Syllabus content—Core

Syllabus

# Topic 1: Anatomy (7 hours)

## The skeletal system

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 1.1.1 | Distinguish anatomically between the *axial* and *appendicular* skeleton. | 2 | Axial skeleton: limit to the skull, ribs, sternum and vertebral column consisting of cervical—7 bones; thoracic—12 bones; lumbar—5 bones; sacral—5 bones (fused as 1); coccyx—4 bones (fused as 1).Appendicular skeleton: limit to the pectoral girdle (scapulae and clavicles), humerus, radius, ulna, carpals, metacarpals, phalanges, pelvic girdle (ilium, ischium and pubis), femur, patella, tibia, fibula, tarsals, metatarsals and phalanges. |
| 1.1.2 | Distinguish between the *axial* and *appendicular* skeleton in terms of function. | 2 | Consider the anatomical functions attachment, protection, movement and support. |
| 1.1.3 | State the four types of bone. | 1 | Limit to long, short, flat and irregular. |
| 1.1.4 | Draw and annotate the structure of a long bone. | 2 | Limit to:* epiphysis
* spongy bone
* articular cartilage
* diaphysis
* compact bone
* bone marrow
* marrow cavity
* blood vessel
* periosteum.
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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 1.1.5 | Apply anatomical terminology to the location of bones. | 2 | Limit to:* inferior
* superior
* proximal
* distal
* medial
* lateral
* posterior
* anterior.

Limit to the bones listed in the axial and appendicular skeleton (see 1.1.1). Assume anatomical position. |
| 1.1.6 | Outline the functions of connective tissue. | 2 | Limit to cartilage, ligament and tendon. |
| 1.1.7 | Define the term *joint*. | 1 | A joint occurs where two or more bones articulate. |
| 1.1.8 | Distinguish between the different types of joint in relation to movement permitted. | 2 | Limit to fibrous, cartilaginous and synovial joints. |
| 1.1.9 | Outline the features of a synovial joint. | 2 | Limit to:* articular cartilage
* synovial membrane
* synovial fluid
* bursae
* meniscus
* ligaments
* articular capsule.
 |
| 1.1.10 | List the different types of synovial joint. | 1 | Consider hinge, ball and socket, condyloid, pivot, gliding and saddle. |

## The muscular system

**3 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 1.2.1 | Outline the general characteristics common to muscle tissue. | 2 | Limit to:* contractility
* extensibility
* elasticity
* atrophy
* hypertrophy
* controlled by nerve stimuli and fed by capillaries.
 |
| 1.2.2 | Distinguish between the different types of muscle. | 2 | Include smooth, cardiac and skeletal. |
| 1.2.3 | Annotate the structure of skeletal muscle. | 2 | Limit to:* epimysium
* perimysium
* endomysium
* muscle fibre
* myofibril
* sarcomere
* actin
* myosin.
 |
| 1.2.4 | Define the terms *origin* and*insertion* of muscles. | 1 | Origin: the attachment of a muscle tendon to a stationary bone.Insertion: the attachment of a muscle tendon to a moveable bone. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 1.2.5 | Identify the location of skeletal muscles in various regions of the body. | 2 | Include the muscles from:* the anterior
	+ deltoid
	+ pectoralis
	+ iliopsoas
	+ sartorius
	+ quadriceps
	+ femoris (rectus femoris, vastus intermedialis, vastus medialis, vastus lateralis)
	+ tibialis anterior
	+ abdominus rectus
	+ external obliques
	+ biceps brachii
* the posterior
	+ trapezius
	+ triceps brachii
	+ latissimus dorsi
	+ gluteus maximus
	+ hamstrings (biceps femoris, semitendinosus, semimembranosus)
	+ gastrocnemius
	+ soleus
	+ erector spinae.
 |

Topic 2: Exercise physiology (17 hours)

* 1. **Structure and function of the ventilatory system**

**5 hours**

**Aim 7:** There are numerous technologies used to facilitate direct measurement in respiratory research (for example, spirometer, online gas analysis).

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 2.1.1 | List the principal structures of the ventilatory system. | 1 | * Nose
* Mouth
* Pharynx
* Larynx
* Trachea
* Bronchi
* Bronchioles
* Lungs
* Alveoli.

