

**ANDHRA PRADESH PARA MEDICAL
BOARD**

HYDERABAD

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Syllabus for

**DIPLOMA IN PERFUSION TECHNICIAN COURSE
(TWO YEARS COURSE)**

**B.N.S. Kumar
Secretary**

In view of representation from the Faculty the Syllabus for the 1st year in all Para medical courses is modified accordingly and kept on website.

DIPLOMA IN PERFUSION TECHNICIAN COURSE (TWO YEARS COURSE)	
Syllabus for First Year	
Paper-I	<u>BASIC HUMAN SCIENCES</u> A) Basics of Anatomy B) Basics of Physiology C) Basics of Biochemistry D) Basics of Bio-statistics
Paper-II	A) Basics of Pathology B) Basics of Blood Banking C) Basics of Microbiology D) Basics of Central Sterilization Services.
Paper-III	A) Hospital Awareness B) Familiarization of different tables/tubes in surgical department, Surgical Awareness, preparation of patient for surgery. C) Patient related services. D) Communication and Computer Skills, Audio & Visual Aids

**DIPLOMA IN PERFUSION TECHNICIAN COURSE
(TWO YEARS COURSE)**

Syllabus for Second Year

Paper-I	<ul style="list-style-type: none">A) Anatomy, Physiology, Basics of Diagnostic techniquesB) AngiographyC) Oxygenators, Theory of Blood Pump, Gross Anatomy and Structural Features of Heart, OxygenationD) Monitoring, Instrumentation and measurements
Paper-II	<ul style="list-style-type: none">A) Patho Physiology and Pharmacology & Perfusion TechniquesB) Adequacy of PerfusionC) Applied Perfusion Technology, Introduction to Perfusion Technology, Perfusion Equipments, Biomedical ElectronicsD) Perfusion problems during radio pulmonary bypass
Paper-III	<ul style="list-style-type: none">A) Cardio Pulmonary By-Pass, Clinical Application of Bypass TechniquesB) Occupational Aspects of PerfusionC) Postoperative Intensive Care unit ManagementD) Instrumentation Study, Instrument Measurement & Critical Care equipment.

1st YEAR

PAPER-I

Basics of Anatomy & Physiology

Basics of Anatomy

1. Introduction to Human Anatomy
2. Cell- Tissues Properties, Different Tissues
3. Digestive System & Hepatobiliary System
4. Respiratory System
5. Cardio Vascular System
6. Lymphatic System
7. Bones and Joints
8. Nervous System
9. Endocrine System
10. Sense Organs
11. Excretory System
12. Reproductive System

Basics of Physiology

1. Introduction to Human Physiology
2. Blood
3. Cardio Vascular System
4. Lymphoid System
5. Digestive System
6. Respiratory System
7. Nervous System
8. Endocrine System
9. Excretory System
10. Reproductive System
11. Sense Organs

Basics of Bio – Chemistry

1. Introduction to Basics of Bio-chemistry including code of ethics for Medical Lab Technicians and Medical Lab Organization.
2. Reception, Registration and bio-chemical parameters investigated.
3. Glassware and plastic ware used in a bio-chemical laboratory.
 - a. **Glassware:**
 - 1) Types of glass and composition.
 - 2) Types of glassware used, their identification, application & uses.
 - 3) Cleaning, drying, maintenance and storage of glassware.
 - b. **Plastic ware: Brief outline**
4. Instrumental methods of Bio-chemical analysis.
 - a. **Colorimetry :**

Visual and photoelectric methods, instrumentation, principle & laws involved construction, operation, care and maintenance, applications.
 - b. **Spectrophotometry**

Principle and theory, types, construction, & applications
5. Basic lab operations like
 - a. **Separation of solids from liquids**
 1. Centrifugation: Principle, Different types of centrifuges care and maintenance, applications.
 2. Filtration using funnel.
 3. Weighing : Different types of balances used, care and maintenance.
 4. Evaporation
 5. Distillation
 6. Refluxing
 7. Drying different salts and dessicotion.

