SRI GURU RAM DAS UNIVERSITY OF HEALTH SCIENCES
BACHELOR OF PERFUSION TECHNOLOGY Session 2025–2026 *(BPERT.2.13)*
3 Years Academic Training + 1 Year Compulsory Clinical Internship

Course Structure Bachelor of Perfusion Technology (Code-BPERT.2.13) Session 2025					
Course No.	**Course Title**	**Course Type**	**L+T+P**	**Credits / week**	**Weightage Theory/ Practical**
Semester-I					
BPERT-ANT.201	Anatomy of cardiovascular system & respiratory system	Foundation	3+0+0	3	30+70=100
BPERT-PHY.201	Physiology of cardiovascular system & respiratory system	Foundation	3+0+0	3	30+70=100
BPERT-BIC.201	Biochemistry- Cycles & pathways	Foundation	2+0+1	3	30+70=100
BPERT.201	Introduction to Perfusion technology -History of CPB & equipments used in CPB	Core	3+0+5	8	30+70=100 30+70=100
ECO.250	English and communication skills	Elective	2+0+0	2	NC*
		Total Credits	**13+0+6**	**19**	**500**
Semester-II (revised)					
BPERT-ANT.202	Anatomy-II	Foundation	3+0+0	3	30+70=100T
BPERT-PHY.202	Physiology-II	Foundation	3+0+0	3	30+70=100T
BPERT-BIC.202	Applied Biochemistry	Foundation	2+0+1	3	30+70=100T 10+40=50P
BPERT-PHA.201	Applied Pharmacology	Foundation	3+0+0	3	30+70=100T
BPERT.202	Introduction to Perfusion Technology-I	Core	2+0+3	5	30+70=100T 10+40=50P
BPERT.203	Introduction to Quality and patient safety	Elective	2+0+0	2	NC
COM.250	Computer Applications	Elective	2+0+0	2	NC
		Total Credits	**17+0+4**	**21**	**600**
Semester-III					
BPERT-PAT.301	Pathology	Foundation	3+0+2	5	30+70=100T 10+40=50P
BPERT-302	Introduction to Perfusion Technology-II	Foundation	3+0+2	5	30+70=100T 30+70=100P
BPERT.303	Fundamentals of Pumps, Oxygenators, Filters & Blood Components	Core	3+1+2	6	30+70=100T 30+70=100P
BPERT.304	Medical Emergencies & Patient Care	Core	3+0+0	3	10+40=50T
		Total Credits	**12+1+6**	**19**	**600**
Semester-IV (Revised)					
BPERT-305	Perfusion Technology Clinical I	Core	5+1+4	10	30+70=100T 30+70=100P
BPERT-306	Core Principles of Anesthesia for Extracorporeal Circulation Technologies	Core	3+2+2	7	30+70=100T 30+70=100P
RMB.301	Research Methodology & Biostatistics	Elective	2+1+0	3	30+70=100T
		Total Credits	**10+4+6**	**20**	**500**
Semester-V					
BPERT.401	Perfusion Technology–Advanced I	Core	4+2+4	10	30+70=100T 30+70=100P
BPERT.402	Cardiovascular Pathology & Pathophysiology	Core	3+2+3	8	30+70=100T 30+70=100P

BPERT.403	Healthcare Management & Leadership	Core	2+0+0	2	15+35=50T
		Total Credits	**9+4+7**	**20**	**450**
Semester-VI					
BPERT.404	Perfusion Technology-Applied II	Core	3+2+2	7	30+70=100T 30+70=100P
BPERT.405	Perfusion Technology-Clinical II	Core	3+2+2	7	30+70=100T 30+70=100P
BPERT.406	Perfusion Technology-Advanced II	Core	3+1+2	6	30+70=100T 30+70=100P
		Total credits	**9+5+6**	**20**	**600**
7semester+8semester					
Perfusion internship	1 paper presentation or 1 case report **Internship (One year)**-Minimum 140 days per semester (Total 280 days) & 90% Attendance requirement				
		Grand Total	**73+9+30**	**119**	**3250**

Course Structure for the Bachelors in Perfusion Technology (Code-BPERT.2.13)
Session 2024

Course No.	Course Title	Course Type	L+T+P	Credits / week	Total credits	Weightage IA/Theory/ Practical
Semester-I						
BPERT-ANT.201	Anatomy of cardiovascular system & respiratory system	Foundation course	3+0+0	3	45	50+50=100
BPERT-PHY.201	Physiology of cardiovascular system & respiratory system	Foundation course	3+0+0	3	45	50+50=100
BPERT-BIC.201	Biochemistry-Cycles & pathways	Foundation course	2+1+0	3	45	50+50=100
BPERT.201	Introduction to Perfusion technology -History of CPB & equipments used in CPB	Core course	3+0+0	3	45	50+50=100
ECO.250	English and communication skills	Elective course	2+0+0	2	32	NC*
BPERT.225	Practical in CPB	Core course	0+0+5	5	80	100
		Total Credits	**13+1+5**	**19**	**292**	**500**
Semester-II						
BPERT-ANT.202	Anatomy of renal system &CNS	Foundation course	3+0+0	3	45	50+50=100
BPERT-PHY.202	Physiology of renal system & general hematology	Foundation course	3+0+0	3	45	50+50=100
BPERT-BIC.202	Biochemistry - Buffer system metabolic acidosis/ alkalosis hemostasis	Foundation course	3+0+0	3	45	50+50=100
BPERT.202	Introduction to Perfusion technology -Components and functioning of CPB with diagrams	Core course	3+0+0	3	45	50+50=100
COM.250	Computer Applications	Elective course	2+0+0	2	32	NC*
BPERT.226	Practical in CPB	Core course	0+0+5	5	80	100
Total Credits			**14+0+5**	**19**	**292**	**500**
Semester-III						
BPERT-ANT.301	Embryology of Heart	Foundation course	3+0+0	3	45	50+50=100

BPERT-PHA.301	General Pharmacology	Foundation course	3+0+0	3	45	50+50=100
BPERT.301	Pathophysiology- Anomalies and diseases of aorta	Core course	3+0+0	3	45	50+50=100
BPERT.302	Effects of CPB on various organ systems, haematological aspects of CPB	Core course	3+0+0	3	45	50+50=100
HVE.350	Human Values & ethics	Elective	2+0+0	2	32	NC*
BPERT.325	Practical in CPB	Core course	0+0+5	5	80	100
		Total Credits	**14+0+5**	**19**	**292**	**500**
Semester-IV (Revised)						
BPERT-PAT.302	Applied Pathology	Foundation	2+1+1	4	10+40=50T 10+40=50P	
BPERT-PHA.302	Pharmacology drugs	Foundation	3+0+0	3	30+70=100T	
BPERT.303	Conduction of CPB	Core	3+0+3	6	30+70=100T 30+70=100P	
BPERT.304	Embryology of Cardio-Respiratory Systems	Core	3+0+2	5	30+70=100T 30+70=100P	
CRP.350	Community Rehabilitation practice	Elective course	2+0+0	2	NC	
		Total Credits	**13+1+6**	**20**	**600**	
Semester-V						
BPERT.401	Special Situations in Perfusion Technology	Core course	3+1+4	8	30+70=100T 30+70=100P	
BPERT.402	Mechanical Circulatory Support	Core course	3+1+0	4	30+70=100T	
BPERT.403	Basic Emergency Care, First Aid & BLS	Core	2+1+0	3	30+70=100T	
BPERT.404	Medical Law and Ethics	Elective course	2+0+0	2	NC	
		Total Credits	**10+3+4**	**17**	**400**	
Semester-VI						
BPERT.405	Advanced Perfusion	Core course	3+1+2	6	30+70=100T 30+70=100P	
BPERT.406	Advanced & Recent Developments in CPB and Perfusion	Core course	3+1+2	6	30+70=100T 30+70=100P	
RMB.401	Research Methodology & Biostatistics	Elective course	2+1+0	3	30+70=100T	
BPERT.407	Microbiology, Immunology and Infection Prevention	Elective course	2+1+0	3	30+70=100T	
BPERT.408	Hospital management	Elective course	2+0+1	3	NC	
		Total credits	**12+4+5**	**21**	**600**	
7semester+8semester						
Perfusion internship	1 paper presentation or 1 case report **Internship (One year)**-Minimum 140 days per semester (Total 280 days) & 90% Attendance requirement					
Grand Total Credits			**73+9+30**	**112**	**3100**	

BACHELORS IN PERFUSION TECHNOLOGY
ACADEMIC SESSION 2025-26

BPERT-ANT.201: HUMAN ANATOMY-I CREDITS-03

Unit	Content	Hours
UNIT-I	Introduction: human body as a whole Definition of anatomy and its subdivisions Anatomical nomenclature and terminology (planes &positions) Surface Anatomy of main structures and vessels Applied anatomy& Joints Musculoskeletal system Connective tissue & its modification, tendons, membranes, special connective tissue. Bone structure, blood supply, growth, ossification, and classification. Muscle classification, structure and functional aspect. Joints classification, structures of joints, movements, range, limiting factors, stability, blood supply Nerve supply, dislocations and applied anatomy	13
UNIT-II	Extremity (Lower & Upper extremities) Bony architecture Joints – structure, range of movement Muscles – origin, insertion, actions, nerve supply Major nerves – course, branches and implications of nerve injuries. Radiographic identification of bone and joints Applied anatomy. Bony architecture Joints – structure, range of movement Muscles – origin, insertion, actions, nerve supply	6
UNIT-III	Spine and thorax Back muscles -Superficial layer Deep muscles of back, their origin, insertion, action and nerve supply. Vertebral column – Structure & Joints of vertebra. Thoracic cage	3
UNIT-IV	Head and neck: Cranium Facial Muscles – origin, insertion, actions, nerve supply Temporal mandibular Joints – structure, types of movement	3
UNIT-V	Cardiovascular system (with relevant applied anatomy) Heart-Size, location, chambers. Circulation -Systemic & pulmonary Great vessels of the heart, branches of aorta. Overview of blood vessels of upper extremity and lower extremity	6
UNIT-VI	Lymphatic system- (with relevant applied anatomy) Salient features of lymphatic organs (spleen, tonsil, thymus, lymph node).	4
UNIT-VII	Gastro-intestinal system (with relevant applied anatomy) Parts of the gastrointestinal tract Gross anatomy of Tongue, stomach, small and large intestine, liver, gall bladder Pancreas and other digestive organ& related applied anatomy	6
UNIT-VIII	Respiratory system (with relevant applied anatomy) Parts of respiratory system with salient gross features of lung Brief description of intercostal muscles and Para-nasal air sinuses	4
	Total	**45**

