

# iUSP159 – Anatomy and physiology for exercise

URN – K/617/5646

**Guided Learning Hours: 41**

Learning outcome	Assessment criteria	Taught content to include
LO1 Understand the structure and function of the circulatory system	1.1. Identify the location of the heart	<ul style="list-style-type: none"> <li>• Position in the body</li> </ul>
	1.2. Describe the function of the heart	<ul style="list-style-type: none"> <li>• To act as a pump</li> <li>• To receive and propel blood</li> </ul>
	1.3. Describe the structure of the heart	<ul style="list-style-type: none"> <li>• Layers               <ul style="list-style-type: none"> <li>- Pericardium</li> <li>- Myocardium</li> <li>- Endocardium</li> </ul> </li> <li>• Chambers               <ul style="list-style-type: none"> <li>- Right atrium</li> <li>- Right ventricle</li> <li>- Left atrium</li> <li>- Left ventricle</li> <li>- Septum</li> </ul> </li> </ul>
	1.4. Describe how blood moves through the four chambers of the heart	<ul style="list-style-type: none"> <li>• Chambers               <ul style="list-style-type: none"> <li>- Right atrium</li> <li>- Right ventricle</li> <li>- Left atrium</li> <li>- Left ventricle</li> </ul> </li> <li>• Deoxygenated blood               <ul style="list-style-type: none"> <li>- Superior vena cava vein</li> <li>- Inferior vena cava vein</li> <li>- Pulmonary artery</li> </ul> </li> <li>• Oxygenated blood               <ul style="list-style-type: none"> <li>- Pulmonary vein</li> <li>- Aorta</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>• Valves <ul style="list-style-type: none"> <li>- Atrio-ventricular (tricuspid and mitral/bicuspid)</li> <li>- Semilunar (aortic and pulmonary)</li> </ul> </li> <li>• Control of heart beat <ul style="list-style-type: none"> <li>- Sino-atrial node</li> <li>- Atrio-ventricular node</li> <li>- Bundle of His</li> </ul> </li> <li>• Constituents of blood</li> </ul>
	<p>1.5. Describe systemic and pulmonary circulation</p>	<ul style="list-style-type: none"> <li>• Systemic circulation to include: <ul style="list-style-type: none"> <li>- Aorta</li> <li>- Superior and inferior vena cava</li> <li>- Arteries, veins and capillaries</li> <li>- Sequence of events <ul style="list-style-type: none"> <li>▪ Atrial systole</li> <li>▪ Ventricular systole</li> <li>▪ Ventricular diastole</li> </ul> </li> <li>- Cardiac output <ul style="list-style-type: none"> <li>▪ Heart rate</li> <li>▪ Stroke volume (preload, contractility, afterload)</li> </ul> </li> </ul> </li> <li>• Pulmonary circulation to include: <ul style="list-style-type: none"> <li>- Deoxygenated blood</li> <li>- Pulmonary veins</li> <li>- Pulmonary arteries</li> <li>- Exchange of gases</li> <li>- Oxygenated blood</li> </ul> </li> </ul>
	<p>1.6. Describe the structure and functions of blood vessels</p>	<ul style="list-style-type: none"> <li>• The structure of the vascular system and how they link to the heart, lungs and muscles to include: <ul style="list-style-type: none"> <li>- Arteries</li> <li>- Capillaries</li> <li>- Veins</li> </ul> </li> <li>• The functions of the vascular system to include: <ul style="list-style-type: none"> <li>- Distribution (respiratory gases, waste products, hormones)</li> <li>- Regulation (body temperature, pH, fluid volume)</li> <li>- Protection (clotting, immune response)</li> </ul> </li> <li>• Lymphatic capillaries</li> <li>• Lymphatic vessels</li> <li>• Lymphatic ducts (thoracic duct and right lymphatic duct)</li> <li>• Lymphatic flow</li> </ul>

		<ul style="list-style-type: none"> <li>• The short and long term effect of exercise on the immune system to include: <ul style="list-style-type: none"> <li>- Moderate exercise</li> <li>- Exhaustive exercise</li> </ul> </li> </ul>
	1.7. Define blood pressure	<ul style="list-style-type: none"> <li>• Factors which produce, maintain and affect blood pressure</li> </ul>
	1.8. Identify blood pressure classifications	<ul style="list-style-type: none"> <li>• Diastolic</li> <li>• Systolic</li> <li>• Hypotension</li> <li>• Hypertension</li> <li>• Normal blood pressure</li> </ul>

