Chapter 5. Overview of Human Body Systems

1 Learning Objectives

By the end of this chapter, you will be able to …

1. **Name and describe the structural components of the 11 principal body systems** (with emphasis on musculoskeletal, cardiovascular, respiratory and nervous).
2. **Summarise each system's core physiologic functions** and relate them to movement, exercise tolerance and tissue repair.
3. **Identify key physiotherapy touch-points** (assessment, common disorders, evidence-based interventions) for every system.
4. **Explain how multiple systems integrate** to maintain homeostasis and influence rehabilitation outcomes.

---

2 Quick-Reference System Map

System	Structural Highlights (Anatomy)	Core Functions (Physiology)	Physiotherapy Relevance	Curricular Anchor
Musculoskeletal	Bones, joints, skeletal muscles, ligaments, tendons	Support, movement, mineral store	MMT, goniometry, manual therapy, exercise prescription	Units 2–4: Skeletal, Muscular, Joints & Ligaments
Cardiovascular	Heart, arteries, veins, capillaries, lymphatics	Pump & transport blood, maintain BP, immune drainage	Cardiac rehab phases I–III, vital-signs monitoring, HIIT design	Unit 5: Cardiovascular System
Respiratory	Upper & lower airways, lungs, diaphragm	Gas exchange, acid–base balance, phonation	Airway-clearance techniques, IMT, spirometry interpretation	Unit 6: Respiratory System
Nervous	Brain, spinal cord, peripheral & autonomic nerves	Rapid control, sensation, cognition	Neuro-screening, reflex testing, motor-re-learning, PNF	Units 3–4: CNS & PNS/ANS
Digestive	Alimentary canal + liver, gall-bladder, pancreas	Nutrient absorption, metabolism	Post-abdominal-surgery mobilisation, enterostomy care	Unit 7: Digestive System
Urinary	Kidneys, ureters, bladder, urethra	Filtration, fluid & electrolyte balance	Pelvic-floor training, fluid-management education	Unit 8: Urinary System
Reproductive	Ovaries/testes + ducts & accessory glands	Gametogenesis, sex hormones	Antenatal/post-natal PT, men's-health rehab	Unit 8 continued
Endocrine	Glands: pituitary, thyroid, adrenals, pancreas	Hormonal regulation of growth & metabolism	Exercise advice for diabetes, osteoporosis prevention	Physiology Unit 6 (Sem II)
Integumentary	Skin, hair, nails, sweat & sebaceous glands	Barrier, thermoregulation	Scar management, pressure-injury prevention	Physiology Unit 5 (Sem II)
Immune / Lymphatic	Lymph nodes, vessels, spleen, thymus	Defence, fluid return	Manual lymph drainage, compression therapy	Cardiovascular Unit – lymphatics
Digestive, Urinary, Endocrine, Immune (integration)	—	—	Systems interplay in metabolic syndrome, arthritis, etc.	"Integration of systems" outcome

---

3 System Snapshots & PT Touch-Points

3.1 Musculoskeletal System

- **Assessment:** Postural analysis, ROM, joint play, MMT.
- **Common Issues:** Osteoarthritis, ligament sprains, fractures.
- **Interventions:** Strength & proprioception routines; mobilisation grades; taping/bracing; EMG-biofeedback.
- **Case Example:** ACL-reconstructed athlete – closed-kinetic-chain quads work from week 4; open-chain resisted knee-extension delayed until graft maturity.

3.2 Cardiovascular System

- **Assessment:** Rest/activity vitals, 6-MWT, Borg RPE, ankle–brachial index.
- **Common Issues:** Hypertension, coronary artery disease, PVD.
- **Interventions:** Aerobic interval training, circuit resistance, inspiratory muscle training (cardio-pulmonary overlap).
- **Clinical Pearl:** Monitor **beta-blocker patients** via RPE rather than HR to avoid under-dosage of intensity.

3.3 Respiratory System

- **Assessment:** Spirometry (FVC, FEV_1), chest expansion, breath-sound auscultation.
- **Common Issues:** COPD, asthma, post-operative atelectasis.
- **Interventions:** ACBT, autogenic drainage, diaphragmatic & segmental breathing, early upright mobilisation.
- **Scenario:** Post-CABG day 2 – teach supported cough, apply incentive spirometer q2 h, walk 30 m with $SpO_2 \geq 92$ %.

3.4 Nervous System

- **Assessment:** Dermatomes & myotomes (somite map), cranial-nerve screen, proprioception tests, reflex grading.
- **Common Issues:** Stroke, peripheral neuropathy, SCI.
- **Interventions:** Task-specific training, constraint-induced therapy, FES, spasticity management (stretch + cryotherapy).
- **Integration Note:** Autonomic dysfunction after SCI affects cardiac and thermoregulatory responses to exercise—coordinate with cardio & integumentary protocols.

3.5 Digestive / Urinary / Endocrine & Others (Brief)

System	PT Intersection
Digestive	Core stabilisation to counter post-laparotomy weakness; positioning to relieve GERD during therapy.
Urinary	Bladder-training programs; pelvic-floor EMG for stress incontinence.
Endocrine	Blood-glucose-guided exercise for DM; weight-bearing loading for osteoporosis.
Immune/Lymphatic	Decongestive therapy post-mastectomy; infection-control principles in PT gym.
Integumentary	Pressure-relief education; scar mobilisation after burns.

---

4 System Integration & Homeostasis

- **Exercise Example:** During treadmill walking, the **musculoskeletal** system generates movement; the **cardiovascular** system increases cardiac output; the **respiratory** system elevates ventilation; the **nervous** system co-ordinates motor patterns and autonomic responses; the **endocrine** system releases catecholamines to maintain glucose supply.
- **Rehabilitation Implication:** A deficit in any node (e.g., post-MI reduced stroke volume) necessitates dosage adjustment across gait-training parameters.

---

5 Self-Check Quiz

1. List three musculoskeletal red-flags that require CV screening before prescribing resistance exercise.
2. In COPD, explain why diaphragmatic training improves both respiratory and postural control.
3. Match the disorder to its primary AND secondary systems:
    - a) Osteoporosis; b) Diabetic foot ulcer; c) Stroke.
4. Why might beta-blockers mask signs of autonomic dysreflexia in high-level SCI?
5. Describe how lymph-oedema can impede musculoskeletal rehabilitation after breast-cancer surgery.

---

6 Suggested Practical Activities

Lab	Brief Description	Skills Practised
Integrated Vital-Signs Circuit	Rotate through ECG, pulse-ox, BP, spirometry stations before & after step-test	Data triage & safety decisions
Palpation–Auscultation Relay	Students identify bony landmarks then immediately auscultate adjacent heart/lung zones	Cross-system anatomical orientation
Systems Case Conference	Groups analyse a poly-system case (e.g., elderly COPD + OA) and design a phased PT plan	Interdisciplinary reasoning

---

7 Key Take-Home Points

1. **Structure dictates function**—knowing each system's anatomy is prerequisite to safe, goal-oriented therapy.
2. Physiotherapists seldom treat a single system in isolation; **integration** is the rule.
3. System-specific red-flags and monitoring parameters guide **clinical decision-making**.
4. Progressive, evidence-based interventions require understanding of **pathophysiology** across systems.
5. Effective communication with the healthcare team hinges on **precise anatomical & physiological terminology**.