BPERT-PHY.201: HUMAN PHYSIOLOGY-I CREDIT-03

Unit	Content	Hours
UNIT-I	General Physiology Cell: morphology, Structure and function of cell organelles Structure of cell membrane Transport across cell membrane Intercellular communication Homeostasis Blood Introduction-composition & function of blood W.B.C., R.B.C., Platelets formation & functions, Immunity Plasma: composition, formation & functions, Plasma Proteins: -types & functions, Blood Groupstypes, significance, determination. Hemoglobin, Heamostasis Lymph-composition, formation, circulation & functions	10
UNIT-II	Introduction, central and peripheral nervous system, functions of nervous system Reflexes-monosynaptic, polysynaptic, superficial, deep &withdrawal reflex Sense organ, receptors, electrical& chemical events	10

	in receptors. Sensory pathways for touch, temperature, pain, proprioception & others.	
UNIT-III	Control of tone & posture: Integration at spinal, brain stem, cerebellar, basal ganglion levels, along with their functions. Motor mechanism: motor cortex, motor pathway: the descending tracts -pyramidal & extrapyramidal tracts-origin, course, termination & functions. Upper motor neuron and lower motor neuron paralysis. Special senses-eye, ear, nose, mouth	12
UNIT IV	Water excretion, concentration of urine-regulation of Na+, Cl-, K+ excretion Nerve Muscle Physiology, Muscles-classification, structure, properties, Excitation, contraction, coupling, Motor unit, EMG, factors affecting muscle tension, Muscle tone, fatigue, exercise. Nerve – structure and function of neurons, classification, properties Resting membrane potential & Action potential their ionic basis, All or None phenomenon Neuromuscular transmission Ionic basis of nerve conduction. Concept of nerve injury & Wallerian degeneration Synapses. Electrical events in postsynaptic neurons Inhibition & facilitation at synapses. Chemical transmission of synaptic activity Principal neurotransmitters. Chemical transmission of synaptic activity Principal neurotransmitters.	13
	Total	**45**

BPERT-BIC.201: BASIC BIOCHEMISTRY CREDIT-02

Unit	Content	Hours
UNIT-I	Carbohydrates: Definition, function and classification of carbohydrate. Monosaccharide, glycoside formation, oligosaccharides and polysaccharides. Glycolysis, catabolic fates of pyruvate, metabolic fate of Acetyl-CoA and Citric acid cycle, gluconeogenesis, glycogen metabolism, pentose phosphate pathway.	8
UNIT-II	Amino acids and proteins: Definition, structure, classification, essential &non essential amino acids. Proteins definition and classification. Primary, secondary, tertiary and quaternary of proteins of proteins	13
UNIT-III	Vitamins: Definition and classification of vitamins, difference between fat soluble and water soluble vitamins. Water soluble vitamins and fat soluble vitamins	10
UNIT-IV	Lipids: Definition, classification and function of lipids. Fatty Acids, Triacylglycerols or Triacylgcerides or neutral fat. Fatty acid metabolism. Ketone body metabolism	14
	Total	**45**

SEMESTER-II

BPERT-ANT.202: HUMAN ANATOMY-II

Unit	Content	Hours
UNIT-I	Urinary system (with relevant applied anatomy) Parts of urinary system Salient gross features of kidney, urinary bladder, ureter and urethra	5
UNIT-II	Reproductive system Parts of male and female reproductive system with salient gross features of testis & uterus, ovary and fallopian tube	5
UNIT-III	Endocrine glands List of the endocrine glands, their position and salient gross features Hormones produced by each endocrine gland.	10
UNIT-IV	Nervous system Classification of the nervous system, Definitions of central, peripheral and autonomic nervous system Neuron- structure and classification, neuroglia Names of lobes of Cerebrum and cerebellum, Parts of brainstem (salient features only). Cerebrospinal fluid and its circulation, names of cranial nerves, spinal nerve, meninges, ventricles (salient features only)	10
UNIT-V	Sensory organs Skin: Its appendages and functions Eye: Parts of eye and its structure Ear: Parts of ear- external, middle and inner ear and contents.	8
UNIT-VI	General Embryology: Spermatogenesis & oogenesis Ovulation, fertilization, Placenta, Fetal circulation. Embryology of lungs & Heart in detail	7
	Total	**45**

BPERT-PHY.202: HUMAN PHYSIOLOGY-II

Unit	Content	Hours
UNIT-I	Cardiovascular system Conducting system-components, impulse conduction Heart valves Cardiac cycle-definition, phases of cardiac cycle. Cardiac output-definition, normal value, determinants. Stroke volume and its regulation. Heart rate and its regulation: Arterial pulse, Blood pressure-definition, normal values, factors affecting blood pressure. Shock-definition, classification, causes and features, Basic idea of ECG, Cardiovascular changes during exercise	8
UNIT-II	Respiratory System Mechanics of respiration Lung volumes and capacities Pulmonary circulation, transport of respiratory gases Factors affecting respiration, Regulation of respiration-neural regulation, voluntary control and chemical regulation Hypoxia, Hypercapnoea, Hypocapnoea, Artificial respiration Disorders of respiration- dyspnoea, orthopnoea, hyperpnoea, hyperventilation, apnoea, Tachypnoea, Respiratory changes during exercise. Digestive System Digestion& absorption of nutrients, Gastro-intestinal secretions & their regulation Functions of Liver & Stomach	
UNIT-III	Sensory Organs: Functions of skin, eye, ear, nose, tongue Alterations in disease	13
UNIT-IV	Endocrines Functions of pituitary, Pineal gland, Thymus, Thyroid, Parathyroid, Pancreas, Suprarenal & placenta Alterations in disease	10
UNIT-V	Reproduction of cells-DNA, Mitosis, Meiosis, Spermatogenesis, Oogenesis Functions of female reproductive organs: Functions of breast, female sexual cycle Introduction to embryology Functions of male reproductive organs: Fertility system Alterations in disease	14

UNIT-VI	Lymphatic and Immunological system: Circulation of lymph Immunity Formations of T- Cells and B- Cells Types of Immune response Antigens Cytokine	
	Total	**45**

BPERT-BIC.202: APPLIED BIOCHEMISTRY CREDIT.03

Unit	Content	Hours
UNIT-I	Collection of Specimen, Types of specimen (blood plasma, serum, urine, body fluid, CSF), there variables and normal range use of anticoagulant & types of vials.	8
UNIT-II	Introduction to lab apparatus Pippetes, biurettes & beakers Flasks types and uses Reagent bottles, funnels types & uses Chemical balance	13
UNIT-III	Concepts of Acid - Base & salt reaction and hydrogen ion concentration, pH meter & buffer.	10
UNIT-IV	Chemistry of Proteins- classification and examples Vitamins: Definition and classification of vitamins, difference between fat soluble and water soluble vitamins. Water soluble vitamins and fat soluble vitamins	14
UNIT-V	Liver function tests and their assessment. Renal function tests and their assessment Cardiac profile- biochemical markers of myocardial infarction, basic principles, evaluation and application	
	Total	**45**

APPLIED BIOCHEMISTRY-PRACTICAL

Content	30 Hours
1. Introduction to apparatus, instruments and use of chemical balance 2. Qualitative analysis, Identification of Carbohydrates, Proteins & substances of biochemical importance 3. Demonstration of colorimeter, spectrophotometer, pH meter, single pan balance 4. Urine examination for the detection of normal and abnormal constituents. Interpretation and diagnosis through charts. a. Liver function tests. b. Lipid profile c. Cardiac markers d. Blood gases and electrolytes. Estimation of blood sugar Estimation of blood urea.	

BPERT-PHA.201: APPLIED PHARMACOLOGY CREDIT.03

Course outcome: This course focus on introduction of drugs and drugs used for nervous system, cardiovascular system and renal system. After learning this subject students are able to understand how body react to drugs and vice versa

Unit	Content	Hours
UNIT-I	GENERAL PHARMACOLOGY: Principles of drug administration and routes of administration and routes of administration, Pharmacokinetics: absorption, distribution, metabolism, excretion of drugs, factors influencing drug action, dosage and factors modifying it. Pharmacodynamics Drug allergy, poisoning & toxicity, synergetic antagonistic effect of drugs plasma half life, drug efficacy & potency,	8

	mechanism of drug action, adverse drug reaction	
UNIT-II	ANS: Cholinergic & anticholinergic drugs, skeletal muscle relaxant, Sympathomimetics drugs (adrenergic drugs), alpha & beta blockers	13
UNIT-III	CNS: Sedative & hypnotics, local & general anesthetics, Antiepileptic & Antipsychotics, Antidepressent & Analgesics	10
UNIT-IV	CVS: Antihypertensive drugs, Anti-anginal drugs, Anti arrhythmic drugs, Cardiac glycosides, plasma expendors	14
UNIT-V	Antiemetic & Diuretics, UTI DRUGS	
	Total	**45**

BPERT.201: INTRODUCTION TO PERFUSION TECHNOLOGY CREDIT.03

Unit	Content	Hours
UNIT-I	History of CPB, set up of Heart lung machine & its components, pumps, line diagrams	20
UNIT-II	Oxygenators, cannulations in cardiac surgery, Priming fluids, Temperature management in cardiac surgery, hemofiltration.	25
	Total	45

BPERT.205: INTRODUCTION TO QUALITY AND PATIENT SAFETY CREDIT 03

Teaching Objective	• The objective of the course is to help students understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system. • To understand the basics of emergency care and life support skills. • To Manage an emergency including moving a patient • To help prevent harm to workers, property, the environment and the general public. • To provide a broad understanding of the core subject areas of infection prevention and control. • To provide knowledge on the principles of on-site disaster management
Learning Outcomes	• Upon completion, Students should be able to apply healthcare quality improvement and patient safety principles, concepts, and methods at the micro-, meso-, and macro-system levels.

Unit	Content	Hours
UNIT-I	**Quality assurance and management** – Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Introduction to NABH guidelines	2
UNIT-II	**Basics of emergency care and life support skills** - Basic life support (BLS), Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One- and Two-rescuer CPR	8
UNIT-III	**Bio medical waste management and environment safety** -Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals/Chemicals/Drug waste, BMW Management & methods of disinfection, Modern technology for handling BMW, Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection (Protective devices).	10
UNIT-IV	**Infection prevention and control**-Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)], Prevention &	10

	control of common healthcare associated infections. Components of an effective infection control program, Guidelines (NABH and JCI) for Hospital Infection Control	
UNIT-V	**Antibiotic Resistance** - History of Antibiotics, How Resistance Happens and Spreads, Types of resistance- Intrinsic, Acquired, Passive, Trends in Drug Resistance, Actions to Fight Resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance	8
UNIT-VI	**Disaster preparedness and management** - Fundamentals of emergency management, Psychological impact management, Resource management, Preparedness and risk reduction, information management, incident command and institutional mechanisms.	7
	Total	**45**

COM.250: Computer Applications

Theory: 15 hours Practical's : 30 hours

Introduction to computer – I/O devices – memories – RAM and ROM – Different kinds of ROM – kilobytes. MB, GB their conversions – large computer – Medium, Micro, Mini computers - Different operating system – Networking – LAN, WAN, MAN (only basic ideas)

Typing text in MS word – Manipulating text – Formatting the text – using different font sizes, bold, italics – Bullets and numbering – Pictures, file insertion – Aligning the text and justify – choosing paper size – adjusting margins – Header and footer, inserting page No's in a document – Printing a file with options – Using spell check and grammar – Find and replace – Mail merge – inserting tables in a document.

Creating table in MS-Excel – Cell editing – Using formulas and functions – Manipulating data with excel – Using sort function to sort numbers and alphabets – Drawing graphs and charts using data in excel – Auto formatting – Inserting data from other worksheets.

Preparing new slides using MS-POWERPOINT – Inserting slides – slide transition and animation – Using templates – Different text and font sizes – slides with sounds – Inserting clip arts, pictures, tables and graphs – Presentation using wizards.