Cross reference to 1.2.2. |
| 2.1.2 | Outline the functions of the conducting airways. | 2 | Limit to:* low resistance pathway for airflow
* defence against chemicals and other harmful substances that are inhaled
* warming and moistening the air.
 |
| 2.1.3 | Define the terms *pulmonary ventilation, total lung capacity (TLC)*, *vital capacity (VC)*,*tidal volume (TV)*, *expiratory reserve volume (ERV)*, *inspiratory reserve volume (IRV)* and *residual volume (RV)*. | 1 | Pulmonary ventilation: inflow and outflow of air between the atmosphere and the lungs (also called breathing).Total lung capacity: volume of air in the lungs after a maximum inhalation.Vital capacity: maximum volume of air that can be exhaled after a maximum inhalation.Tidal volume: volume of air breathed in and out in any one breath.Expiratory reserve volume: volume of air in excess of tidal volume that can be exhaled forcibly.Inspiratory reserve volume: additional inspired air over and above tidal volume.Residual volume: volume of air still contained in the lungs after a maximal exhalation. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 2.1.4 | Explain the mechanics of ventilation in the human lungs. | 3 | Include the actions of the diaphragm and the intercostal muscles, and the relationship between volume and pressure. Students should be aware that accessory muscles are also important during strenuous exercise. |
| 2.1.5 | Describe nervous and chemical control of ventilation during exercise. | 2 | Limit to ventilation increases as a direct result of increases in blood acidity levels (low pH) due to increased carbon dioxide content of the blood detected by the respiratory centre. This results in an increase in the rate and depth of ventilation.Neural control of ventilation includes lung stretch receptors, muscle proprioreceptors and chemoreceptors.The role of H+ ions and reference to partial pressure of oxygen are not required. |
| 2.1.6 | Outline the role of hemoglobin in oxygen transportation. | 2 | Most (98.5%) of oxygen in the blood is transported by hemoglobin as oxyhemoglobin within red blood cells. |
| 2.1.7 | Explain the process of gaseous exchange at the alveoli. | 3 |  |

## Structure and function of the cardiovascular system

**12 hours**

**Aim 7:** There are numerous technologies used to facilitate direct measurement in cardiovascular research, for example, interfaced heart rate monitors, blood pressure monitors, ECG monitors.

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 2.2.1 | State the composition of blood. | 1 | Blood is composed of cells (erythrocytes, leucocytes and platelets) and plasma. Blood is also the transport vehicle for electrolytes, proteins, gases, nutrients, waste products and hormones. |
| 2.2.2 | Distinguish between the functions of *erythrocytes*, *leucocytes* and *platelets*. | 2 |  |
| 2.2.3 | Describe the anatomy of the heart with reference to the heart chambers, valves and major blood vessels. | 2 | The names of the four chambers, four valves (bicuspid, tricuspid, aortic and pulmonary valves) and the four major blood vessels (vena cava, pulmonary vein, the aorta and pulmonary artery) of the pulmonary and systemic circulation are required. The heart has its own blood supply via the coronary arteries; however, the names of the coronary arteries are not required. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 2.2.4 | Describe the intrinsic and extrinsic regulation of heart rate and the sequenceof excitation of the heart muscle. | 2 | The heart has its own pacemaker, but heart rate is also influenced by the sympathetic and parasympathetic branches of the autonomicnervous system and by adrenaline. (It should be recognized that adrenaline has wider metabolic actions, that is, increasing glycogen and lipid breakdown.) The electrical impulse is generated at the sinoatrial node (SA node) and travels across the atria to the atrioventricular node (AV node) to the ventricles. |
| 2.2.5 | Outline the relationship between the pulmonary and systemic circulation. | 2 |  |
| 2.2.6 | Describe the relationship between heart rate, cardiac output and stroke volume at rest and during exercise. | 2 | Cardiac output = stroke volume × heart rate. Stroke volume expands and heart rate increases during exercise. |
| 2.2.7 | Analyse cardiac output, stroke volume and heart rate data for different populations at rest and during exercise. | 3 | Limit to:* males
* females
* trained
* untrained
* young
* old.

Recall of quantitative data is not expected. |
| 2.2.8 | Explain cardiovascular drift. | 3 | An increase of body temperature results in a lower venous return to the heart, a small decrease in blood volume from sweating. A reduction in stroke volume causes the heart rate to increase to maintain cardiac output.Include reference to blood viscosity. |
| 2.2.9 | Define the terms *systolic* and*diastolic blood pressure*. | 1 | Systolic: the force exerted by blood on arterial walls during ventricular contraction.Diastolic: the force exerted by blood on arterial walls during ventricular relaxation. |
| 2.2.10 | Analyse systolic and diastolic blood pressure data at rest and during exercise. | 3 | Recall of quantitative data is not expected. |
| 2.2.11 | Discuss how systolic and diastolic blood pressure respond to dynamic and static exercise. | 3 |  |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 2.2.12 | Compare the distribution of blood at rest and the redistribution of blood during exercise. | 3 | Movement of blood in favour of muscles. |
| 2.2.13 | Describe the cardiovascular adaptations resulting from endurance exercise training. | 2 | Limit to increased left ventricular volume resulting in an increased stroke volume and a lower resting and exercising heart rate. Consider also increased capillarization and increased arterio-venous oxygen difference. |
| 2.2.14 | Explain maximal oxygen consumption. | 3 | Maximal oxygen consumption (VO2max) represents the functional capacity of the oxygen transport system and is sometimes referred to as maximal aerobic power or aerobic capacity. |
| 2.2.15 | Discuss the variability of maximal oxygenconsumption in selected groups. | 3 | Consider:* trained versus untrained
* males versus females
* young versus old
* athlete versus non-athlete.
 |
| 2.2.16 | Discuss the variability of maximal oxygenconsumption with different modes of exercise. | 3 | Consider cycling versus running versus arm ergometry. |