LO2 Understand the structure and function of the respiratory system	2.1. Identify the location of the lungs	<ul style="list-style-type: none"> <li>• Position in the body</li> </ul>
	2.2. Define the function of the lungs	<ul style="list-style-type: none"> <li>• Gaseous exchange</li> </ul>
	2.3. Describe the structure of the lungs	<ul style="list-style-type: none"> <li>• Lobes</li> <li>• Bronchioles</li> <li>• Alveoli</li> <li>• Blood vessels</li> <li>• Nerves</li> <li>• Connective tissue</li> <li>• Elastic tissue</li> <li>• Membrane – pleura</li> </ul>
	2.4. Identify the main muscles involved in breathing	<ul style="list-style-type: none"> <li>• Inspiration</li> <li>• Expiration</li> <li>• Process of diffusion in the alveoli</li> </ul>
	2.5. Describe the passage of air through the Respiratory System	<ul style="list-style-type: none"> <li>• Nose</li> <li>• Nasal cavity</li> <li>• Pharynx</li> <li>• Larynx</li> <li>• Trachea</li> <li>• Bronchi</li> <li>• Bronchioles</li> <li>• Alveoli</li> <li>• Capillaries</li> <li>• Lungs</li> <li>• Pleura (visceral, parietal, pleural cavity)</li> </ul>

		<ul style="list-style-type: none"> <li>• Diaphragm</li> <li>• Intercostals</li> </ul>
	2.6. Describe the process of gaseous exchange of oxygen and carbon dioxide in the lungs	<ul style="list-style-type: none"> <li>• Internal respiration to include: <ul style="list-style-type: none"> <li>- The way in which the exchange of gases takes place between the cells and the circulatory system</li> </ul> </li> </ul>

LO3 Understand the structure and function of the skeleton	3.1. Describe the basic functions of the skeleton	<ul style="list-style-type: none"> <li>• Support framework</li> <li>• Provides attachments for muscles</li> <li>• Forms joints to provide movement</li> <li>• Forms erythrocytes in the bone marrow</li> <li>• Stores calcium</li> <li>• Protection</li> </ul>
	3.2. Identify the structures of the axial skeleton	<ul style="list-style-type: none"> <li>• Skull</li> <li>• Face</li> <li>• Thoracic cage</li> <li>• Vertebrae</li> </ul>
	3.3. Identify the structures of the appendicular skeleton	<ul style="list-style-type: none"> <li>• Upper limb <ul style="list-style-type: none"> <li>- Humerus</li> <li>- Ulna</li> <li>- Radius</li> <li>- Carpals</li> <li>- Metacarpals</li> <li>- Phalanges</li> </ul> </li> <li>• Lower limb <ul style="list-style-type: none"> <li>- Femur</li> <li>- Tibia</li> <li>- Fibula</li> <li>- Patella</li> <li>- Tarsals</li> <li>- Metatarsals</li> <li>- Phalanges</li> </ul> </li> <li>• Shoulder girdle <ul style="list-style-type: none"> <li>- Scapula</li> <li>- Clavicle</li> </ul> </li> <li>• Pelvic girdle <ul style="list-style-type: none"> <li>- Innominate bones <ul style="list-style-type: none"> <li>▪ Ischium</li> </ul> </li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>▪ Ilium</li> <li>▪ Pubis</li> </ul> <p>- Pubis symphysis</p>
3.4.	Explain the classifications of bones	<ul style="list-style-type: none"> <li>• Long</li> <li>• Short</li> <li>• Flat</li> <li>• Irregular</li> <li>• Sesamoid</li> <li>• Position in the body</li> </ul>
3.5.	Explain the structure of a long bone	<ul style="list-style-type: none"> <li>• Compact bone</li> <li>• Spongy/cancellous bone</li> <li>• Diaphysis</li> <li>• Epiphysis</li> <li>• Epiphyseal plate</li> <li>• Periosteum</li> <li>• Medullary cavity</li> <li>• Cartilage</li> </ul>
3.6.	Explain the stages of bone growth	<ul style="list-style-type: none"> <li>• Ossification process pre-natal through childhood to adulthood</li> <li>• The role of osteoblasts and osteoclasts</li> <li>• Growth hormone</li> <li>• Key nutrients in bone growth</li> <li>• Calcium regulation</li> <li>• Bone remodelling</li> </ul>
3.7.	Describe posture in terms of: <ul style="list-style-type: none"> <li>• Curves of the spine</li> <li>• Neutral spine alignment</li> <li>• Potential ranges of motion of the spine</li> <li>• Postural deviations to include kyphosis, lordosis, scoliosis and the effect of pregnancy</li> </ul>	<ul style="list-style-type: none"> <li>• Neutral alignment</li> <li>• Centre of gravity and line of gravity</li> <li>• Base of support</li> <li>• Movement</li> <li>• Kyphosis</li> <li>• Lordosis</li> <li>• Scoliosis</li> <li>• Effect of pregnancy</li> <li>• Post-natal joint laxity <ul style="list-style-type: none"> <li>- Sacroiliac joint</li> <li>- Pelvic misalignment</li> <li>- Looseness of joints</li> </ul> </li> <li>• Different postural conditions to include</li> </ul>