Introduction to Internet – Using search engine – Google search – Exploring the next using Internet Explorer and Navigator – Uploading and Download of files and images – E- mail ID creation – Sending messages – Attaching files in E- mail.

Role of Computers in the Health care: - HIS, Medical Equipment, Pharmacy in inventory management, Patient record maintenance.

Semester III

BPERT-301: Pathology for Perfusion Practice |Credits: 5| 3+0+2 | 100 T + 50 P

Course Rationale: Provides only the pathology necessary for understanding blood, coagulation, organ injury, cardiac disease and transfusion-related problems encountered in perfusion practice.

Course Learning Outcomes:

- Explain basic mechanisms of cell injury, inflammation and healing.
- Recognise common haematological and coagulation disorders.
- Explain transfusion principles and reactions.
- Relate pathology of cardiac and respiratory disease to perfusion.
- Interpret selected laboratory findings relevant to perfusion.

Unit-wise Content

Unit	Content	Hours
I	Cell injury, inflammation, healing, haemodynamic disorders and selected neoplasia concepts.	8
II	Anaemia, WBC disorders, thrombocytopenia, leukemia overview, bleeding disorders and DIC.	12
III	Blood collection, anticoagulants, CBC, smear, PT, APTT, ESR and laboratory safety.	10
IV	Transfusion medicine: donor selection, grouping, cross-match, components, storage and reactions.	9
V	Clinical pathology: urinalysis and selected organ-system pathology relevant to CPB.	6

Practical / Skills

1. Peripheral smear and basic haematology demonstration.
2. Blood grouping/Rh typing.
3. Interpret CBC/PT/APTT.
4. Urinalysis.
5. Transfusion-reaction case discussion.

Suggested Assessment: Written + practical/OSPE.

BPERT-302: Introduction to Perfusion Technology-II | Credits: 5 | 3+0+2 | 100 T + 50 P

Course Rationale: Builds from basic equipment knowledge to integrated interpretation of CPB monitoring,
cardiac diagnostics and common diseases requiring perfusion support.

Course Learning Outcomes:

1. Explain the evolution and principles of extracorporeal circulation.
2. Identify monitoring equipment used in OT and ICU.
3. Interpret basic ECG, CXR, echocardiography, angiography and laboratory information.
4. Describe common cardiac, respiratory and congenital conditions encountered in cardiac surgery.
5. Relate diagnostic findings to perfusion planning.

Unit-wise Content

Unit	Content	Hours
I	History/evolution of cardiac surgery and CPB.	7
II	Extracorporeal circulation, biocompatibility, asepsis, HLM, oxygenator, heater-cooler, ACT and monitoring devices.	12
III	ECG, CXR, echocardiography, coronary angiography, ABG, renal/hepatic/ coagulation profiles.	10
IV	IHD, ACS, MI, cardiomyopathy, heart failure and respiratory disorders.	9

V	Congenital heart disease and valvular/rheumatic disease: overview and perfusion relevance.	7

Practical / Skills
1. ECG identification.
2. CXR review.
3. Basic echocardiography/angiography orientation.
4. ACT-machine demonstration.
5. CPB-machine assembly simulation.

Suggested Assessment: Written + diagnostic OSPE + case presentation.

BPERT-303: Fundamentals of Pumps, Oxygenators, Filters & Blood Components | Credits: 6 | 3+1+2 | 100 T + 50 P

Course Rationale: Develops a sound understanding of the hardware and blood-management principles
underlying extracorporeal circuits.

Course Learning Outcomes:
1. Explain types and principles of pumps.
2. Compare oxygenator designs and performance principles.
3. Identify filters, tubing and heat exchangers.
4. Explain blood components and blood-conservation strategies.
5. Demonstrate basic circuit component selection and safe handling.

Unit-wise Content

Unit	Content	Hours
I	Oxygenators: historical and modern membrane systems; design and function.	8
II	Pumps: roller, centrifugal and peristaltic systems; principles and characteristics.	13
III	Filters, tubing, heat exchangers and safety components.	10
IV	Blood components, haemoconcentration, CUF, MUF, cell salvage and blood conservation.	9
V	Coagulation disorders relevant to extracorporeal circulation.	5

Practical / Skills
1. Identify pump and oxygenator types.
2. Assemble a simplified circuit.
3. Identify filters and tubing.
4. Demonstrate temperature-control setup.
5. Demonstrate blood-component selection through case scenarios.

Suggested Assessment: Written + practical/OSPE + viva.

BPERT-304: Medical Emergencies & Patient Care | Credits: 3 | 3+0+0 | 100

Course Rationale: Provides the emergency and patient-care foundation needed for safe work in cardiac OT, ICU and emergency environments.

Course Learning Outcomes:
1. Perform structured primary assessment under supervision.
2. Recognise common cardiac and respiratory emergencies.
3. Explain basic airway, CPR, fluid and transfusion principles.
4. Communicate and document emergencies appropriately.
5. Apply safe patient handling and transport principles.

Unit-wise Content

Unit	Content	Hours
I	Emergency-service organisation, monitoring, fluids, blood transfusion, airway management, CPR, ventilation and acid-base/electrolyte basics.	10

II	Cardiac and respiratory emergencies: shock, heart failure, MI, arrhythmias, asthma, COPD and pneumothorax.	12
III	Neurological emergencies, seizures, head injury and trauma care.	7
IV	Patient-centred care, communication, rights, reporting and safe transfer.	8
V	Special patient groups and common acute conditions relevant to hospital practice.	8

Suggested Teaching-Learning Methods: Simulation; emergency drills; case discussion
Suggested Assessment: Written + emergency-scenario assessment.

BPERT.305: Perfusion Technology – Clinical I

Course Code	Course Title	Credit	Contact Hours
BPERT.305	Perfusion Technology – Clinical- I	10	210

Course Rationale

This course provides supervised clinical training in the conduct of cardiopulmonary bypass and perioperative perfusion management. Students gain experience in patient assessment, circuit preparation, intraoperative monitoring, troubleshooting, documentation, and team communication. The course integrates theoretical knowledge with clinical application and promotes the development of competency, professionalism, and patient safety awareness in the cardiac operating room environment.

Learning Objectives

At the end of the course, students should be able to:

- Prepare for cardiopulmonary bypass by reviewing patient information, laboratory data, and procedural requirements.
- Assist in the setup, conduct, and monitoring of adult cardiopulmonary bypass procedures under supervision.
- Interpret clinical and perfusion monitoring parameters during cardiac surgery.
- Recognize common perfusion-related problems and participate in troubleshooting measures.
- Maintain accurate documentation and communicate effectively with members of the cardiac surgical team.
- Demonstrate professional behaviour, patient safety awareness, and adherence to institutional protocols during clinical practice.

Course Content

Unit	Topic	Hours
I	**Clinical Case Preparation**• Review of patient diagnosis and surgical procedure• Blood group, laboratory investigations and risk factors• Equipment and disposables selection• Prime strategy basics• Anticoagulation plan awareness• Blood conservation plan• Temperature management strategy• pre-bypass team briefing	**15**
II	**Adult CPB Workflow**• Cannulation support and team communication• Initiation of cardiopulmonary bypass• Maintaining flow and arterial pressure• Ventilation and gas management• Cardioplegia coordination• Cross-clamp and rewarming phases• Weaning from bypass• Protamine administration and post-bypass monitoring	**20**

III	**Clinical Monitoring•** Arterial and venous pressure monitoring• MAP and pump flow assessment• Temperature monitoring sites• ACT, ABG and electrolyte monitoring• Haematocrit and glucose monitoring• Urine output assessment• SvO_2 and lactate awareness• Alarm management and trend analysis	**20**
IV	**Troubleshooting and Safety•** Inadequate venous return• Low MAP and high MAP situations• High arterial line pressure• Poor oxygenation and gas exchange issues• Air in circuit awareness• Electrical failure management awareness• Oxygen supply issues• Emergency communication and crisis response	**20**
Total		75

Practical / Tutorial / Clinical Learning Activities (Credit =4+1=5, Hours 120+15=135)

- Participation in supervised cardiopulmonary bypass procedures.
- Clinical observation of patient preparation, cannulation, bypass conduct, and weaning.
- Monitoring and interpretation of perfusion parameters during cardiac surgery.
- Case-based discussions on clinical decision-making and troubleshooting.
- Simulation exercises for emergency and crisis management scenarios.
- Tutorial and seminar presentations on clinical perfusion topics.
- Participation in postoperative handover, audit, and documentation activities.
- Maintenance of clinical logbook and competency records.
- Relevant practical and clinical postings as per institutional requirements.

BPERT.306: Core Principles of Anaesthesia for Extracorporeal Circulation Technologies

Course Code	Course Title	Credit	Contact Hours
BPERT 306	Core Principles of Anaesthesia for Extracorporeal Circulation Technologies	7	135

Course Rationale

This course provides Perfusion Technology students with an understanding of anaesthetic principles relevant to cardiac surgery and extracorporeal circulation. It emphasizes perioperative patient management, physiological monitoring, hemodynamic interactions, blood gas analysis, and multidisciplinary communication between anaesthesia and perfusion teams. The course prepares students to function effectively within the cardiac surgical team while ensuring patient safety during cardiopulmonary bypass and related procedures.

Learning Objectives

At the end of the course, students should be able to:

- Explain the basic principles of anaesthesia relevant to cardiac surgery and extracorporeal circulation.
- Describe perioperative monitoring techniques and their significance during cardiopulmonary bypass.
- Correlate anaesthetic management with perfusion-related physiological and hemodynamic changes.
- Interpret blood gas, hemodynamic, and monitoring data in collaboration with the anaesthesia team.
- Recognize special clinical situations that may influence perfusion and anaesthetic management.
- Demonstrate effective communication and teamwork during perioperative cardiac care.

Course Content

Unit	Topic	Hours
I	**Anaesthesia Basics for Perfusionists**• Preoperative assessment awareness• Monitoring lines and invasive pressure monitoring• Induction and maintenance of anaesthesia overview• Ventilation before and after CPB• Anaesthetic drugs and hemodynamic effects• Muscle relaxants and analgesia awareness• Temperature monitoring and warming devices• Anaesthesia record correlation	15
II	**Blood Gas and Hemodynamic Interface**• ABG interpretation with the anaesthesia team• Ventilator changes and gas exchange• Vasoactive drug communication• TEE and NIRS awareness• Anticoagulation coordination• Transfusion coordination• Weaning from bypass physiology• Post CPB hemodynamic management	15
III	**Special Situations**• Difficult airway awareness• Pulmonary hypertension and right ventricular dysfunction• Low ejection fraction (EF) patients• Massive bleeding management awareness• Anaphylaxis and protamine reactions• Pregnancy and cardiac surgery awareness• Paediatric anaesthesia awareness• Emergency return to bypass	15
IV	**Team Communication**• Briefing and surgical timeout procedures• Communication during cannulation and CPB initiation• Cross-clamp and cardioplegia communication• Rewarming and weaning communication• Closed-loop medication confirmation• Crisis communication• Patient handover procedures• Debriefing and quality improvement discussions	15
Total		**60**

Practical / Tutorial / Clinical Learning Activities (Credit =2+2=4, Hour=60+15=75)

- Observation of anaesthetic induction and maintenance during cardiac surgical procedures.
- Participation in multidisciplinary case discussions involving anaesthesia and perfusion teams.
- Interpretation of hemodynamic monitoring, ABG reports, and perioperative physiological data.
- Observation of TEE, NIRS, invasive monitoring systems, and ventilator management.
- Simulation exercises on crisis management, communication, and emergency scenarios.
- Tutorials and seminar presentations on anaesthesia-related topics.
- Relevant practical or clinical observation as per institutional availability.
- Logbook maintenance and assignment submission.