6. Water Chemicals and related substances
 - a. Purity of chemicals
 - b. Corrosives
 - c. Hygroscopic Substance
7. Prevention, Safety and first aid in lab accidents.
8. Collection of Specimens
 - a. **Blood:** Types of Specimens, Collection, Precautions during collection processing and preservation.
 - b. **Urine:** Types of Specimens, Collection, Precautions during collection, Processing and Preservation.
9. Urine biochemical parameters.
10. Units of measurements
11. **Solutions** : Types based on solute and solvent, Types based on method of expressing concentration, calculations.
12. **Carbohydrates:** Definitions, Biological importance, Acid value, iodine value, saponification value.
13. Amino acids and Proteins Definition, Biological importance, Classification, Qualitative tests.
14. **Diagonistic tests** : Blood sugar, Glucose tolerance test, Blood urea, Serumuric acid, Serum creatinine.
15. **Vitamins and Minerals**
 - a. **Vitamins:**
Water Soluble vitamins, Fat Soluble vitamins, Sources, Daily requirements, Deficiency diseases.
 - b. **Minerals :**
Sources, Daily requirements, Deficiency diseases.

Paper-II

Basics of Pathology

Introduction to Pathology in brief

1. Urine – Analysis – Physical Examination – specific gravity PH, reaction, colour.
Chemical Examination – Sugar Albumin, bile salts, bile Pigments etc.
Microscopic, Sediment for RBC, WBC, Epitheleal cells, casts, crystals, parasites.
Preparation of Reagents, procedure and principle of tests.
2. **Sputum Analysis** – Physical Examination, Preparation and staining smear for Microscopic Examination.
3. **Semen Analysis** – Physical Examination Microscopy – counting, motility, staining, Morphology, abnormal and normal forms.
4. **Body Fluids** – Differential count of Peritoneal, pericardial, pleural fluids and CSF, charging chamber, Identifying and counting the cells.

Basics of Microbiology

I. Introduction to Microbiology in brief

Definition,
History

II. Microscopy

- a) Principle working and maintenance of compound Microscope.
- b) Principle of Fluorescent microscope, Electron Microscope, Dark Ground Microscope.

History

Types of Microscope: (a) Light Microscope, (b) DGI, (c) Fluorescent, (d) Phase contrast.

(e) Electron Microscope : a). Transmission, b) Scanning, Principles of operational mechanisms of various types of Microscopes.

III. Sterilization and disinfection – classification and Methods of sterilization.

Sterilization: Definition, types and principles of sterilization methods:

(a) Heat (dry heat, moist heat with special reference to autoclave, (b) Radiation, (c) Filtration, efficiency testing to various sterilizers.

Antiseptics and Disinfectants :

Definition, types and properties, mode of action, uses of various disinfectants, precautions while using the disinfectants, qualities of a good disinfectants, testing efficiency of various disinfectants.

- 1) Principle and Methods of sterilization by heat
 - a) By Dry Heat, flaming, Red Heat, Hot air oven, incineration.
 - b) By Moist Heat-pasteurization, Inspissation, tyndalisation, autoclave.

2) Filtration Methods

- 3) Ionising Radiation – Disinfection, Mode of action and uses of important chemical disinfectants – Phenol and Phenolic compounds, alcohols, halogens, dyes and acids and alkalis.

4) Gaseous Methods of sterilization.

- IV. Cleaning, drying & Sterilization of Glassware disposal of contaminated material i.e. clinical infective material inoculated culture media. Handling and Disposal of Biomedical waste.
- V. **Biomedical waste management in a Microbiology Laboratory** : types of the waste generated, segregation, treatment, disposal.
- VI. Morphology and classification of Bacteria Sp. of cell, capsule, flagella, spore, Anaerobic Methods of cultivation of Bacteria.