		<ul style="list-style-type: none"> <li>- Dowager’s hump</li> <li>- Round shoulders</li> <li>- Winged scapulae</li> <li>- Midriff bulge</li> <li>- Protruding abdomen</li> <li>- Knock knees</li> <li>- Bow legged</li> <li>- Flat back</li> <li>- Sway back</li> <li>- Stress-related weight changes and postural defects</li> <li>• Different factors which may influence posture to include <ul style="list-style-type: none"> <li>- Hereditary</li> <li>- Injury</li> <li>- Illness – mental and physical</li> <li>- Work-related factors – type of job</li> <li>- Standing</li> <li>- Sitting</li> <li>- Lying</li> <li>- Hobby/sport related influences</li> <li>- Emotional</li> <li>- Environmental</li> <li>- Sleeping position</li> <li>- Beds and pillows</li> <li>- Sustained positions</li> <li>- Repetitive movements</li> <li>- Trends</li> <li>- Pregnancy</li> </ul> </li> </ul>
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LO4 Understand joints in the skeleton	4.1. Describe the classification of joints	<ul style="list-style-type: none"> <li>• Fibrous joints <ul style="list-style-type: none"> <li>- Fixed</li> </ul> </li> <li>• Cartilaginous joints <ul style="list-style-type: none"> <li>- Slightly moveable</li> </ul> </li> <li>• Synovial joints <ul style="list-style-type: none"> <li>- Freely moveable</li> <li>- Position in the body</li> </ul> </li> </ul>
	4.2. Describe the structure of synovial joints	<ul style="list-style-type: none"> <li>• Fibrous capsule joint</li> <li>• Articular cartilage</li> <li>• Synovial cavity</li> </ul>

		<ul style="list-style-type: none"> <li>• Synovial membrane</li> <li>• Synovial fluid</li> </ul>
	4.3. Describe the types of synovial joints and their range of motion	<ul style="list-style-type: none"> <li>• Ball and socket</li> <li>• Hinge</li> <li>• Pivot</li> <li>• Gliding</li> <li>• Saddle</li> <li>• Condyloid</li> <li>• Position in the body</li> </ul>
	4.4. Describe joint movement potential and joint actions	<ul style="list-style-type: none"> <li>• Attachments <ul style="list-style-type: none"> <li>- Origin</li> <li>- Insertion</li> </ul> </li> <li>• Actions <ul style="list-style-type: none"> <li>- Flexion</li> <li>- Extension</li> <li>- Hyper-extension</li> <li>- Abduction</li> <li>- Adduction</li> <li>- Internal rotation</li> <li>- External rotation</li> <li>- Circumduction</li> <li>- Elevation</li> <li>- Depression</li> <li>- Lateral flexion</li> <li>- Horizontal flexion and extension</li> <li>- Supination</li> <li>- Pronation</li> <li>- Dorsiflexion</li> <li>- Plantarflexion</li> <li>- Inversion</li> <li>- Eversion</li> </ul> </li> </ul>