RMB. 401: Research Methodology and Biostatistics

Course Code	Course Title	Credit	Contact Hours
BPERT.301	Research Methodology and Biostatistics	3	45

Course Rationale

This course introduces the principles of research methodology and biostatistics relevant to healthcare and Perfusion Technology. It provides students with the knowledge and skills required to understand scientific literature, conduct basic research activities, interpret data, and participate in quality improvement initiatives. The course also emphasizes research ethics, academic integrity, and evidence-based practice to support lifelong learning and professional development.

Learning Objectives

At the end of the course, students should be able to:

- Explain the fundamental concepts and processes involved in scientific research.
- Formulate research questions, objectives, and hypotheses relevant to healthcare practice.
- Apply basic biostatistical methods for data organization, analysis, and interpretation.
- Understand ethical principles governing biomedical research and publication.
- Critically evaluate research literature and clinical evidence.
- Participate in audits, quality improvement projects, and basic research activities related to perfusion practice.

Course Content

Unit	Topic	Hours
I	**Research Fundamentals**• Meaning and need of research• Research problem and research question• Aims and objectives• Hypothesis and variables• Literature review• Study designs• Sampling basics• Bias and confounding awareness	**5**
II	**Biostatistics Basics**• Types of data• Mean, median, mode and standard deviation• Percentages and proportions• Tables and graphs• Normal distribution awareness• Correlation and regression awareness• p-value and confidence interval introduction• Spreadsheet-based data analysis	**5**
III	**Research Ethics**• Informed consent in research• Ethics committee/Institutional Review Board (IRB) role• Confidentiality and anonymization• Risk-benefit assessment• Plagiarism and academic integrity• Authorship ethics• Clinical audit versus research• Data storage and privacy	10
IV	**Perfusion Research Applications**• Case report writing• Clinical audit of perfusion indicators• Quality improvement projects• Device and equipment audit• Blood conservation audit• ECMO and CPB registry awareness• Poster and oral presentation techniques• Minor project planning	**10**
Total		**30**

Practical / Tutorial / Clinical Learning Activities Credit =1, Hours=15

- Critical appraisal of published research articles.
- Literature search and reference management exercises.
- Development of research questions, objectives, and study proposals.
- Basic statistical calculations using spreadsheet software.
- Preparation of case reports, audit reports, and research presentations.
- Tutorial and seminar presentations on research methodology topics.
- Participation in quality improvement and audit activities where available.
- Relevant practical or clinical observation as per institutional availability.

- Logbook maintenance and assignment submission.

BPERT.401: Perfusion Technology – Advanced- I

Course Code	Course Title	Credit	Contact Hours
BPERT.401	Perfusion Technology – Advanced- I	10	210

Course Rationale

This course builds upon the foundational and clinical principles of Perfusion Technology by introducing advanced concepts in myocardial protection, Pediatric perfusion, complex cardiac surgery, and emerging extracorporeal technologies. It provides students with broader exposure to specialized perfusion practices while emphasizing patient safety, clinical decision-making, multidisciplinary communication, and professional responsibilities within the scope of undergraduate perfusion education.

Learning Objectives

At the end of the course, students should be able to:

- Explain the principles and methods of myocardial protection during cardiac surgery.
- Describe the unique physiological and perfusion considerations in Pediatric cardiac surgery.
- Discuss perfusion management challenges associated with aortic and other complex cardiac procedures.
- Demonstrate awareness of advanced extracorporeal support technologies and their clinical applications.
- Correlate perfusion strategies with organ protection and patient outcomes.
- Apply knowledge of advanced perfusion concepts in supervised clinical and simulation-based environments.

Course Content

Unit	Topic	Hours
I	**Myocardial Protection•** Myocardial ischemia and reperfusion injury• Principles of cardioplegia• Antegrade and retrograde cardioplegia delivery• Blood and crystalloid cardioplegia• Warm, cold and tepid cardioplegia strategies• Single-dose and multidose concepts• Topical cooling awareness• Monitoring adequacy of myocardial protection	15
II	**Pediatric Perfusion Introduction•** Differences between adult and Pediatric physiology• Small extracorporeal circuits and prime volume considerations• Hemodilution concerns in Pediatric patients• Temperature management strategies• Overview of congenital heart diseases• Ultrafiltration in paediatric cardiac surgery• Communication within the paediatric cardiac team• Undergraduate scope and transition to advanced practice	15
III	**Aortic and Special Surgery Awareness•** Aortic aneurysm and dissection overview• Deep hypothermic circulatory arrest (DHCA) awareness• Cerebral perfusion strategies overview• Left heart bypass awareness• Minimally invasive cardiac surgery and peripheral CPB• Pregnancy and cardiac surgery awareness• Redo sternotomy risk awareness• Organ protection during complex cardiac surgery and emergency preparedness	**15**
IV	**Emerging Technologies – Broad Exposure•** ECMO and extracorporeal life support (ECLS) overview• Intra-aortic balloon pump (IABP) overview• Ventricular assist devices (VAD) overview• Organ preservation systems awareness• Cell salvage and blood conservation technologies• Hemoadsorption and inflammatory modulation awareness• Perfusion data management and digital monitoring• Simulation in perfusion education and future developments	15

Total	60

Practical / Tutorial / Clinical Learning Activities (Credit =4+2=6, Hours=120+30=150)

- Observation and discussion of myocardial protection strategies during cardiac surgery.
- Clinical exposure to paediatric and congenital cardiac surgery cases where available.
- Case-based discussions on complex aortic and special cardiac surgical procedures.
- Demonstration and observation of advanced perfusion technologies including ECMO, IABP, VAD, and cell salvage systems.
- Simulation exercises involving advanced perfusion scenarios and crisis management.
- Tutorials and seminar presentations on emerging developments in perfusion science.
- Relevant practical or clinical observation as per institutional availability.
- Maintenance of logbook and competency records.
- Assignment preparation and case presentations.

BPERT 402: Cardiovascular Pathology and Pathophysiology

Course Code	Course Title	Credit	Contact Hours
BPERT 402	Cardiovascular Pathology and Pathophysiology	8	165

Course Rationale

This course provides an advanced understanding of cardiovascular diseases, congenital heart defects, and the pathophysiological changes encountered during cardiac surgery and cardiopulmonary bypass. It emphasizes disease mechanisms, clinical manifestations, surgical implications, organ dysfunction associated with extracorporeal circulation, and their relevance to perfusion planning. The course enables students to correlate pathology with clinical decision-making and safe perfusion practice.

Learning Objectives

At the end of the course, students should be able to:

- Explain the pathology and pathophysiology of major adult cardiovascular diseases.
- Describe the anatomical and physiological basis of common congenital heart diseases.
- Discuss organ-specific pathophysiological changes associated with cardiopulmonary bypass.
- Correlate disease processes with surgical interventions and perfusion management strategies.
- Interpret clinical, laboratory, and imaging findings relevant to cardiovascular disorders.
- Identify risk factors and communicate pathophysiological considerations during perioperative patient management.

Course Content

Unit	Topic	Hours
I	**Adult Cardiovascular Pathophysiology**• coronary artery disease• Acute coronary syndrome• Valvular stenosis and regurgitation• Rheumatic heart disease• Aortic aneurysm and dissection• Heart failure• Cardiomyopathies• Pulmonary hypertension	15
II	**Congenital Heart Disease Basics**• Acyanotic lesions: ASD, VSD and PDA• Cyanotic lesions: Tetralogy of Fallot (TOF) and Transposition of Great Arteries (TGA) overview• Single ventricle physiology awareness• Shunt physiology basics• Pulmonary blood flow concepts• Pediatric hypoxia and cyanosis• Surgical repair overview• Broad perfusion implications of congenital heart disease	15

III	**CPB Complications and Organ Pathophysiology**• Inflammatory response to cardiopulmonary bypass• Coagulopathy and bleeding disorders• Acute kidney injury (AKI)• Neurological injury and embolic events• Pulmonary dysfunction• Endocrine and glucose metabolism changes• Gastrointestinal and hepatic dysfunction• post-perfusion syndrome awareness	15
Total		**45**

Practical / Tutorial / Clinical Learning Activities (Credit 3+2=5, Hours 90+30=120)

- Case-based discussions on cardiovascular diseases and surgical management.
- Correlation of pathological findings with clinical presentation and perfusion requirements.
- Interpretation of laboratory investigations, imaging studies, and hemodynamic data.
- Review of surgical cases involving CABG, valve surgery, congenital heart disease, and aortic procedures.
- Tutorials and seminar presentations on cardiovascular pathology topics.
- Clinical observation of patients undergoing cardiac surgical procedures where available.
- Risk assessment exercises and perfusion planning discussions.
- Logbook maintenance and assignment submission.

BPERT 403: Healthcare Management and Leadership

Course Code	Course Title	Credit	Contact Hours
BPERT 403	Healthcare Management and Leadership	2	30

Course Rationale

This course introduces the principles of healthcare management, leadership, quality assurance, and patient safety relevant to perfusion services. It emphasizes resource management, departmental organization, quality improvement, professional leadership, and ethical decision-making in healthcare settings. The course prepares students to understand the administrative and managerial aspects of perfusion practice while fostering leadership skills, accountability, and a culture of patient safety.

Learning Objectives

At the end of the course, students should be able to:

- Describe the organizational structure and management principles of a perfusion service.
- Explain quality assurance, patient safety, and risk management practices in healthcare.
- Demonstrate awareness of leadership principles, teamwork, and professional development.
- Discuss inventory management, equipment maintenance, and resource utilization in perfusion services.
- Recognize legal, ethical, and regulatory responsibilities associated with healthcare management.
- Apply principles of communication, conflict resolution, and continuous quality improvement in professional practice.

Course Content

Unit	Topic	Hours
I	**Perfusion Service Management**• Organization of a perfusion department• Duty roster and case allocation awareness• Inventory planning and management• Disposable stock control and expiry monitoring• Capital equipment maintenance• Vendor coordination and ethical procurement practices• Cost awareness in charitable and private institutions• Emergency stock preparedness	8
II	**Quality and Patient Safety**• Standard Operating Procedures (SOPs) and checklists• Incident reporting and root cause analysis• Quality indicators in cardiopulmonary bypass• Audit culture and continuous quality improvement• NABH and JCI accreditation awareness• Equipment calibration and preventive maintenance• Traceability of disposables and consumables• Safety training and emergency drills	8

III	**Leadership and Education•** Leadership styles in healthcare• Communication with administration and healthcare teams• Training and mentoring juniors and students• Conflict resolution strategies• Feedback and performance appraisal basics• Professional meetings and continuing professional development (CPD)• Documentation of departmental activities• Building and sustaining a culture of safety	7
IV	**Legal and Ethical Management•** Confidential records management• Policy and protocol adherence• Resource allocation ethics• Device failure reporting and documentation• Consent and communication boundaries• Professional registration and regulatory awareness• Occupational safety and staff welfare• Transparent handling of errors and adverse events	7
Total		**30**

Practical / Tutorial / Clinical Learning Activities

- Case-based discussions on healthcare management and leadership scenarios.
- Review of departmental policies, SOPs, and quality assurance documents.
- Participation in audits, inventory reviews, and quality improvement exercises where available.
- Leadership and communication workshops through role-play and group activities.
- Seminar presentations on patient safety, accreditation standards, and healthcare management topics.
- Observation of departmental management processes and multidisciplinary team interactions.
- Relevant practical or clinical observation as per institutional availability.
- Logbook maintenance and assignment submission.

