

BCP-I EXAM 2026 – SYNOPSIS OF SYLLABUS

PART A: BASIC SCIENCES

HUMAN ANATOMY

I. CELL BIOLOGY AND HISTOLOGY

- - Cell: Organelles, membrane, cycle, mutations
- - Tissues: Epithelial, Connective, Muscle, Nervous
- - Healing, Membranes & Glands

Reference Texts: 1. Ross & Pawlina: Histology: A Text and Atlas , 8th ed., 2020 .

2. Alberts et al.: Molecular Biology of the Cell , 7th ed., 2022.

II. CARDIOVASCULAR SYSTEM

- Heart : Chambers, valves, coronary circulation, conducting system
- Circulation : Pulmonary, systemic, portal pathways, major vessels

Reference Texts:1. Moore & Dalley: Clinically Oriented Anatomy , 8th ed., 2017.

2. Gray's Anatomy for Students, 4th ed., 2019

III . RESPIRATORY SYSTEM

Airway Anatomy : Trachea, bronchi, bronchioles. , Lungs & Pleura: Structure, lobes, pleural cavity. ,
Respiration Mechanics & Gas Exchange., Nerve Supply.

Reference Texts: 1. Snell: Clinical Anatomy by Regions , 10th ed., 2018.

2. West: Respiratory Physiology: The Essentials , 11th ed., 2020

IV. NERVOUS SYSTEM

- CNS : Brain & spinal cord
- PNS : Spinal & cranial nerves
- ANS : Sympathetic & parasympathetic systems

Reference Texts: Haines: Fundamental Neuroscience for Basic and Clinical Applications , 6th ed., 2023

V. URINARY SYSTEM

- Kidneys: anatomy, nephron function

- Ureters, bladder, urethra: structure & features

Reference Texts: 1. Moore & Persaud: *The Developing Human: Clinically Oriented Embryology* , 11th ed., 2020.

2. Tortora & Derrickson: *Principles of Anatomy and Physiology* , 16th ed., 2021

VI. ENDOCRINE SYSTEM

Pituitary gland and hypothalamic control. , Thyroid gland: anatomy and hormones. , Adrenal glands: cortex and medulla. , Pancreatic islets (Islets of Langerhans) .

Reference Texts: 1. Young & O'Dowd: *Wheater's Functional Histology* , 6th ed., 2020.

2. Barrett et al.: *Ganong's Review of Medical Physiology* , 26th ed., 2019

HUMAN PHYSIOLOGY

I. Circulatory Body Fluids & Hematology

- Blood composition, hematopoiesis
- Blood cells (WBCs, RBCs, platelets)
- Blood groups, transfusion, coagulation, immunity

II. Cardiovascular Physiology

- Pacemaker & conduction
- ECG & arrhythmias
- Cardiac mechanics & hemodynamics
- Regulation (neural & reflexes)
- Regional circulations

III. Respiratory Physiology

- Pulmonary function & gas exchange
- Gas transport (O₂, CO₂)
- Acid-base balance
- Respiratory control (neural & chemical)

IV. Endocrine Physiology (Concise Study)

Hormones & functions of major glands (Thyroid, Pancreas, Adrenal, Pituitary)

V. Temperature Regulation

Thermoregulatory mechanisms: heat production, dissipation, feedback controls.

VI. Renal / Excretory Physiology

Filtration, tubular function, electrolyte balance, renal tests, micturition

Recommended References: 1. Guyton & Hall: Textbook of Medical Physiology , 14th ed., 2020.

2. Ganong's Review of Medical Physiology , 26th ed., 2019

BIOCHEMISTRY

1. Basic Concepts : Atomic weight, molecular weight, valency, normality, molarity

2. Biomolecules :

- Carbohydrates: Glycolysis, TCA cycle
- Lipids: β -oxidation, fatty acid synthesis
- Proteins: Amino acids, transamination, urea cycle
- Nucleic Acids: DNA/RNA structure, replication, transcription, translation

3. Energy : Bioenergetics, ATP generation, mitochondrial function

4. Clinical Biochemistry :

- LFTs, Cardiac Markers (Troponins, CK-MB, LDH, Myoglobin)
- Hormones (Thyroid, Insulin, Cortisol, Adrenal)

Recommended Reference Books: 1. Harper's Illustrated Biochemistry , 32nd Ed., 2022.

2. Lippincott's Illustrated Reviews: Biochemistry , 7th Ed., 2021.

MICROBIOLOGY

- Introduction: History, scope, applications
- Classification: Microorganisms (bacteria, viruses, fungi, protozoa)
- Bacterial Structure: Morphology, Gram +/- differences
- Antimicrobials: Mechanism, resistance, disinfection methods
- Sterilization: Physical & chemical methods, indicators
- Practical Techniques: Microscopy, staining (Gram stain), motility