LO5 Understand the muscular system	5.1. Identify the three types of muscle tissue	<ul style="list-style-type: none"> <li>• Cardiac muscle</li> <li>• Smooth muscle</li> <li>• Skeletal muscle</li> </ul>
	5.2. Define the characteristics and functions of the three types of muscle tissue	<ul style="list-style-type: none"> <li>• Cardiac muscle <ul style="list-style-type: none"> <li>- Striated</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>- Involuntary</li> <li>• Smooth muscle <ul style="list-style-type: none"> <li>- Non-striated</li> <li>- Involuntary</li> </ul> </li> <li>• Skeletal muscle <ul style="list-style-type: none"> <li>- Striated</li> <li>- Voluntary</li> </ul> </li> </ul>
	5.3. Describe the basic structure of skeletal muscle	<ul style="list-style-type: none"> <li>• Fascicle</li> <li>• Fibre</li> <li>• Myofibril (sarcomere segments)</li> <li>• Epimysium</li> <li>• Perimysium</li> <li>• Endomysium</li> </ul>
	5.4. Name and locate the anterior skeletal muscles	<ul style="list-style-type: none"> <li>• Position</li> <li>• Action</li> <li>• Muscles <ul style="list-style-type: none"> <li>- Anterior deltoid</li> <li>- Pectoralis major and minor</li> <li>- Biceps</li> <li>- Rectus abdominus</li> <li>- Obliques: external, internal</li> <li>- Transversus abdominus</li> <li>- Hip flexors: iliocacus, psoas major (illiopsoas)</li> <li>- Quadriceps: vastus lateralis, vastus intermedialis, vastus medialis, rectus femoris</li> <li>- Tibialis anterior</li> </ul> </li> </ul>
	5.5. Name and locate the posterior skeletal muscles:	<ul style="list-style-type: none"> <li>• Position</li> <li>• Action</li> <li>• Muscles <ul style="list-style-type: none"> <li>- Trapezius</li> <li>- Posterior deltoid</li> <li>- Triceps</li> <li>- Latissimus dorsi</li> <li>- Erector spinae</li> <li>- Gluteals: gluteus maximus, gluteus medius, gluteus minimus</li> <li>- Hamstrings: semitendinosus, semibranosus, biceps femoris</li> <li>- Gastrocnemius</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>- Soleus</li> </ul>
	5.6. Describe the structure and function of the pelvic floor muscles	<ul style="list-style-type: none"> <li>• Pelvic floor muscles</li> <li>• Transverse abdominus</li> <li>• Multifidus</li> </ul>
	5.7. Describe the different types of muscle action	<ul style="list-style-type: none"> <li>• Agonist/prime mover</li> <li>• Antagonist</li> <li>• Synergists</li> <li>• Fixators/stabilisers</li> <li>• Isometric action and contraction</li> <li>• Isotonic action and contraction</li> <li>• Isokinetic</li> <li>• Concentric action and contraction</li> <li>• Eccentric action and contraction</li> </ul>
	5.8. Identify the joint actions brought about by specific muscle group actions	<ul style="list-style-type: none"> <li>• Spine <ul style="list-style-type: none"> <li>- Structure</li> <li>- Actions and range of movement <ul style="list-style-type: none"> <li>▪ Flexion</li> <li>▪ Extension</li> <li>▪ Rotation</li> <li>▪ Side flexion</li> </ul> </li> </ul> </li> <li>• Major synovial joints <ul style="list-style-type: none"> <li>- Shoulder</li> <li>- Elbow</li> <li>- Wrist</li> <li>- Hip</li> <li>- Knee</li> <li>- Ankle</li> </ul> </li> <li>• Actions and range of movements of each joint</li> </ul>
	5.9. Identify skeletal muscle fibre types and their characteristics	<ul style="list-style-type: none"> <li>• Slow twitch <ul style="list-style-type: none"> <li>- Type I</li> <li>- Red</li> </ul> </li> <li>• Fast twitch <ul style="list-style-type: none"> <li>- Type 11a - Fast oxidative glycolytic or FOG</li> <li>- Type 11b - Fast glycolytic or (FG)</li> <li>- White</li> </ul> </li> </ul>