BPERT 404: Perfusion Technology – APPLIED- II

Course Code	Course Title	Credit	Contact Hours
BPERT 404	Perfusion Technology – Applied -II	7	135

Course Rationale

This course builds upon the foundational principles of extracorporeal circulation and focuses on advanced cardiopulmonary bypass technologies, modern perfusion equipment, biocompatibility, hemodynamics, filtration systems, thermal management, emboli prevention, and safety protocols. Emphasis is placed on the application of engineering principles, advanced monitoring, troubleshooting, and evidence-based perfusion practices to optimize patient outcomes during cardiac surgery and mechanical circulatory support.

Learning Objectives

At the end of the course, students should be able to:

- Explain advancements in perfusion pumps, oxygenators, biomaterials, and circuit technologies.
- Compare the design and operational characteristics of roller and centrifugal pumps.
- Describe blood-material interactions and strategies to improve biocompatibility.
- Apply principles of fluid mechanics and hemodynamics to extracorporeal circuits.
- Understand thermal regulation and heat exchanger operation during cardiopulmonary bypass.
- Evaluate oxygenator performance and identify device-related complications.
- Describe filtration technologies and emboli prevention strategies.
- Calculate hemodilution parameters and blood conservation strategies.
- Perform comprehensive pre-bypass safety checks and equipment verification.
- Integrate advanced monitoring and troubleshooting principles into clinical perfusion practice.

Course Content

Unit	Topic	Hours
I	(Kinetic/Displacement/ Hydrodynamic)**Mechanisms and Modern Perfusion Systems**• Evolution from early finger pumps to the DeBakey roller pump• Development of centrifugal pump technology• Magnetically levitated centrifugal pumps and reduction of shear stress• Transition from conventional tubing to biocompatible circuits• Heparin-bonded tubing systems• Miniaturization of extracorporeal circuits• Closed versus open circuit systems• Minimally Invasive Extracorporeal Circulation (MiECC)• Development of transportable ECMO systems• Roller pumps versus centrifugal pumps: advantages and limitations• Perfusion console operation and safety features• Pressure monitors, alarms, battery backup systems• Body Surface Area (BSA) calculations and physiological flow determination	**10**
II	**Surface Coatings, Blood Activation and Biocompatibility**• Blood interaction with artificial surfaces• Pathophysiology of Systemic Inflammatory Response Syndrome (SIRS)• Complement activation pathways• Intrinsic coagulation pathway activation• Contact activation and thrombogenesis• Heparin-bonded circuit technology• Covalent and ionic heparin bonding mechanisms• Reduction of thrombosis and inflammatory response• Alternative biocompatible coatings• Phosphorylcholine-coated circuits• Albumin-coated surfaces• Synthetic polymer surface modifications• Clinical applications of biocompatible circuits	**10**
III	**Fluid Mechanics and Integrated Thermal Management**• Principles of extracorporeal blood flow• Laminar and turbulent flow characteristics• Reynolds number and flow prediction• Application of Poiseuille's Law in perfusion circuits• Influence of tubing diameter and length on resistance• Pressure gradients within extracorporeal circuits• Shear stress and hemolysis mechanisms• Protection of erythrocytes during CPB• Oxygenator and cannula pressure dynamics• Heat exchanger design and operation• Conductive and convective heat transfer• Placement of heat exchangers within CPB circuits• Hypothermia and organ protection strategies• Controlled rewarming protocols• Prevention of gaseous micro emboli during temperature management	**5**
IV	**Performance Evaluation, Filtration and Emboli Management**• Evaluation of oxygenator gas exchange performance• Interpretation of pre- and post-membrane blood gases• Assessment of oxygen transfer efficiency• Carbon dioxide removal efficiency• Monitoring transmembrane pressure gradients (Delta P)• Recognition of oxygenator dysfunction• Protein fouling and thrombosis formation• Plasma leakage and wet-lung syndrome• Oxygenator change-out procedures• Pre-bypass filtration systems• Arterial line filters and filtration mechanics• Leukocyte depletion technologies• Lipid filtration systems• Air and particulate emboli classification• Bubble detection technologies• Doppler flow monitoring systems• Emboli prevention strategies• Neurological complications associated with microemboli	**10**

V	**Hemodilution, Blood Conservation and Safety Verification**• Hemodilution physiology and mathematical modelling• Calculation of dilutional hematocrit and hemoglobin• Impact of hemodilution on oxygen delivery• Blood viscosity and tissue perfusion relationships• Retrograde Autologous Priming (RAP)• Venous Antegrade Priming (VAP)• Blood conservation strategies during CPB• Transfusion thresholds and decision-making• Ultrafiltration techniques• Comprehensive pre-bypass safety checklists• Calibration of pressure transducers• Calibration of blood gas monitoring systems• Temperature probe verification• Emergency backup systems• Battery and electrical safety checks• Hand-crank operation and emergency preparedness• Oxygen supply verification• Documentation and quality assurance procedures	**10**
Total		**45**

Practical / Tutorial / Clinical Learning Activities Credit=2+2=4, Hours=60+30=90)

- Comparative setup and operation of roller and centrifugal pump systems.
- Demonstration of modern perfusion consoles and integrated monitoring systems.
- Calculation of body surface area, cardiac index, and target flow rates.
- Laboratory demonstrations of blood-material interactions and biocompatible coatings.
- Simulation exercises involving pressure monitoring and flow dynamics.
- Heat exchanger operation and temperature management workshops.
- Oxygenator performance assessment using blood gas interpretation.
- Filtration system demonstrations and arterial filter setup.Air embolism detection and prevention simulations.
- Hemodilution calculations and blood conservation exercises.
- Pre-bypass safety checklist drills.
- Emergency oxygenator failure and pump failure simulations.
- Seminar presentations on emerging perfusion technologies.
- Clinical observation of advanced CPB and ECMO systems where available.
- Logbook maintenance and competency documentation.

Suggested Practical Competencies

- Operate and compare roller and centrifugal pump systems.
- Calculate physiological flow rates and hemodynamic parameters.
- Assess oxygenator function using blood gas analysis.
- Monitor and interpret pressure gradients within extracorporeal circuits.
- Demonstrate safe thermal management during CPB.
- Perform filtration system setup and verification.
- Recognize and manage embolic risks.
- Calculate dilutional hematocrit and transfusion requirements.
- Conduct comprehensive pre-bypass safety assessments.
- Demonstrate competency in emergency troubleshooting procedures.

Recommended Textbooks

- Gravlee GP, Davis RF, Hammon JW, Kussman BD. Cardiopulmonary Bypass: Principles and Practice.
- Stammers AH, Mejak BL. Foundations of Perfusion Practice.
- Toomasian JM, Bartlett RH. Extracorporeal Circulation for Adult and Pediatric Applications.
- Kaplan JA. Kaplan's Cardiac Anesthesia.
- Hensley FA, Martin DE. A Practical Approach to Cardiac Anesthesia.
- AmSECT Standards and Guidelines for Perfusion Practice.

Recommended References

- AmSECT Standards and Guidelines.
- EACTS/EACTA Cardiopulmonary Bypass Guidelines.
- Society of Thoracic Surgeons (STS) Perfusion Practice Guidelines.
- Extracorporeal Life Support Organization (ELSO) Guidelines.

- American Heart Association (AHA) Scientific Statements on CPB and ECMO.

BPERT 405: Perfusion Technology – Clinical -II

Course Code	Course Title	Credit	Contact Hours
BPERT 405	Perfusion Technology – Clinical -II	7	135

Course Rationale

This course provides advanced supervised clinical exposure in perfusion practice, focusing on complex cardiac surgical procedures, perioperative planning, crisis management, and postoperative patient care. It emphasizes clinical decision-making, risk assessment, troubleshooting, multidisciplinary communication, and documentation. The course prepares students to integrate theoretical knowledge with practical skills while functioning safely and effectively within the cardiac surgical team.

Learning Objectives

At the end of the course, students should be able to:

- Participate in preoperative planning and preparation for routine and complex cardiac surgical procedures.
- Apply perfusion principles in the management of patients undergoing advanced cardiac surgery under supervision.
- Recognize and respond appropriately to common clinical emergencies and perfusion-related crises.
- Interpret perioperative clinical data and contribute to patient management discussions.
- Demonstrate effective communication, documentation, and teamwork in the operating room and intensive care settings.
- Evaluate postoperative outcomes and identify opportunities for quality improvement and patient safety enhancement.

Course Content

Unit	Topic	Hours
I	**Supervised Clinical Case Planning**• Review of diagnosis and surgical procedure• Risk assessment and checklist preparation• Prime and circuit selection• Blood availability and conservation planning• Temperature and cardioplegia strategy• Anticoagulation plan awareness• Emergency preparedness• Multidisciplinary team briefing	5
II	**Complex Clinical Management Basics**• Redo cardiac surgery awareness• Combined CABG and valve surgery awareness• Low ejection fraction (EF) patients• Aortic disease and complex vascular procedures• Pulmonary hypertension and right ventricular dysfunction• Renal dysfunction and fluid balance considerations• Coagulopathy management awareness• Difficult weaning and return-to-bypass awareness	15

III	**Crisis Troubleshooting•** Power failure management awareness• Oxygen supply failure• Pump head malfunction• Oxygenator failure• Massive air embolism awareness• High arterial line pressure• Poor venous drainage• Emergency communication, handover, and documentation	15
IV	**ICU Interface and Post-CPB Care•** post-bypass laboratory investigations and hemodynamics• Protamine administration and bleeding observation• Handover to intensive care unit (ICU) team• Overview of postoperative complications• IABP and ECMO handover awareness• Documentation review and audit• Case debriefing• Learning from adverse events and quality improvement activities	10
Total		**45**

Practical / Tutorial / Clinical Learning Activities Credit =2+2=4, Hours =60=30=90)

- Participation in supervised clinical case planning and preparation.
- Observation and assisted involvement in complex cardiac surgical procedures.
- Clinical monitoring and interpretation of perfusion, hemodynamic, and laboratory parameters.
- Simulation-based training in crisis management and troubleshooting.
- Participation in postoperative handovers, case discussions, and multidisciplinary rounds.
- Case-based discussions on complex cardiac surgical and perfusion scenarios.
- Tutorial and seminar presentations on advanced clinical perfusion topics.
- Relevant practical or clinical observation as per institutional availability.
- Maintenance of clinical logbook and competency records.
- Assignment submission and reflective learning exercises.