Recommended Reference Books

1. Ananthanarayan and Paniker's Textbook of Microbiology – 12th Edition, 2023

2. Medical Microbiology by Jawetz, Melnick & Adelberg – 28th Edition, 2022

FUNDAMENTALS OF PERFUSION SCIENCE

- OR Protocols : Aseptic zones, hand hygiene, sterile techniques, equipment handling
- Equipment Safety : Electrical safety, biomedical equipment maintenance
- Infection Control : Biomedical waste management, sterilization methods
- Emergency Response : BLS, ACLS, Code Blue protocols
- Cardiopulmonary Bypass : CPB circuit components, perfusionist's role

Recommended Reference Books

1. Mishra, P. K. , Introduction to Perfusion Technology , 2nd Ed., Jaypee, 2021
2. Gravlee GP et al., Cardiopulmonary Bypass: Principles and Practice , 4th Ed., Wolters Kluwer, 2022
3. Standards and Guidelines for Perfusion Practice , American Society of Extracorporeal Technology (AmSECT), Latest Edition, 2023

APPLIED PATHOLOGY

- Cardiovascular : Atherosclerosis, hypertension, aneurysms, heart failure, cardiomyopathy, IHD, valvular diseases, congenital heart diseases
- Surgical considerations: CPB, valvular surgery, prosthetic valves
- Hematology : Anemia, leukocyte disorders, bleeding disorders, lab tests (CBC, coagulation profile)
- Respiratory : COPD, obstructive vs restrictive lung diseases, pulmonary edema, pleural effusion
- Renal : Clinical manifestations (hematuria, proteinuria), ARF, CRF, etiology, lab markers

Recommended Reference Books

1. Robbins & Cotran Pathologic Basis of Disease , Authors: Kumar, Abbas, Aster, 10th Edition, Elsevier, 2021.
2. Essentials of Pathology for Allied Health Sciences, Author: Harsh Mohan, 1st Edition, Jaypee Brothers, 2020

APPLIED PHARMACOLOGY

- General Principles : Pharmacokinetics/dynamics during CPB
- Cardiovascular : Inotropes, vasodilators, vasopressors, antiarrhythmics
- Anesthetic : General/local anesthetics, inhalational/IV agents
- Analgesics : Opioids, non-opioids
- Organ Protection : Neuroprotection, renal, hepatic, myocardial protection
- Emergency Drugs : Resuscitative agents, inhalational gases
- Respiratory : Bronchodilators, steroids, mucolytics
- Miscellaneous : Diuretics, antimicrobial agents, IV fluids, electrolyte supplements

Recommended Reference Books:

1. Rang & Dale's Pharmacology , Authors: H.P. Rang, J.M. Ritter, 10th Edition, Elsevier, 2023
2. Goodman & Gilman's: The Pharmacological Basis of Therapeutics, 14th Edition, McGraw-Hill, 2022

BCP-I EXAM 2026 – SYNOPSIS OF SYLLABUS

PART-B : PERFUSION SCIENCE

INTRODUCTION/FOUNDATION OF PERFUSION SCIENCE

- Diagnostics & Preoperative Techniques : Chest X-ray, ECG, echocardiography, angiography, nuclear cardiology, laboratory investigations.
- Monitoring & Instrumentation : ECG, pressure monitoring, oximetry, thermometry, defibrillators, gas delivery systems
- Extracorporeal Circulation : Principles, circuit materials, gas exchange, blood pumps (types & characteristics)
- Circuit Connections & Management : Vascular access, cannulae, auxiliary circuits, cardioplegia delivery, venting strategies
- Physiology & Materials : Biocompatibility, heat exchangers, flow meters, regulating devices
- Perfusion Techniques : Hemodynamic management, blood banking, component management

Recommended Reference Books

- 1.Gravlee, G.P., et al. Cardiopulmonary Bypass: Principles and Practice , 4th Edition, Wolters Kluwer, 2022
2. Ghosh, B. Textbook of Perfusion Technology ,2nd Edition, Jaypee Brothers, 2022

PERFUSION READINESS: ETHICS, LAW, AND SCIENTIFIC BASIS

- Medical Ethics : Autonomy, beneficence, non-maleficence, justice, informed consent
- Biostatistics : Data types, descriptive/inferential statistics, research interpretation
- Computer Applications : Basics of healthcare technology
- Electrical Safety : Principles, equipment safety, grounding, leakage current
- Biomedical Waste : Classification, segregation, disposal protocols
- CPR : BLS, ACLS, E-CPR, perfusionist's role
- ICU & Sterilization : ICCU protocols, infection control, sterilization methods
- Blood Transfusion : Indications, components, transfusion reactions, fluid therapy
- Autotransfusion : Cell salvage, indications, setup, advantages, limitations

Recommended Reference Books

1. **“Principles of Medical Ethics” – American Medical Association, Latest Ed.**
2. **Kishore J. – Medical Ethics & Law Simplified, 3rd Ed., Century Publications, 2021**
3. **Basu, S. – Biostatistics and Research Methodology, Jaypee, 2022**