# Topic 3: Energy systems (13 hours)

## Nutrition

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 3.1.1 | List the macronutrients and micronutrients. | 1 | Macro: lipid (fat), carbohydrate, water and protein.Micro: vitamins and minerals. |
| 3.1.2 | Outline the functions of macronutrients and micronutrients. | 2 | Specific knowledge of individual vitamins and minerals is not required. |
| 3.1.3 | State the chemical composition of a glucose molecule. | 1 | C, H and O (1:2:1 ratio) |
| 3.1.4 | Identify a diagram representing the basic structure of a glucose molecule. | 2 |  |
| 3.1.5 | Explain how glucose molecules can combine to form disaccharides and polysaccharides. | 3 | Condensation reaction—the linking of a monosaccharide to another monosaccharide, disaccharide or polysaccharide by the removal of a water molecule. |
| 3.1.6 | State the composition of a molecule of triacylglycerol. | 1 | Limit to glycerol and three fatty acids. |
| 3.1.7 | Distinguish between *saturated* and *unsaturated fatty acids*. | 2 | Saturated fatty acids have no double bonds between the individual carbon atoms of the fatty acid chain. Saturated fats originate from animal sources, for example, meat, poultry, full-fat dairy products and tropical oils, such as palm and coconut oils. Unsaturated fatty acids contain one or more double bonds between carbon atoms within the fatty acid chain. Unsaturated fats originate from plant-based foods, for example, olive oil, olives, avocado, peanuts, cashew nuts, canola oil and seeds, sunflower oil and rapeseed. |
| 3.1.8 | State the chemical composition of a protein molecule. | 1 | Limit to C, H, O and N. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 3.1.9 | Distinguish between an *essential* and a *non-essential amino acid*. | 2 | Essential amino acids cannot be synthesized by the human body and must be obtained from diet.Non-essential amino acids can be synthesized by the human body. |
| 3.1.10 | Describe current recommendations for a healthy balanced diet. | 2 | Consider recommendations for carbohydrates, proteins, lipids, fibre, water and salt for adults in the general population. The relative contribution of carbohydrate, protein and lipid (including monounsaturated, polyunsaturated and saturated) should be given.**Aim 9:** Recommended intakes of nutrients have been published in some countries. Therecommendations vary and this raises questions about how the levels are decided.**Int/Aim 8:** Students can be made aware of the sociocultural influences of food selection and preparation across populations, for example, Mediterranean, Japanese, Western (USA, UK) and Indian.**TOK:** Justification of how a balanced diet is defined. |
| 3.1.11 | State the approximate energy content per 100 g of carbohydrate, lipid and protein. | 1 | Students should know that the energy content values per 100 g are: carbohydrate 1760 kJ, lipid 4000 kJ and protein 1720 kJ. |
| 3.1.12 | Discuss how the recommended energy distribution of the dietary macronutrients differs between endurance athletes and non-athletes. | 3 | Limit to the important difference in carbohydrate intake and how, therefore, this also affects fat and protein intake. For example, carbohydrate intake is higher, protein and fat intake is slightly higherfor a marathon runner than a non-athlete, and vice versa.**Int:** Variation between countries, for example, a high-carbohydrate diet consumed by athletes in some countries.**Aim 8:** Some sports require smaller stature; therefore, diet manipulation may occur prior to competition.**Aim 9:** Recommended intakes vary within published literature.**TOK:** Justification of how diet contributes to performance. |

## Carbohydrate and fat metabolism

**2 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 3.2.1 | Outline metabolism, anabolism*,* aerobic catabolism and anaerobic catabolism. | 2 | Metabolism: All the biochemical reactions that occur within an organism, including anabolic and catabolic reactions.Anabolism: Energy requiring reactions whereby small molecules are built up into larger ones.Catabolism: Chemical reactions that break down complex organic compounds into simpler ones, with the net release of energy. |
| 3.2.2 | State what glycogen is and its major storage sites. | 1 |  |
| 3.2.3 | State the major sites of triglyceride storage. | 1 | Adipose tissue and skeletal muscle. |
| 3.2.4 | Explain the role of insulin in the formation of glycogen and the accumulation of body fat. | 3 |  |
| 3.2.5 | Outline glycogenolysis and lipolysis. | 2 |  |
| 3.2.6 | Outline the functions of glucagon and adrenaline during fasting and exercise. | 2 |  |
| 3.2.7 | Explain the role of insulin and muscle contraction on glucose uptake during exercise. | 3 | Emphasize that both insulin and muscle contraction stimulate glucose uptake from the blood into skeletal muscle. |