PAPER- III

A. Hospital Awareness

A brief idea of hospital as an organization management different units of a hospital effective communication skills, communication channel

Maintenance of records
Effective leadership
General patient care
Medical terminologies
Vital signs
Unit preparation
Transporting & Transferring patients
Sterilization Techniques
Control of infection
Medication – Oral & parenteral
Admission – Discharge procedure
Bandages

Practicals : Posted in ward & taught clinically

A. Surgical Department

Familiarization of different tubes

1. Drainage tube
2. Post Operative Exercises
3. Post OP Management of Patient
4. Shock of Management
5. Changing Surgical Dressing.

1. Preoperative preparation of patient
2. Preanesthetic preparation
3. Assisting in operation
4. Anaesthesia
5. CSSD
 1. Recovery room
 2. Movement of papers
 3. Scheduling of theaters
 4. Supplying of articles
 5. Specific area practices
 - As scrubnurse
 - As circulating nurse

Communication and Computer Skills, Audio & Visual Aids.

COMMUNICATION

Process
Types of communication
Strategies for effective Communication
Barriers of communication

SOFT SKILLS

Presentation with the use of visual aids such as power point
Conversation
Extempore speech, usage of effective language for communication of health work.
Case studies and situational analysis
Survey and Reporting

COMPUTER

Computer basic
MS – Office
MS – Word
MS – Excel
MS – Power Point

INTERNET CONCEPTS

Browsing
Down- Loading
Use of Slide Projector

2nd Year

PEPER-I

A) Basics of diagnostic techniques

Chest of X-ray: Normal chest x-ray, postern-aneter-view, views in different positions, identification of borders of heart.

-cardiomegaly, pneumothorax, hydrothorax, pleural effusion, etc.

ECG - Normal electro cardio graph different waves, its significance, atrial arrhythmias, ventricular arrhythmias, heart blocks etc.

Echo- trans thoracic echo, transesophageal echo, indications applications, different views and information.

Laboratory investigations in relation to perfusion technology Hemoglobin, blood grouping, urine analysis, mini-renal etc.

History of cardiac surgery and perfusion Specific reference of Gibbon Lillehei, Carrel Pre cardio pulmonary bypass surgery Axygous flow principle Hypothermic / nonhypothermic non-cardio pulmonary surgery including gross's well technique and controlled cross circulation.

B) Angiography –

coronary angio, peripheral angio, coronary- normal coronary and its branches in different views, indications and limitations. Peripheral - cerebral, renal, limbs (upper and lower). Nuclear cardiology - thallium scan, indications, advantages and disadvantages.

C) Oxygenators, Theory of Blood Pump

Various types of oxygenators Bubble oxygenators Rotating spiral / cylinder / disc oxygenators Membrane oxygenators.

Theory of blood pump, ideal blood pump, pulsatile versus non-pulsatile flow, occlusive and non-occlusive pumps, various types of pumps - roller, bellow, sigmamotor, diaphragm, ventricular and centrifugal pumps.

Element of extracorporeal circulation / hazards of:

- a. Blood failure
- b. Bubble trap
- c. Flow meters
- d. Temperatures
- e. Heat exchanger
- f. Regulating devices

Connection of the vascular system with extracorporeal circulation:

Arterial and venous cannulae, connection tubes and connectors vents, suckers, cardioplegia delivery system, venous drainage.

Haemodynamics of arterial return, venous drainage, cardioplegia delivery and venting.

Blood grouping, handling of blood products and their management blood components and their use.

A. Monitoring and instrumentation and measurements

Concepts of monitoring- instrumentation technology of ECG machine, pressure transducers, syringe and peristaltic pumps, monitors, ventilators, pulse oximeters, temperature probes and thermo regulatory monitoring, defibrillators and fibrillators, Piped and non-piped gas delivery systems and connections. Basic physics related to medically used gases.

Haemodynamic monitoring

Haemostatic monitoring

Haematologic monitoring

Maintenance of oxygen, carbon dioxide and acid base status and their monitoring

Neurological monitoring (SSPE, EEG and cerebral function monitor)
Aseptic technique

Physiology of extra-corporeal circulation Materials used in extracorporeal circuit
Principles of extracorporeal gas exchange.