BPERT 406: Perfusion Technology – Advanced- II

Course Code	Course Title	Credit	Contact Hours
BPERT 406	Perfusion Technology – Advanced -II	6	120

Course Rationale

This course provides broad exposure to advanced and emerging areas of Perfusion Technology while preparing students for professional practice, higher education, and lifelong learning. It introduces advanced perfusion applications, professional standards, technological innovations, and career pathways relevant to contemporary perfusion practice. The course emphasizes safe professional conduct, evidence-based practice, technological awareness, and preparedness for future specialization.

Learning Objectives

At the end of the course, students should be able to:

- Describe advanced applications of Perfusion Technology in specialized clinical settings.
- Explain professional standards, regulatory requirements, and ethical responsibilities in perfusion practice.
- Discuss recent technological innovations and emerging trends in extracorporeal circulation.
- Demonstrate awareness of quality improvement, research, and digital technologies in perfusion.
- Identify opportunities for professional development, higher studies, and specialization.
- Develop a career plan aligned with professional, academic, and research goals.

Course Content

Unit	Topic	Hours
	Advanced Perfusion Breadth – Basic Level• Paediatric and neonatal cardiopulmonary bypass overview• Complex congenital cardiac surgery awareness• Aortic surgery and deep hypothermic circulatory arrest (DHCA) awareness• Cerebral perfusion strategies overview• Heart and lung transplant perfusion	**15**

I	awareness• Mechanical circulatory support awareness• ECMO and extracorporeal life support overview• non-cardiac perfusion applications overview **Ventricular Decompression**	
II	**Standards, Regulation and Certification Awareness•** Practice standards and standard operating procedures (SOPs)• Ethical and legal responsibilities in perfusion practice• Continuing professional development (CPD) and lifelong learning **Cardiogenic Shock Support**	**5**
III	**Technology and Innovation Awareness•** Advances in oxygenator and pump technologies• Mini-circuits and biocompatible surface coatings• Point-of-care coagulation testing technologies• Perfusion information systems and digital documentation• Simulation-based perfusion training• Artificial intelligence and healthcare data analytics awareness• Quality dashboards and performance monitoring• Emerging research questions and future innovations in perfusion science **Cannula Selection:** Technical specifications of specialized, multi-stage femoral and jugular cannulae designed to accommodate the spatial restrictions of robotic arms. **Normothermic Ex-Vivo Machine Perfusion (NMP)Circuit Mechanics: Metabolic Assessment: Organ Optimization: Hematology and Complex Anticoagulation** Wearable artificial lungs Nanotechnology coatings Future focus: patient mobility AI-controlled perfusion	**15**
IV	**Endovascular Clamping:** The operational mechanics of endo-aortic balloon occlusion catheters (e.g., Endo Clamp) as a minimally invasive alternative to traditional external aortic cross-clamps. **Remote Management:** Formulating strategies for delivering antegrade cardioplegia and venting the aortic root entirely through integrated, multi-lumen peripheral access **5.** **Targeted Regional Perfusion in Oncology** Techniques for systemic vascular isolation and the maintenance of independent extracorporeal circuits for targeted hepatic or extremity perfusion. **Isolated Hepatic Perfusion (IHP)Vascular Isolation Dynamics:** The complex surgical and percutaneous routing required to completely isolate the hepatic artery and retro hepatic inferior vena cava from the systemic circulation. **Tissue Viability and Oxygenation:** Managing an independent mini-circuit equipped with a membrane oxygenator to sustain extremity tissue viability and regulate precise regional temperatures during high-dose drug exposure. Career planning and professional growth strategies	**10**
Total		**45**

Practical / Tutorial / Clinical Learning Activities (Credit=2+1=3, Hours=60+15=75)

- Case-based discussions on advanced perfusion applications and emerging technologies.
- Seminar presentations on recent developments in perfusion science and extracorporeal support.
- Review and discussion of professional standards, guidelines, and regulatory frameworks.
- Exposure to simulation-based learning and advanced clinical scenarios where available.
- Portfolio development, logbook review, and career planning exercises.
- Literature review and appraisal of recent perfusion research publications.
- Discussions on postgraduate education, certification pathways, and professional advancement.
- Relevant practical or clinical observation as per institutional availability.
- Assignment preparation and submission.

BPERT 450- Internship (Semester VII & VIII)

Course Code	Course Title	Credit	Contact Hours
BPERT.450	Internship	54	2340

Course Rationale

The internship provides a structured transition from classroom learning to supervised clinical practice in Perfusion Technology. It enables students to integrate knowledge of cardiovascular physiology, perfusion science, extracorporeal circulation, patient monitoring, and professional ethics into real-world clinical settings.

Through rotations in cardiac operating rooms, perfusion services, intensive care units, extracorporeal support services, and related departments, students develop technical competence, clinical judgment, communication skills, and professional responsibility. The internship prepares graduates for safe entry-level perfusion practice and lifelong professional development within multidisciplinary healthcare teams.

Internship Duration

12 Months (Semester VII & VIII)

Schedule: 42 hours/week (7 hours/day, 6 days/week)

Learning Outcomes

At the end of the internship, students should be able to:

- Participate safely in the preparation, operation, and post-procedure management of cardiopulmonary bypass circuits under supervision.
- Demonstrate competency in equipment preparation, priming, monitoring, troubleshooting, and documentation.
- Assist in perioperative perfusion care while adhering to safety protocols and ethical standards.
- Apply infection prevention, quality assurance, and patient safety principles in clinical practice.
- Communicate effectively with surgeons, anaesthesiologists, perfusionists, and other healthcare professionals.
- Maintain accurate clinical records, logbooks, and quality documentation.
- Demonstrate professionalism, leadership qualities, and readiness for independent entry-level practice.
- Participate in audit, research, and quality improvement activities related to perfusion services.

Table Internship Rotation Structure & Competencies

Area	Duration (Months)	Competencies
Cardiopulmonary Bypass (Adult Cardiac Surgery)	4	Circuit preparation, priming, de-airing, CPB monitoring, perfusion charting, anticoagulation monitoring, patient safety protocols
Cardiac Operating Room & Clinical Perfusion Practice	2	Equipment setup, cannulation awareness, cardioplegia delivery observation, communication during surgery, troubleshooting assistance
Intensive Care Unit (Cardiac ICU)	2	Hemodynamic monitoring, postoperative care awareness, ventilator basics, IABP/ECMO observation, multidisciplinary communication
ECMO / Mechanical Circulatory Support Services	2	ECMO circuit identification, monitoring principles, anticoagulation awareness, emergency preparedness, device safety
Research, Audit and Quality Improvement	2	Literature review, audit participation, data collection, outcome analysis, quality improvement projects, report preparation

`Internship Rotation Plan

- **Posting Guidelines:** Every student shall complete all prescribed rotations with documented competency acquisition.
- **Attendance & Conduct:** Minimum 90% attendance and adherence to institutional regulations are mandatory.

- **Clinical Supervision:** Students shall perform activities only under the supervision of qualified perfusionists and authorized faculty.
- **Assessment:** Internship shall be competency-based and non-CGPA contributing unless otherwise specified by the university.
- **Certification:** Internship completion certificate shall be awarded upon satisfactory completion and verification by the HOD/Coordinator and Head of Institution.

Competency Domains for Alignment

Domain	Representative Competencies
Cognitive & Clinical Reasoning	Perfusion planning, physiological interpretation, problem solving, clinical decision awareness
Technical & Psychomotor Skills	Circuit assembly, priming, monitoring, equipment handling, troubleshooting, documentation
Professionalism & Ethics	Patient safety, confidentiality, accountability, ethical practice, infection prevention
Communication & Teamwork	Interdisciplinary communication, handover, documentation, teamwork in the cardiac operating room
Research & Quality Improvement	Clinical audit, data collection, outcome evaluation, literature review, evidence-based practice
Leadership & Management	Resource utilization, equipment management, initiative, professional responsibility

Internship Logbook

Requirements Daily Clinical Log

- Date-wise recording of procedures observed and assisted.
- Documentation of clinical activities and learning experiences.
- Supervisor verification and signature.

Weekly Learning Objectives

- Rotation-specific goals.
- Reflection on clinical experiences.
- Progress review with supervisor.

Competency Checklist

- Circuit assembly and priming.
- Equipment identification and operation.
- Monitoring and documentation.
- Safety procedures and troubleshooting.
- Clinical communication and professionalism.

Supervisor Evaluation

Assessment using a structured rating scale covering:

- Technical competence.
- Clinical understanding.
- Professional behaviour.
- Communication skills.
- Safety awareness.
- Reliability and teamwork.

Formative Assessment Methods

- Direct Observation of Procedural Skills (DOPS)
- Objective Structured Practical Examination (OSPE)
- Mini Clinical Evaluation Exercise (Mini-CEX)
- Case Presentations
- Reflective Portfolios
- Logbook Assessment
- Clinical Viva Voce
- Supervisor Evaluations
- Audit and Research Project Reports
- Simulation-Based Assessments

Internship Completion Requirements

Students must satisfactorily complete:

- Prescribed clinical rotations.
- Required minimum attendance.
- Competency checklist validation.
- Logbook submission.
- Clinical case presentations.
- Research/audit assignments.
- Professional conduct requirements.

Internship Certification

The internship completion certificate shall include:

- Clinical rotation details and duration.
- Total internship hours completed.
- Competencies achieved.
- Audit, research, and quality improvement activities undertaken.
- Certification by the HOD/Coordinator and Head of Institution.
- Board of examiners for 7th & 8th semester:
- HOD of B.Sc. (PrT): Chairperson
- Programme Co-ordinator/Course Co-ordinator/Chief of B.Sc. (PrT)/In charge of B.Sc. (PrT): Co-chairperson
- Subject Experts: Internal examiners (two) members

Note: The B.Sc. (PrT) degree shall be awarded only after successful completion and validation of the prescribed internship requirements.

BPERT 500: Dissertation / Project

Course Code	Course Title	Credits	Contact Hours
BPERT 500	Dissertation / Project	6	180

Course Learning Outcomes

At the end of the course, the student will be able to:

- Identify and formulate a research problem relevant to Perfusion Technology.
- Conduct a comprehensive review of scientific literature.
- Design and execute a research study using appropriate methodology.
- Collect, analyse, and interpret research data.
- Apply ethical principles in clinical and biomedical research.
- Prepare a structured dissertation following academic standards.
- Present research findings effectively through oral and written communication.
- Demonstrate evidence-based clinical reasoning and critical thinking skills.

Course Content

Unit	Topics	Hours
I	Research problem identification, literature review, research objectives, hypothesis formulation, research ethics, proposal preparation	36
II	Research methodology, study design, sampling techniques, data collection tools, protocol development	36
III	Data collection, statistical analysis, interpretation of results, data presentation	36
IV	Dissertation writing, referencing, plagiarism awareness, scientific communication and manuscript preparation	36
V	Seminar presentation, dissertation submission, viva voce, defence of research findings	36
	Total	**180**

Assessment Pattern

Component	Marks
Research Proposal & Progress Review	15
Literature Review	15
Data Collection & Analysis	20
Dissertation Report	20
Seminar Presentation	10
Viva Voce	20
Total	**100**

ACADEMIC SESSION 2024-25 (COURSE CURRICULUM)

Semester V

BPERT-401: Special Situations in Perfusion Technology | Credits: 4 | 3+1+0 | 100

Course Rationale: Prepares students for situations requiring modification of standard CPB strategies.