* 1. **Nutrition and energy systems**

**7 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 3.3.1 | Annotate a diagram of the ultrastructure of a generalized animal cell. | 2 | The diagram should show ribosomes, rough endoplasmic reticulum, lysosomes, Golgi apparatus, mitochondrion and nucleus. |
| 3.3.2 | Annotate a diagram of the ultrastructure of a mitochondrion. | 2 | Cristae, inner matrix and outer smooth membrane. |
| 3.3.3 | Define the term *cell respiration*. | 1 | Cell respiration is the controlled release of energy in the form of adenosine triphosphate (ATP) from organic compounds in cells. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 3.3.4 | Explain how adenosine can gain and lose a phosphate molecule. | 3 |  |
| 3.3.5 | Explain the role of ATP in muscle contraction. | 3 | Limit to the breakdown of ATP to adenosine diphosphate (ADP) releasing a phosphate molecule, which provides energy for muscle contraction.Cross reference with 4.1.3. |
| 3.3.6 | Describe the re-synthesis of ATP by the ATP–CP system. | 2 | Creatine phosphate (CP), a high energy molecule, is broken down to provide a phosphate molecule for the re-synthesis of ATP that has been utilized during the initial stages of exercise. |
| 3.3.7 | Describe the production of ATP by the lactic acid system. | 2 | Also known as anaerobic glycolysis—the breakdown of glucose to pyruvate without the use of oxygen. Pyruvate is then converted into lactic acid, which limits the amount of ATP produced (two ATP molecules). |
| 3.3.8 | Explain the phenomena of oxygen deficit and oxygen debt. | 3 | Oxygen debt is now known as excess post- exercise oxygen consumption (EPOC). |
| 3.3.9 | Describe the production of ATP from glucose and fatty acids by the aerobic system. | 2 | Limit to: in the presence of oxygen, pyruvate is processed by the Krebs cycle which liberates electrons that are passed through the electron transport chain producing energy (ATP).Fats are also broken down by beta oxidation that liberates a greater number of electrons, thus more ATP. In the presence of oxygen, and in extreme cases, protein is also utilized. |
| 3.3.10 | Discuss the characteristics of the three energy systems and their relative contributions during exercise. | 3 | Limit to:* fuel sources
* duration
* intensity
* amount of ATP production and by-products.
 |
| 3.3.11 | Evaluate the relative contributions of the three energy systems during different types of exercise. | 3 | Energy continuum. Different types of exercise (endurance athlete, games player, sprinter) should be considered. |

# Topic 4: Movement analysis (15 hours)

## Neuromuscular function

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 4.1.1 | Label a diagram of a motor unit. | 1 | Limit to:* dendrite
* cell body
* nucleus
* axon
* motor end plate
* synapse
* muscle.
 |
| 4.1.2 | Explain the role of neurotransmitters in stimulating skeletal muscle contraction. | 3 | Limit to acetylcholine and cholinesterase. |
| 4.1.3 | Explain how skeletal muscle contracts by the sliding filament theory. | 3 | Include the terms:* myofibril
* myofilament
* sarcomere
* actin
* myosin
* H zone
* A band
* Z line
* tropomyosin
* troponin
* sarcoplasmic reticulum
* calcium ions
* ATP.

**Aim 7:** Various online muscle contraction simulations are available. |
| 4.1.4 | Explain how slow and fast twitch fibre types differ in structure and function. | 3 | Limit fibre types to slow twitch (type I) and fast twitch (type IIa and type IIb).Type IIa and IIb are high in glycogen content depending on training status.**Aim 8:** Implications of invasive techniques for taking samples, such as muscle biopsies.**Aim 9:** Implications of drawing conclusions from indirect measurements. |

* 1. **Joint and movement type**

**3 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 4.2.1 | Outline the types of movement of synovial joints. | 2 | Consider:* flexion
* extension
* abduction
* adduction
* pronation
* supination
* elevation
* depression
* rotation
* circumduction
* dorsi flexion
* plantar flexion
* eversion
* inversion.
 |
| 4.2.2 | Outline the types of muscle contraction. | 2 | Consider:* isotonic
* isometric
* isokinetic
* concentric
* eccentric.
 |
| 4.2.3 | Explain the concept of reciprocal inhibition. | 3 | Consider agonist and antagonist. |
| 4.2.4 | Analyse movements in relation to joint action and muscle contraction. | 3 | For example, during the upward motion of a bicep curl the joint action is flexion. The bicep contracts concentrically while the tricep relaxes eccentrically. |
| 4.2.5 | Explain delayed onset muscle soreness (DOMS) in relation to eccentric and concentric muscle contractions. | 3 | DOMS results primarily from eccentric muscle action and is associated with structural muscle damage, inflammatory reactions in the muscle, overstretching and overtraining.DOMS is prevented/minimized by reducing the eccentric component of muscle actions during early training, starting training at a low intensity and gradually increasing the intensity, and warming up before exercise, cooling down after exercise. |

* 1. **Fundamentals of biomechanics**

**8 hours**

In this sub-topic, no calculations are required.

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 4.3.1 | Define the terms *force*, *speed*, *velocity*, *displacement, acceleration*, *momentum* and *impulse*. | 1 | Encourage the use of vectors and scalars. |
| 4.3.2 | Analyse velocity–time, distance–time and force– time graphs of sporting actions. | 3 |  |
| 4.3.3 | Define the term *centre of mass.* | 1 |  |
| 4.3.4 | Explain that a change in body position during sporting activities canchange the position of the centre of mass. | 3 | Consider one example of an activity where the centre of mass remains within the bodythroughout the movement and one activity where the centre of mass temporarily lies outside the body. Students should understand the changes in body position and centre of mass pathway. |
| 4.3.5 | Distinguish between *first*, *second* and *third class levers*. | 2 |  |
| 4.3.6 | Label anatomical representations of levers. | 1 | Limit to:* the triceps–elbow joint
* the calf–ankle joint
* the biceps–elbow joint.

