cord stem cell banking.
4	Stem cell-
	a. Cord blood,
	b. Peripheral blood Haematopoietic stem cell and
	c. Stem cell banking and application.
5	Procedures of collection of stem cell and calculation of stem cell collected.
6	Quality control of stem cells products.
7	Cryopreservation, maintenance, QC and thawing procedures in stem cell banking.
8	Immunotherapy
9	Mesenchymal stem cells
10	Universal red cells
11	Regenerative medicine.
12	HLA crossmatch: CDC crossmatch
	Practical Sessions • Demonstration of nucleic acid testing, collection and cryopreservation of stem cells.

Distribution of topics semester wise.(Specific for Transfusion medicine)

1st Semester	Course Name
	Introduction to quality and patient safety
	Lab related to Transfusion Medicine
2nd Semester	**Medical terminology and record keeping**
	Blood centre Organization
3rd Semester	**Research Methodology and Biostatistics**
	Blood Donation and donor management
	Basic Immunohematology
4th Semester	**Research Methodology and Biostatistics**
	Transfusion transmitted infections
	Blood component preparation, storage and quality control
5th Semester	**Haemotherapy**
	Blood Bank Equipment, Documentation and Quality Control
6th Semester	**Apheresis**
	Recent advances

7th and 8th Semester (INTERNSHIP)

A student can only start internship after clearing all papers of 1st to 6th semester as per the schedule prescribed (pass / promotion rules), and his/her conduct has to be good throughout this duration.

Students have to undertake the rotational postings during which students have to work under supervision of an experienced staff in the following areas.

S. No	Posting	Duration
1	Blood donation Complex	2 months
2	Component Lab	2 months
3	Crossmatch Lab	2 months
4	Quality Lab	1 months
5	NAT lab	1 months
6	TTI Screening	2 months
7	Immunohematology	2 months
	Total	12 months

At the end of each posting the student has to get certified in the log book from the supervising staff regarding their satisfactory performance, punctuality and conduct.
If the student has not attended the internship posting or his performance has not been satisfactory, that posting will be repeated.
The candidate has to submit a small project report at the end of internship.