Conduct and monitoring of cardiopulmonary bypass:

ECG, Arterial blood pressure, CVP, Arterial pressure pulse wedge, pressure measurement, arterial pump flow rate, suction pump flow, temp, biochemistry, central function, computer linked monitor,

PAPER-II

A) Details of Perfusion Techniques

Adult perfusion, Paediatric perfusion, assessment of patient (via history) before bypass, Assessment of patient post bypass, Calculation of prime components, Selection of cannulae, Assembly of equipment, Priming of oxygenator, Going on and coming off bypass, Adverse effects of CPB

Monitoring and control of:

Flow/pressure, Haemodilution, Haemodynamic aspect of total Heart Lung Bypass, Metabolic aspects of total Heart Lung Bypass, Acid/base balance, Oxygen and carbon dioxide exchange, Patient core temperature, Anticoagulation, Hypothermia, Total circulatory arrest, Pressure, Flow, Resistance, Adequacy of perfusion, Myocardial preservation. Management of complications and disasters, Auto transfusion, Recording of bypass data, Check lists, Safety of perfusion, Power and equipment failures, Preventive maintenance.

B) Adequacy of perfusion –

General considerations, specific aspects of perfusion, monitoring, other concomitants which may affect its adequacy

Pulsatile perfusion - introduction, theory & physiology of pulsatile flow, haemodynamic, metabolic effects, clinical use, hematological effects

Cannulation technique during cardiopulmonary bypass: Venous cannulation-principles of venous drainage, types and sizes of cannula, connection to the patient, the venous drainage,

Counter pulsation techniques and assist devices

Perfusion techniques for pediatric cardiac surgery:

Perfusate composition, cannulation techniques, aspects of perfusion practice in paediatric cardiac surgery, myocardial protection, removal of sugi, pressure monitoring, heparin dosage reversal.

ECMO - special perfusion techniques for special cardiac surgeries

(hypothermia and circulatory arrest) Perfusion for non cardiac surgery, invasive cardiology and outside the operation suite.

Recent advances in perfusion techniques.

C) Applied Perfusion Technology

Pharmacokinetics: Haemodilution, hypothermia perfusion, acidbase status, sequestration and pharmacodynamics: Binding (to tissue, protein), age, tissue penetration, temp, acid base status, anaesthetic agents, specific drugs with CPB influence, properties, opioids, neuromuscular blocking drugs, calcium channel blockers, vasodilators, nitrates, beta- blockers, calcium entry blocking drugs in pulmonary bypass surgery.

Drugs used in cardio Pulmonary bypass: premedication drugs used by anaesthesiologists example beta adrenergic blocking agents, calcium entry blocking drugs, antihypertensive drugs, anticholinergic drugs, sedative/hypnotics drugs etc.

Arterial cannulation, cannulas, connection to a patient.
Cardioplegia cannulae, serts

Termination of cardiopulmonary bypass - preparation of separation, separation, technique, separation problems - situation, vasodilation, hypotension, principles and methodology.

Myocardial protection and cardioplegia - pretreatment of the myocardium, cardioplegia, hypothermia, controlled reperfusion, cycocardial protection for specific clinical problems, Complications of cardioplegia. Non cardioplegic methods during cardiac surgery on cardiopulmonary by pass.

Priming of fluids and hemodilution: Crystalloids, 5% Dextrose, Balanced salt 50m, Mannitol, colloidal osmotic pressure, plasma expander, plasma preparation, dexatrans, gelatins, hetastarch.

hemodilution: Historical perspective, advantages - physiological effects, complications during bypass, safety during cardiopulmonary bypass, bypass safety, organizational aspects, accidents & its management (perfusion relative), coagulopathies, mechanical and electrical failure, perfusion management, perfusion systems, safety and performance surgical teams.

Blood cell trauma - analysis of forces of fluid motion, effects of physical forces on blood cells, clinical effect. Complications of blood transfusion.