Students will be expected to indicate effort, load, fulcrum and the muscles and bones involved. |
| 4.3.7 | Define Newton’s three laws of motion. | 1 |  |
| 4.3.8 | Explain how Newton’s three laws of motion apply to sporting activities. | 3 | For example, consider how Newton’s second and third laws enable an athlete to accelerate out of starting blocks. Impulse momentum relationship. The law of conservation of momentum should also be considered. |
| 4.3.9 | State the relationship between angular momentum*,* moment of inertia and angular velocity*.* | 1 |  |
| 4.3.10 | Explain the concept of angular momentum in relation to sporting activities. | 3 | Include consideration of moments of inertia, major axes of rotation and an appreciation of the law of conservation of angular momentum. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 4.3.11 | Explain the factors that affect projectile motion at take-off or release. | 3 | Include speed of release, height of release and angle of release. |
| 4.3.12 | Outline the Bernoulli principle with respect to projectile motion in sporting activities. | 2 | The relationship between airflow velocity and air pressure is an inverse one, and is expressed in Bernoulli’s principle.The pressure difference causes the spinning golf ball to experience a force directed from theregion of high air pressure to the region of low air pressure. A golf ball with backspin will experience higher air pressure on the bottom of the ball and lower air pressure on the top of the ball, causinga lift force (from high air pressure to low air pressure).Consider how airflow affects the golf ball and one other example. When an object is moving through the air it is important to consider the relative airflow on different sides of the object. The airflow difference between opposite sides (for example, the bottom and top of a spinning golf ball) of the object moving through the air causes a pressure difference between the two sides. The lift force is perpendicular to the direction of the airflow.**Aim 7:** Still photography and video can be used to record and analyse movement.A visit to a university may be possible to see the use of high-speed photography, photoelectric cells and motion-analysis software. |

# Topic 5: Skill in sports (15 hours)

## The characteristics and classification of skill

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.1.1 | Define the term *skill*. | 1 | Skill is the consistent production of goal-oriented movements, which are learned and specific to the task (McMorris 2004). |
| 5.1.2 | Describe the different types of skill. | 2 | Limit to cognitive, perceptual, motor and perceptual motor skills. |
| 5.1.3 | Outline the different approaches to classifying motor skills. | 2 | Limit to:* gross–fine
* open–closed
* discrete–serial–continuous
* external–internal paced skills
* interaction continuum (individual–coactive– interactive).
 |
| 5.1.4. | Compare skill profiles for contrasting sports. | 3 | Using the continua in 5.1.3, compare contrasting sports. |
| 5.1.5 | Outline ability. | 2 | *Ability* refers to a general trait or capacity of the individual that is related to the performance and performance potential of a variety of skills or tasks.**TOK:** Abilities have been thought of as stable traits but a more modern perspective understands that people have a genetic potential for each ability and that their level of performance in a particular ability can be influenced by a number of factors such as life experience or coaching.**TOK:** Current research considers that abilities will change with time. |
| 5.1.6 | Distinguish between Fleishman’s *physical proficiency abilities* (physical factors) and *perceptual motor abilities* (psychomotor factors). | 2 | Fleishman (1972) distinguishes between physical proficiency and perceptual motor ability. Recall of the individual abilities is not required. |
| 5.1.7 | Define the term *technique*. | 1 | In general terms, technique is a “way of doing”. In the performance of a specific sports skill it is defined as the “way in which that sports skill is performed”. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.1.8 | State the relationship between ability, skill and technique. | 1 | Skill = ability + selection of an appropriate technique. |
| 5.1.9 | Discuss the differences between a skilled and a novice performer. | 3 | Limit to consistency, accuracy, control, learned, efficiency, goal-directed and fluency. |