CLINICAL PERFUSION SCIENCE

1. Pharmacological Aspects : Pharmacokinetics/dynamics, drugs used in CPB (anesthetics, vasodilators, inotropes, anticoagulants).
2. CPB Conduct : Setup, initiation, monitoring, management, hemodynamic/metabolic monitoring
3. Pulsatile Perfusion : Theory, physiology, hemodynamic impacts, clinical application
4. Cannulation : Arterial/venous approaches, site-specific considerations, complications
5. Termination of CPB : Weaning strategies, rewarming, volume management, separation criteria
6. Myocardial Protection : Pretreatment, cardioplegia types, hypothermia, controlled reperfusion
7. Oxygenation : Bubble vs membrane oxygenators, gas exchange principles, comparisons
8. Heat Exchange : Principles, function, efficiency, complications, temperature control
9. Priming Fluids : Types (crystalloid, colloid, blood), hemodilution, physiological impact

Recommended Reference Books

1. **Gravlee, G. P., Davis, R. F., Stammers, A. H., Cardiopulmonary Bypass: Principles and Practice – 4th Edition, 2021, Lippincott Williams & Wilkins**
2. **Khonsari, S. & Sintek, C., Cardiac Surgery: Safeguards and Pitfalls in Operative Technique* – 4th Edition, 2023, Springer .**

APPLIED PERFUSION SCIENCE

1. Blood Cell Trauma : Mechanical forces, effects on blood cells, clinical consequences (hemolysis, thrombocytopenia)
2. Anticoagulation : Heparin pharmacology, monitoring, reversal, heparin-free bypass, coagulopathy management
3. Inflammatory Response : SIRS, immunological, neuroendocrine, organ system responses, mitigation strategies
4. Blood Conservation : Intraoperative salvage, hemofiltration, dialysis, circuit miniaturization, hemodilution optimization

5. Microemboli & Filtration : Sources, effects, arterial line filters, micro-pore filtration, circuit design modifications

Recommended Reference Books

1. Gravlee, G.P., Davis, R.F., Stammers, A.H., **Cardiopulmonary Bypass: Principles and Practice*** – 4th Edition, 2021, Lippincott Williams & Wilkins.
2. Kumar, D., & Turner, M., **Clinical Perfusion Practice: A Physiological Approach*** – 1st Edition, 2020, Cambridge Scholars Publishing.

ADVANCED PERFUSION SCIENCE

1. Mechanical Circulatory Support : IABP, VADs, Total Artificial Heart, post-implantation care
2. Pediatric Perfusion : Neonatal strategies, circuit miniaturization, hypothermia, myocardial protection
3. ECMO : VV and VA ECMO, cannulation, anticoagulation, weaning, ECPR, transport
4. Minimally Invasive Surgery : Perfusion modifications, femoral cannulation, endoaortic balloon occlusion
5. Transplantation : Donor selection, graft harvest, preservation, immunosuppression
6. Specialized Perfusion : Arch surgery, regional organ perfusion, hybrid procedures
7. CPB Safety & Innovations : Complication management, special patient conditions, mini circuits, AI integration
8. Recent Advances : Biocompatible coatings, remote monitoring, perfusion data integration
9. Future Directions : Ex vivo organ perfusion, xenotransplantation, bioprinting, wearable devices

Recommended References Books 1. Kapoor PM. , **Cardiac Anesthesia & Perfusion Manual** , Jaypee Brothers, 2020.

2. AmSECT Standards and Guidelines for Perfusion Practice , 2024 Edition

CORE CALCULATIONS REQUIRED FOR PERFUSIONISTS

1. Hematocrit Adjustment (PCV on CPB) : Calculate required blood or plasma to reach target hematocrit during CPB.

2. Body Surface Area (BSA) Calculation : BSA, Lean body mass ,Used to determine cardiac index, flow rates, drug dosing.

3. BMI : Guides metabolic status and indexed perfusion requirements.

4. Arterial Oxygen Content (CaO_2), Oxygen Delivery (DO_2).
5. Oxygen Consumption (VO_2), Oxygen Extraction Ratio (O_2ER).
6. Systemic Vascular Resistance (SVR) & Pulmonary Vascular Resistance (PVR).
7. Oncotic Pressure & Plasma Volume Replacement
8. Electrolyte Correction Calculations.
9. Acid-Base Balance Interpretation.
10. Arterial Blood Gas (ABG) Analysis & Priming Volume Calculations.
11. Cardioplegia Delivery Volumes and Ratios.

CORE PRACTICAL SKILLS / SIMULATIONS

1. Setup of a full dummy CPB circuit with proper priming and de-airing.
2. Simulated perfusion emergencies : (if available /wet lab)

Oxygenator change, Reservoir level drop, Venous air lock, Arterial air detection, Runaway pump head, Heat exchanger water breach.

3. Identification and management of perfusion components: Cannulae, oxygenators, pumps, heat exchangers
4. ACT testing and result interpretation
5. Drug identification and perfusion pharmacology basics
6. Monitoring of hemodynamics, ABG, electrolytes during bypass
7. Calculation and adjustment of blood products (PRBC, FFP, Platelets)
8. Management of perfusion-related coagulation issues
9. Measurement of ultrafiltration volumes and fluid balance
10. Safe operation of all perfusion-related devices (e.g., IABP, ECMO, centrifugal pumps)

BEST OF LUCK

"Warm greetings from BCPI family! Wishing you all the best for your exams and a bright future ahead!"