Anticoagulation on bypass, its monitoring, its reversal and complications. Heparinless bypass. Platelet aggregation and platelet dysfunction. Coagulopathies due to cardiopulmonary bypass and its management.

D) Perfusion problems during radio pulmonary bypass

Perfusion problems during radio pulmonary bypass, high arterial line pressure, air and arterial line, poor venous return, air lock in a venous line
Inflammatory responses to cardiopulmonary bypass & its clinical effects. Methods to minimize the same. Immune response, neuroendocrine, renal metabolic splanchnic response, pulmonary response and electrolyte response to cardiopulmonary bypass..

Blood conservation hemofiltration & dialysis during cardiopulmonary bypass including modified ultra filtration reverse autologous priming and other methods.

Micro emboli gaseous and particulate, filters used in cardiopulmonary bypass circuit

Micro pore filtration during cardiopulmonary bypass.

Complications and safety during cardiopulmonary bypass- bypass safety, organizational aspects, accidents, coagulopathies, mechanical and electrical failures, perfusion management, perfusion systems, safety for the perfusionist and surgical team management of perfusion accidents

Minimally invasive surgery and the perfusionist.

Experimental perfusion

Cardiopulmonary resuscitation- Basic cardiac life support

Advanced cardiac life support

Biomedical Electronics

Basic Electricity, Electronics, Principles of Electrical Safety, Principles of recording biological signals, Principles of cardiac pacing and defibrillation.

Introduction to Perfusion Technology:

History and principles of operation of oxygenators, Design and efficiency of heat exchangers, oxygenators, roller pumps, Biocompatibility of equipment and techniques, Sterilization techniques, Technical aspects of ultra filtration.

Perfusion as a method of cardiopulmonary bypass.

Perfusion Equipments

Hardware: Heart-Lung machines/Centrifugal pumps, Pressure and low level alarm devices, Heart-lung heater/coolers, Mechanical/Electronic Flowmeters, Blenders, temperature monitors, computerized perfusion data systems, Oxygen analysers, Cell savers, Intra-aortic ballon pumps.

Disposable : Various types of Membrane and bubble oxygenators, reservoirs, Arterial filters, Pre bypass filters, Arterial, Venous cannulae, Hemoconcentrator devices, Cardioplegia sets, filters.

Gross Anatomy and Structural features of heart :

-Location, size, surface features, venous area, septum and atrial appendage.

Right atrium- structural features, venous area, septum and appendage.

Left atrium- structural features venous area, septum and appendage.

-Right ventricle- structural features inflow and outflow characteristics.

-Left ventricle- structural features inflow and outflow characteristics.

-Valves-location, structure and functions of each valve.

Blood supply of Heart in brief: Coronary arteries.

-Innovation: Sympathetic and parasympathetic sensory.

Oxygenation- general consideration^ bubble & membrane (including assessment and comparison of oxygenator function)

Heat exchangers - principles, function of heat exchangers & their management.

Pharmacology

This course introduces the students to basic Pharmacology of common drugs.

1. Terminology - Classification of drugs

Principles of drug administration and routes of administration, absorption, distribution, metabolism, excretion of drugs, factors influencing drug action dosage and factors modifying it.

Drug allergy and toxicity, mechanism of drug action (various ways in which they act)

2. Definition, actions, indications, contraindications, adverse reaction of the following;

Drugs acting on autonomous nervous system; stimulating and inhibiting, cholinergics and adrenergics. Drugs acting at neuromuscular junction and other muscle relaxant.