* 1. **Information processing**
1. **hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.2.1 | Describe a simple model of information processing. | 2 | Information processing is the system by which we take information from our surrounding environment, use it to make a decision and then produce a response: input–decision-making– output.All the approaches are only models. Input and output are assessable/observable, but the decision-making process can only be speculation. |
| 5.2.2 | Describe Welford’s model of information processing. | 2 | Welford’s model (1968) includes:* sense organs
* perception
* short-term memory
* long-term memory
* decision-making
* effector control
* feedback.
 |
| 5.2.3 | Outline the components associated with sensory input. | 2 | Consider exteroceptors, proprioceptors and interoceptors. |
| 5.2.4 | Explain the signal-detection process. | 3 | Often referred to as the detection–comparison– recognition process (DCR).Limit to background noise, intensity of the stimulus, efficiency of the sense organs, early signal detection and improving signal detection. |
| 5.2.5 | Distinguish between the characteristics of *short-term sensory store*, *short-term memory* and *long-term memory*. | 2 | Limit to capacity, duration and retrieval. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.2.6 | Discuss the relationship between selective attention and memory. | 3 | Selective attention (SA) operates in the short- term sensory store (STSS). Only the relevant information is passed to the short-term memory (STM) where it is held for several seconds. SA ensures that information overload does not occur and prevents confusion, as the brain would not be able to cope with streams of information. Afiltering mechanism operates, which separates the relevant information from the irrelevant (noise) information so that athletes concentrate on one cue or stimulus (for example, the ball, positionof player in a game of tennis) to the exclusion of others. SA is very important when accuracy or fast responses are required and can be improved by learning through past experience and interaction with long-term memory. |
| 5.2.7 | Compare different methods of memory improvement. | 3 | Limit to:* rehearsal
* coding
* brevity
* clarity
* chunking
* organization
* association
* practice.
 |
| 5.2.8 | Define the term *response time*. | 1 | Response time = reaction time + movement time.**Aim 7:** Use of online methods of measuring response time. |
| 5.2.9 | Outline factors that determine response time. | 2 | Response time is an ability, having individual and group variance (for example, gender and age).Reaction time includes stimulus transmission, detection, recognition, decision to respond, nerve transmission time and initiation of action.Include consideration of Hick’s Law. |
| 5.2.10 | Evaluate the concept of the psychological refractory period (PRP). | 3 | Include the single channel mechanism and how PRP helps to explain deception in sports. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.2.11 | Describe a motor programme. | 2 | Defined as a set of movements stored as a whole in the memory, regardless of whether feedback is used in their execution.Limit to:* a whole plan (executive programme/motor programme) and subroutines
* coordination of subroutines
* relegating executive programmes to subroutines.
 |
| 5.2.12 | Compare motor programmes from both open- and closed- loop perspectives. | 3 | Include Adams’ concepts of memory trace and perceptual trace. |
| 5.2.13 | Outline the role of feedback in information-processing models. | 2 | Limit to:* intrinsic, extrinsic
* knowledge of results, knowledge of performance
* positive, negative
* concurrent, terminal.
 |
| 5.2.14 | Outline the role of feedback with the learning process. | 2 | Limit to:* reinforcement of learning
* motivation
* adaptation of performance
* punishment.
 |

## 5.3 Principles of skill learning

**5 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.3.1 | Distinguish between *learning*and *performance*. | 2 | Learning is a relatively permanent change in performance brought about by experience, excluding changes due to maturation and degeneration.Performance is a temporary occurrence, fluctuating over time.A change in performance over time is often used to infer learning. |
| 5.3.2 | Describe the phases (stages) of learning. | 2 | Cognitive/verbal (early phase), associative/motor (intermediate phase) and autonomous (final phase). |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 5.3.3 | Outline the different types of learning curves. | 2 | Limit to:* positive acceleration
* negative acceleration
* linear
* plateau.
 |
| 5.3.4 | Discuss factors that contribute to the different rates of learning. | 3 | Limit to:* physical maturation
* physical fitness
* individual differences of coaches
* age
* difficulty of task
* teaching environment
* motivation.
 |
| 5.3.5 | Define the concept of*transfer*. | 1 |  |
| 5.3.6 | Outline the types of transfer. | 2 | Limit to positive and negative, as they apply to:* skill to skill
* practice to performance
* abilities to skills
* bilateral
* stage to stage
* principles to skills.

Refer to an example in each case. |
| 5.3.7 | Outline the different types of practice. | 2 | Limit to* distributed
* massed
* fixed (drill)
* variable
* mental.
 |
| 5.3.8 | Explain the different types of presentation. | 3 | Limit to:* whole
* whole–part–whole
* progressive part
* part.

Refer to an example in each case. |
| 5.3.9 | Outline the spectrum of teaching styles. | 2 | Limit to command, reciprocal and problem- solving. |

# Topic 6: Measurement and evaluation of human performance (13 hours)

## Statistical analysis

**2 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 6.1.1 | Outline that error bars are a graphical representation of the variability of data. | 2 | Only standard deviation needs to be considered. |
| 6.1.2 | Calculate the mean and standard deviation of a set of values. | 2 | Students should specify the sample standard deviation, not the population standard deviation.Students will not be expected to know the formulas for calculating these statistics. They will be expected to use the statistics function of a graphic display or scientific calculator.**Aim 7:** Students could also be taught how to calculate standard deviation using a spreadsheet computer program. |
| 6.1.3 | State that the statistic standard deviation is used to summarize the spread of values around the mean, and that within a normal distribution approximately 68% and 95% of the valuesfall within plus or minus one or two standard deviations respectively. | 1 | For normally distributed data, about 68% of all values lie within ±1 standard deviation of the mean. This rises to about 95% for ±2 standard deviations. |
| 6.1.4 | Explain how the standard deviation is useful for comparing the means and the spread of data between two or more samples. | 3 | A small standard deviation indicates that the data is clustered closely around the mean value. Conversely, a large standard deviation indicates a wider spread around the mean. |
| 6.1.5 | Outline the meaning of coefficient of variation. | 2 | Coefficient of variation is the ratio of the standard deviation to the mean expressed as a percentage. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 6.1.6 | Deduce the significance of the difference between two sets of data using calculated values for *t* and the appropriate tables. | 3 | For the *t*-test to be applied, ideally the data should have a normal distribution and a sample size of at least 10. The *t*-test can be used to compare two sets of data and measure the amount of overlap. Students will not be expected to calculate values of *t*. Only two-tailed, paired and unpaired *t*-tests are expected.**Aim 7:** While students are not expected to calculate a value for the *t*-test, students could be shown how to calculate such values using a spreadsheet program or the graphic display calculator.**TOK:** The scientific community defines an objective standard by which claims about data can be made. |
| 6.1.7 | Explain that the existence of a correlation does not establish that there is a causal relationship between two variables. | 3 | **Aim 7:** While calculations of such values are not expected, students who want to use *r* and *r*2 values in their practical work could be shown how to determine such values using a spreadsheet program. |