<p>LO6 Understand the life-course of the musculoskeletal system and its implications for special populations exercise</p>	<p>6.1. Describe the life-course of the musculoskeletal system, and its implications for working with:</p> <ul style="list-style-type: none"> <li>• Young people in the 14 -16 age range</li> <li>• Antenatal and postnatal women</li> <li>• Older people (50 plus)</li> </ul> <p>To include relevant tendon, ligament, muscle, joint and bone mineral density changes and their implications for exercise</p>	<ul style="list-style-type: none"> <li>• Young people (14 -16 age range)</li> <li>• Antenatal and postnatal women</li> <li>• Older adults (50 plus)</li> </ul>
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<p>LO7 Understand energy systems and their relation to exercise</p>	<p>7.1. Describe how carbohydrates, fats and proteins are used in the production of energy/adenosine triphosphate</p>	<ul style="list-style-type: none"> <li>• Carbohydrates (sugar and starches)</li> <li>• Oxygen</li> <li>• Fats</li> <li>• Proteins</li> </ul>
	<p>7.2. Explain the use of the three energy systems during aerobic and anaerobic exercise</p>	<ul style="list-style-type: none"> <li>• Anaerobic creatine phosphate/phosphocreatine <ul style="list-style-type: none"> <li>- Utilises high energy phosphates in muscles (ATP and PC)</li> <li>- Short duration activities (up to approximately 10 seconds maximal effort)</li> <li>- High intensity</li> <li>- Limiting factors</li> </ul> </li> <li>• Anaerobic system/lactic acid <ul style="list-style-type: none"> <li>- Breakdown of glycogen without using oxygen</li> <li>- Lactic acid formation</li> <li>- Short duration activities (up to approximately 3 minutes)</li> <li>- High intensity</li> <li>- Limiting factors</li> </ul> </li> <li>• Aerobic system <ul style="list-style-type: none"> <li>- Breakdown of glycogen using oxygen</li> <li>- Long duration activities (over approximately 3 minutes)</li> <li>- Low intensity</li> <li>- Limiting factors</li> </ul> </li> <li>• Practical examples of when each system is predominantly in use</li> <li>• Relevance of each to individuals in relation to aims and objectives of the training programme</li> </ul>

LO8 Understand the nervous system and its relation to exercise	8.1. Describe the role and functions of the nervous system	<ul style="list-style-type: none"> <li>• Central nervous system <ul style="list-style-type: none"> <li>- Brain</li> <li>- Spinal cord</li> </ul> </li> <li>• Peripheral nervous system <ul style="list-style-type: none"> <li>- 31 pairs of spinal nerves</li> <li>- 12 pairs of cranial nerves</li> </ul> </li> <li>• Autonomic nervous system <ul style="list-style-type: none"> <li>- Sympathetic</li> <li>- Parasympathetic</li> </ul> </li> </ul>
	8.2. Describe the principles of muscle contraction	<ul style="list-style-type: none"> <li>• Innervation <ul style="list-style-type: none"> <li>- Initiation of contraction</li> <li>- All-or-none theory</li> </ul> </li> <li>• Energy for contraction <ul style="list-style-type: none"> <li>- Fatigue</li> </ul> </li> <li>• Sliding filament theory <ul style="list-style-type: none"> <li>- Actin and myosin</li> <li>- Cross bridges</li> </ul> </li> <li>• Type of contraction <ul style="list-style-type: none"> <li>- Isotonic – concentric and eccentric</li> <li>- Isometric (static)</li> <li>- Isokinetic</li> </ul> </li> </ul>
	8.3. Describe the 'all-or-none law'/motor unit recruitment	<ul style="list-style-type: none"> <li>• The motor unit</li> <li>• Axon terminals</li> <li>• Acetylcholine</li> <li>• Sodium ions</li> <li>• The action potential</li> <li>• The sodium/potassium pump</li> <li>• Sliding filament theory – including sarcoplasmic reticulum, calcium ions, ATP</li> <li>• All-or-none law of muscle physiology</li> <li>• Muscle fatigue and oxygen debt</li> </ul>
	8.4. Describe how exercise can enhance neuromuscular connections and improve motor fitness	<ul style="list-style-type: none"> <li>• To include the stretch reflex: <ul style="list-style-type: none"> <li>- Neural receptors/sense organs</li> <li>- Golgi tendon organs</li> <li>- Proprioceptive neuromuscular facilitation (PNF)</li> </ul> </li> </ul>

Assessment	
MCQ	

Guide to taught content
<p>The content contained within the unit specification is not prescriptive or exhaustive but is intended to provide helpful guidance to teachers and learners with the key areas that will be covered within the unit, and, relating to the kinds of evidence that should be provided for each assessment objective specific to the unit learning outcomes.</p>

**Document History**

Version	Issue Date	Changes	Role
v1	13/08/2019	First published	Qualifications and Regulation Co-ordinator