Course Learning Outcomes:

1. Explain perfusion principles for aortic surgery.
2. Describe pregnancy and paediatric perfusion considerations.
3. Explain DHCA, ACP and RCP principles.
4. Describe minimally invasive and selected non-cardiac perfusion procedures.

5. Apply structured safety checklists to special cases.

Unit-wise Content

Unit	Content	Hours
I	Aortic aneurysm/dissection and thoracic vascular disease.	8
II	Foetal circulation, CPB in pregnancy, reperfusion injury and special CPB checklists.	10
III	Paediatric and infant CPB: circuits, cannulae and blood prime concepts.	8
IV	DHCA, ACP/RCP, alpha-stat and pH-stat concepts.	10
V	Minimally invasive cardiac surgery, non-cardiac CPB and perfusion safety devices.	9

Practical / Skills

1. Special-case circuit planning.
2. DHCA/ACP/RCP simulation.
3. Paediatric circuit identification.
4. Case-based imaging interpretation.
5. Safety-device identification.

Suggested Assessment: Written + case-based practical/seminar.

BPERT-402: Mechanical Circulatory Support & ECMO | Credits: 5 | 2+1+2 | 100 T + 50 P

Course Rationale: Provides structured undergraduate-level exposure to IABP, ECMO and VAD concepts, monitoring and emergency recognition.

Course Learning Outcomes:

1. Explain principles and indications of IABP, ECMO and VADs.
2. Identify circuit/device components.
3. Interpret basic flow, pressure and oxygenation information.
4. Recognise common device complications and emergencies.
5. Demonstrate safe observation/handling skills within the student scope of practice.
6. Explain crystalloid and blood cardioplegia strategies.
7. Describe common cardioplegia solutions and delivery systems.
8. Explain heparin monitoring, heparin resistance, HIT and reversal.
9. Relate vasoactive and inotropic drugs to CPB and postoperative haemodynamics.
10. Explain temperature management and organ effects of CPB.

Unit-wise Content

Unit	Content	Hours
I	IABP: components, balloon, indications, insertion/removal concepts, monitoring and complications.	8
II	ECMO: VV/VA concepts, components, indications, contraindications and monitoring.	12
III	VADs: components, indications, limitations and total artificial heart overview.	8
IV	MCS emergencies, anticoagulation, oxygenation and troubleshooting principles.	9
V	Recent developments and multidisciplinary management.	8
I	Myocardial protection: St Thomas, del Nido, Custodiol/HTK, blood cardioplegia and delivery systems.	10
II	Vasodilators, vasoconstrictors, antiarrhythmics, diuretics, inotropes and selected sedative/analgesic drugs.	12

III	Heparin dosing/monitoring, heparin resistance, HIT, alternatives and protamine.	10
IV	Temperature management, hypothermia, rewarming and temperature gradients.	6
V	Systemic effects of CPB: CNS, respiratory, renal, hepatic, immune and inflammatory responses.	7

Practical / Skills

1. IABP waveform/triggering demonstration.
2. ECMO circuit assembly simulation.
3. Flow/pressure monitoring.
4. VAD component identification.
5. Emergency scenario discussion.

Practical / Skills

1. Prepare/compare cardioplegia plans using case scenarios.
2. Interpret ACT/heparin-monitoring cases.
3. Identify common vasoactive/inotropic agents.
4. Simulate temperature-management decisions.
5. Case-based drug selection.

Suggested Assessment: Written + drug/cardioplegia OSPE + viva.

Suggested Assessment: Written + MCS/ECMO OSPE + case presentation.

BPERT.403: BASIC EMERGENCY CARE AND FIRST AID

Course Code	Course Title	Credit	Contact Hours
BPERT.403	Basic Emergency Care and First Aid	3	60

Course Rationale

Students will acquire knowledge and **practical skills** necessary to recognize emergencies, provide first aid and perform basic life support.

Learning Objectives

- Assess emergency situations safely.
- Demonstrate CPR and Basic Life Support.
- Provide first aid for common medical and surgical emergencies.

Unit	Topic	Hours
I	Principles of First Aid, Emergency Assessment, Golden Rules of First Aid	**4**
II	Wounds, Bleeding, Burns, Fractures, Sprains and Bandaging Techniques	**2**
III	Poisoning, Snake Bite, Scorpion Bite, Dog Bite and Foreign Body Management	**3**
IV	Shock – Types, Clinical Features and Initial Management	**2**
V	Vital Signs Assessment – Pulse, Blood Pressure, Temperature and Respiration	**2**
VI	Basic Life Support (Adult and Paediatric CPR), Airway Management and Recovery Position	2
	Total	15

Practical / Tutorial / Clinical Learning Activities (Credit =1+1=2, Hours- 30+15=45)

- Adult, child, and infant CPR: Learn the proper techniques for chest compressions, rescue breaths, and AED use.
- Foreign airway obstruction: Understand how to recognize and manage choking in adults, children, and infants.
- Breathing emergencies: Learn how to assess and manage respiratory distress and provide oxygen therapy.
- Automated external defibrillation (AED): Get trained on how to safely and effectively use an AED in an emergency.
- Team dynamics and communication: Develop skills for effective communication and teamwork during emergencies.

BPERT.404: MEDICAL LAW AND ETHICS

RATIONALE

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

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

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours

The important and relevant topics that need to focus on are as follows: 1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics – Confidentiality 4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia 7. Organ transplantation 8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.	**18**
9. Professional Indemnity insurance policy 10. Development of standardized protocol to avoid near miss or sentinel events 11. Obtaining an informed consent. 12. Medical ethics - Definition - Goal - Scope 13. Introduction to Code of conduct 14. Basic principles of medical ethics – Confidentiality 15. Malpractice and negligence - Rational and irrational drug therapy 16. Autonomy and informed consent - Right of patients 17. Care of the terminally ill- Euthanasia 18. Organ transplantation 19. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects. 20. Professional Indemnity insurance policy 21. Development of standardized protocol to avoid near miss or sentinel events 22. Obtaining an informed consent.	

S.No.	Title of Book	Author	Publication
1	Medical Law and Ethics	Bonnie F. Fremgen	Pearson
2	Medical Law and Ethics	Jonathan Herring	OUP UK
3	Medical Law and Ethics	Purosottam Behera	Mittal Publications
4	Reflections on Medical Law and Ethics in India	Bismi Gopalakrishnan, Mercy Khaute, B. Sandeepa Bhat	Eastern Law House

Semester VI

BPERT-405: Advanced Perfusion & Perfusion Safety | Credits: 6 | 3+1+2 | 100 T + 50 P

Course Rationale: Consolidates advanced perfusion management, complex extracorporeal support and prevention/management of perfusion accidents.

Course Learning Outcomes:

1. Integrate advanced CPB monitoring and safety principles.
2. Explain peripheral bypass and assisted venous drainage concepts.
3. Describe perfusion approaches for complex cardiac and thoracic procedures.
4. Recognise mechanical, electrical, gas and patient-related perfusion emergencies.
5. Demonstrate structured emergency response in simulation.

Unit-wise Content

Unit	Content	Hours
I	Advanced extracorporeal support, peripheral bypass, femoral-femoral bypass and peripheral cannulation.	12
II	Vacuum-assisted venous drainage, kinetic augmentation, suction bypass and advanced circuit concepts.	10
III	Advanced paediatric and complex perfusion principles.	10
IV	Perfusion accidents: mechanical/electrical failure, air, pressure, oxygenation and coagulation problems.	15
V	Team response, safety culture, incident review and prevention.	13

Practical / Skills

1. Advanced circuit planning.
2. Emergency pump-failure simulation.
3. Air-in-circuit response simulation.
4. Oxygenator/gas-supply failure scenario.
5. Perfusion accident communication drill.
6. Case presentation.

Suggested Assessment: Written + high-stakes simulation/OSCE + competency logbook.

BPERT-406: Advanced & Recent Developments in CPB and Perfusion | Credits: 6 | 3+1+2 | 100 T + 50 P

Course Rationale: Provides an evidence-informed overview of emerging and advanced perfusion practice while keeping undergraduate expectations realistic.

Course Learning Outcomes:

1. Describe current developments in perfusion technology at an appropriate undergraduate level.
2. Explain perfusion for paediatric, aortic, minimally invasive and selected non-cardiac procedures.
3. Discuss ECMO and extracorporeal support developments.
4. Evaluate benefits, limitations and safety considerations of new technologies.
5. Present a recent research paper or technology review.

Unit-wise Content

Unit	Content	Hours
I	Advanced paediatric perfusion and complex congenital surgery.	8
II	ECMO, thoracic aortic surgery, DHCA and cerebral perfusion.	12
III	Perfusion outside the conventional OT, invasive cardiology and selected non-cardiac applications.	8
IV	Minimally invasive surgery, safety devices and perfusion-system developments.	10
V	Recent evidence, emerging technologies, experimental perfusion and future	10

	directions.	

Practical / Skills

1. Journal/paper presentation.
2. Technology appraisal.
3. Case-based discussion.
4. Simulation of selected advanced techniques.

Suggested Assessment: Written + seminar/paper presentation + practical case discussion.

RMB-401: Research Methodology, Biostatistics | Credits: 3 | 2+1+0 | 100

Course Rationale: Enables students to understand, interpret and communicate clinical research without
requiring advanced mathematical statistics.

Course Learning Outcomes:

1. Formulate a focused clinical research question.
2. Distinguish common study designs.
3. Understand sampling, variables and basic sample-size concepts.
4. Summarise data using appropriate descriptive statistics.
5. Interpret confidence intervals, p-values and basic statistical tests.
6. Read tables/graphs and identify common sources of bias.
7. Prepare a brief evidence-based presentation.

Unit-wise Content

Unit	Content	Hours
I	Research questions, literature search, study designs, variables and measurement.	4
II	Data presentation, frequency distributions, tables, graphs and descriptive statistics.	4
III	Mean, median, mode, range, variance, SD and IQR; choosing summaries.	4
IV	Probability, normal distribution, sampling, confidence intervals and basic significance testing.	3
V	Common tests: chi-square, t-test, non-parametric tests and correlation—conceptual use.	2
VI	Bias, confounding, ethics, plagiarism, referencing and evidence appraisal.	3

Practical / Skills

1. Prepare a data dictionary.
2. Create a simple table/graph.
3. Interpret a clinical research table.
4. Critically appraise one perfusion paper.
5. Prepare a 5–7 minute journal presentation.

Suggested Assessment: Written + research appraisal assignment/presentation.