* 1. **Study design**

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 6.2.1 | Outline the importance of specificity, accuracy,reliability and validity with regard to fitness testing. | 2 |  |
| 6.2.2 | Discuss the importance of study design in the context of the sports, exercise and health sciences. | 3 | This should include a demonstration of causality in experimental results by the inclusion of control groups, randomization, placebos, blinding and double-blinding, statistical analysis. |
| 6.2.3 | Outline the importance of the Physical Activity Readiness Questionnaire (PAR-Q). | 2 |  |
| 6.2.4 | Evaluate field, laboratory, sub-maximal and maximal tests of human performance. | 3 |  |

* 1. **Components of fitness**

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 6.3.1 | Distinguish between the concepts of *health-related fitness* and *performance- related (skill-related) fitness*. | 2 | *Health-related fitness* includes body composition, cardio-respiratory fitness (aerobic capacity), flexibility, muscular endurance, strength.*Performance-related (skill-related) fitness* includes agility, balance, coordination, power, reaction time and speed.Some components of performance-related fitness (agility, balance, coordination) could become health-related for certain groups such as the elderly and those suffering from hypokinetic diseases. |
| 6.3.2 | Outline the major components of fitness identified in 6.3.1. | 2 |  |
| 6.3.3 | Outline and evaluate a variety of fitness tests. | 3 | Consider validity, reliability and limitations of the following tests.* Aerobic capacity—multistage fitness test/ bleep test (Leger test), Cooper’s 12-minute run, Harvard step test
* Flexibility—sit and reach
* Muscle endurance—maximum sit-ups, maximum push-ups, flexed arm hang
* Agility—Illinois agility test
* Strength—hand grip dynamometer
* Speed—40-metre sprint
* Body composition—body mass index, anthropometry and underwater weighing
* Balance—stork stand
* Coordination—hand ball toss
* Reaction time—drop test, computer simulation
* Power—vertical jump, standing broad jump

**Aim 9:** Issues of using direct and indirect measures of fitness, and the extrapolation of data and generalizations across populations, could be considered. Cultural variations in theestablishment of standardized norms may also be explored.**Aim 7:** Opportunity to use computer simulation/ modelling and databases. |

* 1. **Principles of training programme design**
1. **hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| 6.4.1 | Describe the essential elements of a general training programme. | 2 | This should include:* warm-up and stretching activities
* endurance training
* cool down and stretching activities
* flexibility training
* resistance training
* the incorporation of recreational activities and sports into the schedule.

**TOK:** Recent research questions the effectiveness of static stretching as a necessary componentof the warm-up. The difficulty of conducting controlled trials without a placebo effect could be discussed. The willingness of athletes to believe what they are told, without questioning the advice, could also be considered. |
| 6.4.2 | Discuss the key principles of training programme design. | 3 | Limit to:* progression
* overload (frequency, intensity and duration)
* specificity
* reversibility
* variety
* periodization.
 |
| 6.4.3 | Outline ways in which exercise intensity can be monitored. | 2 | Limit to:* use of heart rate based upon its relationship with oxygen uptake, that is, target heart rate that coincides with a given percentage of maximal oxygen uptake
* the Karvonen method
* the training heart rate range/zone
* ratings of perceived exertion (Borg/OMNI/ CERT scale).
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Syllabus content—Options

Syllabus

# Option A: Optimizing physiological performance (15 hours SL, 25 hours HL)

## Training

**5 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.1.1 | Distinguish between *training*, *overtraining* and *overreaching.* | 2 | Training is performing exercise in an organized manner on a regular basis with a specific goal in mind (cross-reference with 6.2).Overtraining is when an athlete attempts to do more training than he or she is able to physically and/or mentally tolerate. Overtraining resultsin a number of symptoms that are highly individualized.Overreaching is transient overtraining. |
| A.1.2 | Describe various methods of training. | 2 | Limit to:* flexibility training
* strength and resistance training
* circuit training
* interval training
* plyometrics
* continuous training
* fartlek training/speed play
* cross-training.
 |
| A.1.3 | Discuss possible indicators of overtraining. | 3 | Limit to:* changes to resting heart rate
* chronic muscle soreness
* reduced immune function and frequent upper-respiratory tract infections (coughs and colds)
* sleep disturbance
* fatigue
* decreased appetite
* sudden and unexplained decrease in performance.
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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.1.4 | Discuss how periodization should be organized to optimize performance and avoid overtraining and injury. | 3 | Periodization—transition (post-season), preparation (pre-season), competition. Knowledge of macrocycle, mesocycle and microcycle **is** required. |