3. Cardiovascular drugs-enumerate the mode of action, side effects and therapeutic uses of the following drugs.

a. Antihypertensives example : beta adrenergic antagonists, alpha adrenergic antagonists etc.

b. Antiarrhythmic drugs

c. Cardiac glycosides

d. Sympathetic and nonsympathetic inotropic agents

e. Coronary vasodilators

f. Antianginal and anti failure agents

- g. Drugs used in haemostasis -anticoagulants Thrombolytics and antithrombolytics
- h. Cardioplegic drugs - history, principles and types of cardioplagia
- i. Primary solutions - history, principles and types
- j. Drugs used in the treatment of shock

4. Antihistamines and antiemetics –

Classification, mechanism of action, adverse effects, preparations, dose, routes and administration

5. Analgesics

- a. Definition classification
- b. Routes of administration, dose, frequency of administration, side effects and management of non opioid and opioid analgesics.

6. Drugs acting on CNS: Alcohol, Sedatives, Hypnotics, Anticonvulsants, Psychotherapeutics, Stimulants.

7. Anaesthetic agents

- a. Definition and classification of general anaesthetics
- b. Pharmacokinetics and pharmacodynamics of general anaesthetics, inhaled anaesthetic agents etc.
- c. Local anaesthetics - classification mechanism of action, duration and methods to prolongation of duration of action of local anaesthetics, Preparations, dose and routs of administration, side effects and managements.

8. Inhalation gases, preparations, classification mechanism of action.

9. Pharmacotherapy of respiratory disorders

- a. Introduction - Modulators of bronchial smooth muscle tone and pulmonary vascular smooth muscle tone.
- b. Mucokinetic and mucolytic agents
- c. Use of bland aerosols in respiratory care
- d. Pharmacotherapy of bronchial asthma

10. Diuretics

Classification, mechanism of action, adverse effects and complication. Preparation, dose and routs of administration.

11. Endocrine Pharmacology: Thyroid harmones, glucocorticoids, anabolic steroids, calcitonin, insulin and oral hypoglycemic agents.

12. Chemotherapy of infection

- a. Definition, classification and mechanism of action of antimicrobial agents and chemoprophylaxis
 - b. Classification, preparation, dose, routes of administration and adverse effects of penicillin, cephalosporins, antitubercular drugs etc.
13. Corticosteroids - classification, mechanism of action, adverse effects and complication preparation, dose and routes of administration.
14. Pharmacological protection of organs during cardio pulmonary bypass
15. Inhalation gases, preparation, classification mechanism of action.
16. Miscellaneous.
- a. IV fluids - various preparations and their usage.
 - b. Immunomodulatory agents
 - c. Newer drugs included in perfusion technology
 - d. Drugs used in metabolic and electrolyte imbalance

Practicals

PAPER-III

A) CLINICAL APPLICATION OF BYPASS TECHNIQUES

General bypass. Coronary. Valvular. Redos, Congenital, Ventricular assist. Isolated limb perfusion. ECMO. Total body washout.

Monitoring : Setup for ECG and intravascular pressure monitoring. Resuscitation and support.

Sterilization within the hospital and Administrative aspects of perfusion.

B) OCCUPATIONAL ASPECTS OF PERFUSION

Infectious diseases. Precautions. Stress/fatigue, Professional standards and modes of conduct, Bioethics.

Management/Quality control:

Quality control. Quality assurance. Management.

C) POST OPERATIVE INTENSIVE CARE UNIT MANAGEMENT

Basic Respiratory Physiology, Transducers, Types, Storage and standardization. Collection and handling of blood gas samples. Reflection of photometry and Techniques, calculations of Cardiac output.

Cardioverter : Defibrillators. Uses. Hazards

Resuscitation: Detection of Cardiac arrest. Emergency Resuscitation, Equipment for resuscitation.

Respirators: Mechanics of ventilation. Various types of ventilators. Volume ventilators. Pressure ' ventilators. Mechanical ventilators. Oxygen saturation monitor. Infusion pumps. ACT monitors.

PRACTICALS

1. Monitoring of vital signs, Spo2
2. ABG analysis
3. Types of Anesthesia required for different types of surgeries
4. A regular check of cannula and drains
5. Maintain records and reports
6. Transportation of patient to SICU
7. Suctioning of Endotracheal tube / Tracheostomy tube
8. After care of equipment
9. Mechanical ventilation – Settings and modes