BPERT.407	**Microbiology, Immunology and Infection Prevention credits: 3**

Unit	Content	Hours
I	**Microbiology Basics**• Bacteria, viruses, fungi and parasites overview• Normal flora and pathogenic organisms• Culture, sensitivity and antimicrobial basics• Sterilization and disinfection•	15

	Biofilm formation• Hospital pathogens: MRSA, VRE and gramnegative organisms• Bloodstream infection concepts• Sample collection awareness	
II	**Immunology Basics**• Innate and adaptive immunity• Antigen, antibody and complement• Inflammation and cytokines• Hypersensitivity overview• Transplant immunology awareness• Immune response to artificial surfaces• Systemic inflammatory response syndrome (SIRS)• Immunosuppression and infection risk	15
III	**Infection Prevention in Cardiac Care**• Surgical site infection prevention• Central line infection prevention• Ventilator-associated infection awareness• Antibiotic prophylaxis overview• Sterile handling of perfusion disposables• ECMO circuit infection awareness• Water/heater-cooler infection concern awareness• Biomedical waste and occupational exposure	10
	Total	40

Tutorial / Clinical Learning Activities

• Demonstration and practice of hand hygiene and PPE usage.
• Observation of sterilization and disinfection procedures.
• Interpretation of basic culture and sensitivity reports.
• Infection control audits and case-based discussions.
• Tutorial/seminar presentations on infection prevention topics.
• Relevant practical or clinical observation as per institutional availability.
• Logbook maintenance and assignment submission.

BPERT-408: Hospital Systems & Leadership | Credits: 3 | 2+0+1 | 100

Course Rationale: Prepares students for transition from undergraduate training to supervised professional employment and lifelong learning.

Course Learning Outcomes:

1. Explain hospital organisation and cardiac OT/ICU workflow.
2. Describe basic staffing, equipment and resource management.
3. Demonstrate leadership and teamwork principles.
4. Prepare professional documentation and a CV.
5. Plan continuing professional development and career progression.

Unit-wise Content

Unit	Content	Hours
I	Hospital organization, cardiac OT, ICU, CSSD, blood bank and allied departments.	8
II	Staffing, scheduling, inventory, equipment maintenance and documentation.	8
III	Leadership, teamwork, communication, conflict resolution and handover.	8
IV	Quality, safety, accreditation and professional accountability.	6
V	Career development, CV/interview skills, continuing education and higher studies.	5

Practical / Skills

1. Prepare a CV.
2. Mock interview.

3. Develop a duty/skill roster.
4. Map a cardiac OT workflow.
5. Prepare a professional development plan.

Suggested Assessment: Portfolio + viva/presentation + practical assignment.

7. Compulsory Clinical Internship – Semesters VII & VIII

The internship is an integral component of the four-year programme. It shall commence only after successful completion of the academic requirements of Semesters I–VI, subject to university rules. The internship is intended to consolidate knowledge and develop supervised entry-level clinical competence.

Internship Duration

One full academic year (Semesters VII and VIII). The curriculum intentionally removes the conflicting six-month/1800-hour statement from the submitted version. Actual duty hours, weekly off-days, leave and attendance shall follow university and hospital regulations.

Recommended Internship Rotation

Posting	Indicative Duration	Core Learning Focus
Orientation & induction	5 days	Hospital orientation, OT/ICU safety, infection control, documentation, professional conduct and emergency procedures.
Cardiac OT / CVTS Perfusion	Majority of internship	Pre-bypass assessment, circuit preparation, priming, CPB conduct, monitoring, myocardial protection, weaning, troubleshooting and documentation.
Cardiac ICU	30 days	Post-CPB care, haemodynamic monitoring, ventilation, ABG, fluids/electrolytes, bleeding, transfusion, ECMO observation and case presentation.
Blood Bank / Transfusion	5–10 days	Blood grouping, components, cross-match, storage, transfusion safety and reactions.
CSSD / Record & Quality	10–15 days	Sterilisation, instrument flow, documentation, quality and infection prevention.
Emergency/Casualty	5–10 days	BLS, emergency assessment, airway, shock and patient transport.
Biomedical Engineering	3–5 days	Equipment safety, maintenance, preventive checks and troubleshooting.
Research/Academic activity	Throughout internship	Case report, audit/research activity, seminar and professional presentation.

Internship Competency Framework

Each skill should be recorded using four levels:

Level	Meaning
1 – Observe	Student observes the procedure and explains the basic principle.
2 – Assist	Student assists a trained professional under direct supervision.
3 – Perform under supervision	Student performs the skill safely with direct supervision.
4 – Demonstrate	Student performs consistently at the expected undergraduate entry

competence	level, with appropriate supervision and escalation.

Minimum Internship Competencies

1. Follow patient-identification, infection-control and OT/ICU safety procedures.
2. Complete a pre-bypass equipment and safety checklist.
3. Identify and prepare the CPB circuit and major components.
4. Assist with circuit assembly and priming.
5. Understand and assist with initiation and maintenance of CPB under supervision.
6. Monitor and record flow, pressure, temperature, oxygenation, ACT, ABG and relevant laboratory parameters.
7. Assist with cardioplegia and myocardial-protection procedures.
8. Recognise common CPB abnormalities and immediately escalate concerns.
9. Assist with weaning from CPB under supervision.
10. Understand blood conservation, haemoconcentration and transfusion principles.
11. Observe and participate, within scope, in IABP/ECMO/MCS care.
12. Interpret basic ICU monitoring and postoperative cardiac-surgery trends.
13. Maintain accurate perfusion records and clinical documentation.
14. Communicate effectively during handover and emergencies.
15. Participate in multidisciplinary rounds and case discussions.
16. Demonstrate ethical and professional behaviour.
17. Complete a case report or approved academic project and present it.
18. Demonstrate readiness for supervised entry-level professional practice.

Internship Logbook – Recommended Sections

Section	**Examples**
OT/CPB	Case date, diagnosis, procedure, circuit, oxygenator, pump, priming, anticoagulation, monitoring, cardioplegia, CPB duration, temperature, complications and outcome.
ICU	Vitals, ECG, invasive monitoring, ABG, ventilation, fluids, drains, blood products, vasoactive support and case presentation.
MCS/ECMO	Device/circuit observation, indication, flow/pressure/oxygenation monitoring and emergency observations.
Skills	Checklist with Observe/Assist/Perform/Competent levels.
Quality & Safety	Safety checklist, incident/near-miss learning, infection-control activities and audit.
Academic	Seminar, case report, journal presentation, research/audit work.
Professionalism	Attendance, communication, teamwork, punctuality and feedback.

Internship Assessment

Component	**Suggested Weight/Approach**
Continuous formative assessment	Faculty/senior perfusionist observation using competency checklist.
Logbook	Completion, accuracy, reflective learning and verified procedures.
Mid-internship review	Formal feedback and individual learning plan.
Case presentation	Structured clinical case presentation.
Case report/project	One approved case report, audit or small academic project.

Final competency assessment	OSCE/OSPE or structured clinical assessment.
Professional behaviour	Communication, teamwork, patient safety and documentation.

The exact marks and pass criteria should be notified by the University through the applicable examination
regulations.

8. Student-Friendly Teaching and Assessment Framework

Recommended Teaching-Learning Methods

1. Short concept-focused lectures rather than prolonged monologues.
2. Case-based learning in every clinical/perfusion subject.
3. Simulation laboratory for CPB, ICU and emergency scenarios.
4. Demonstration followed by supervised student practice.
5. OSPE/OSCE stations for equipment, interpretation and safety skills.
6. Bedside teaching during clinical postings.
7. Small-group seminars and journal clubs.
8. Flipped learning for selected technical topics.
9. Clinical logbooks with faculty feedback.
10. Interdisciplinary teaching with anaesthesia, cardiac surgery, ICU, nursing and biomedical engineering teams.

Recommended Assessment Blueprint

Assessment Method	Purpose
MCQ/SAQ	Core knowledge and terminology.
Structured written questions	Conceptual understanding and clinical reasoning.
OSPE	Equipment identification, calculations, interpretation and technical skills.
OSCE	Communication, emergency response, patient safety and clinical reasoning.
Case-based assessment	Integration of basic science and perfusion knowledge.
Logbook	Longitudinal evidence of clinical exposure and competency.
Seminar/journal presentation	Communication and evidence appraisal.
Portfolio	Professional development, audit, reflection and documentation.

9. Recommended Skill Progression

Stage	Expected Student Activity
Semester I	Identify and explain; basic laboratory and communication skills.
Semester II	Observe and assist; basic ICU and CPB-equipment skills.
Semester III	Perform selected basic skills in simulation under supervision.
Semester IV	Integrate patient assessment with CPB conduct and troubleshooting.
Semester V	Apply advanced concepts to special situations and MCS.
Semester VI	Manage complex simulated cases and demonstrate safety-focused reasoning.
Internship	Perform appropriate entry-level tasks under supervision and demonstrate documented competence.

10. One Clinical Case Per Unit/Module

To reduce rote learning, every major module should include at least one clinically oriented case. Suggested cases include:

1. Congenital heart disease: identify anatomy and explain perfusion implications.
2. Adult valve surgery: plan basic CPB equipment and monitoring.
3. Low haematocrit during CPB: relate physiology, haemodilution and blood management.
4. High ACT/low ACT scenario: interpret anticoagulation monitoring.
5. ABG during CPB: identify acid-base and gas-exchange abnormality.
6. Low venous return: work through a structured CPB troubleshooting algorithm.
7. High arterial-line pressure: identify possible causes and immediate escalation.
8. Post-CPB low cardiac output: integrate haemodynamics, drugs and ICU care.
9. ECMO patient: identify circuit, flow and oxygenation variables.
10. Perfusion equipment failure: communicate and implement the institutional emergency protocol.

11. Curriculum Mapping to Graduate Competencies

Competency	Introduced	Developed	Consolidated
Basic anatomy/physiology	Sem I	Sem II–IV	Sem VI/Internship
CPB equipment	Sem II	Sem III	Sem IV–VI/Internship
CPB conduct	Sem II	Sem IV	Sem V–VI/Internship
ICU skills	Sem II	Sem IV	Internship
MCS/ECMO	Sem II observation	Sem V	Sem VI/Internship
Patient safety	Sem I–II	Sem III–V	Sem VI/Internship
Professional communication	Sem I	Sem II–IV	Internship
Research/evidence	Sem I–III exposure	Sem VI	Internship
Ethics/law	Sem I exposure	Sem IV–V	Internship
Leadership/employability	Sem II	Sem V	Sem VI/Internship

12. Recommended Faculty and Clinical Delivery Model

1. Each core perfusion course should have a designated course coordinator.
2. Practical classes should maintain an appropriate student-to-equipment ratio.
3. Clinical postings should have an identified faculty/senior-perfusion mentor.
4. Students should not independently perform high-risk clinical procedures beyond their authorised level of training.
5. Every clinical skill should have a written competency checklist.
6. Simulation should be used before first exposure to high-risk procedures wherever feasible.
7. Feedback should be documented after major clinical/simulation assessments.

13. Editorial and Technical Corrections Made

1. Standardised inconsistent course titles and removed duplicated/ambiguous course numbering.
2. Corrected terminology such as 'Conduction of CPB' to 'Conduct of Cardiopulmonary Bypass'.
3. Corrected 'Asics of pumps' to 'Fundamentals of Pumps, Oxygenators, Filters & Blood Components'.
4. Changed generic 'Pharmacology drugs' to clinically descriptive pharmacology titles.

5. Standardised 'Mechanical Circulatory Support Device' to 'Mechanical Circulatory Support & ECMO'.
6. Removed repetition within the Medical Law and Ethics topic list.
7. Separated general pathology from perfusion-oriented applied pathophysiology.
8. Reframed hospital management content for perfusion professional practice.
9. Made the four-year duration and one-year internship internally consistent.
10. Standardised headings, outcomes, units, practical skills and assessment language.

Curriculum Revised & Compiled by:
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