* 1. **Environmental factors and physical performance**
1. **hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.2.1 | Explain the relationship between cellular metabolism and the production of heat in the human body. | 3 | Include consideration of the meaning of efficiency with regard to energy liberation, ATP re-synthesis and heat production. |
| A.2.2 | State the normal physiological range for core body temperature. | 1 |  |
| A.2.3 | Outline how the body thermoregulates in hot and cold environments. | 2 | Include the principles of conduction, convection, radiation and evaporation.**Int:** The ability of people who habitually live in very cold/hot climates to tolerate these harsh conditions compared with people who live in temperate climates could be considered. |
| A.2.4 | Discuss the significance of humidity and wind in relation to body heat loss. | 3 |  |
| A.2.5 | Describe the formation of sweat and the sweat response. | 2 | Consideration of the role of the sympathetic nervous system and the hypothalamus is not required. |
| A.2.6 | Discuss the physiological responses that occur during prolonged exercise in the heat. | 3 | Limit this to cardiovascular response (cross- reference with topic 2.2.8), energy metabolism\* and sweating.\* The reduced muscle blood flow in high temperatures results in increased glycogen breakdown in the muscle and higher levels of muscle and blood lactate in comparison to the same exercise performed in a cooler environment. |
| A.2.7 | Discuss the health risks associated with exercising in the heat. | 3 | Heat-related disorders include heat cramps, heat exhaustion and heat stroke.Because of their relatively large body surface area and immature sweat response, infants, children and young adolescents are more susceptible to complications associated with exercise performed in the heat and the cold. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.2.8 | Outline what steps should be taken to prevent and to subsequently treat heat- related disorders. | 2 |  |
| A.2.9 | Describe how an athlete should acclimatize to heat stress. | 2 | Performing training sessions in similar environmental conditions (heat and humidity) for 5 to 10 days results in almost total heat acclimatization. Initially, the intensity of trainingshould be reduced to avoid heat-related problems in these conditions.National representative teams/sportspeople choosing to acclimatize to the conditions of a host country during a major international sporting competition could be considered.**Aim 8:** The cost associated with the acclimatization of athletes using environmental chambers and/or expensive overseas training facilities (science and technology drives demand) could be explored. This also raises an ethical implication that poorer nations are unable to afford such support mechanisms and so their athletes are disadvantaged in comparison to athletes from wealthier nations. |
| A.2.10 | Discuss the physiological and metabolic adaptations that occur with heat acclimatization. | 3 | Include increased plasma volume, increased sweat response and reduced rate of muscle glycogen utilization. |
| A.2.11 | Outline the principal means by which the body maintains core temperature in cold environments. | 2 | Consider shivering, non-shivering thermogenesis and peripheral vasoconstriction. |
| A.2.12 | Explain why the body surface area to body mass ratio is important for heat preservation. | 3 | For example, tall, heavy individuals have a small body surface area to body mass ratio, which makes them less susceptible to hypothermia.Small children tend to have a large body surface area to body mass ratio compared to adults.This makes it more difficult for them to maintain normal body temperature in the cold. |
| A.2.13 | Outline the importance of wind chill in relation to body heat loss. | 2 | A chill factor created by the increase in the rate of heat loss via convection and conduction caused by wind. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.2.14 | Explain why swimming in cold water represents a particular challenge to the body’s ability to thermoregulate. | 3 | Consider the thermal conductivity of water and air.During cold-water immersion, humans generally lose body heat and become hypothermic at a rate proportional to the thermal gradient and the duration of exposure. During swimming, theeffect of cold water on body heat loss is increased because of greater convective heat loss. However, at high swimming speeds, the metabolic rate of the swimmer may compensate for the increased heat loss. |
| A.2.15 | Discuss the physiological responses to exercise in the cold. | 3 | Limit this to muscle function and metabolic responses. |
| A.2.16 | Describe the health risks of exercising in the cold, including cold water. | 2 | Limit to frostbite and hypothermia. |
| A.2.17 | Discuss the precautions that should be taken when exercising in the cold. | 3 | The principal barrier is clothing, the amount of insulation offered by which is measured in a unit called a clo (1 clo = 0.155 m2 K W-1).Consider the insulating effect of clothing. Consideration of exercising in water is not required. |

* 1. **Non-nutritional ergogenic aids**
1. **hours**

**Aim 8:** There are clear ethical issues in the use of performance-enhancing drugs.

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.3.1 | Define the term *ergogenic aid*. | 1 | An ergogenic aid is any substance or phenomenon that improves an athlete’s performance. |
| A.3.2 | Describe, with reference to an appropriate example, the placebo effect. | 2 |  |
| A.3.3 | List five classes of non- nutritional ergogenic aids that are currently banned by the International Olympic Committee (IOC) and the World Anti-Doping Agency (WADA). | 1 | Specific names of banned substances need not be given. Limit to:* anabolic steroids
* hormones and related substances
* diuretics and masking agents
* beta blockers
* stimulants.
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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.3.4 | Discuss why pharmacological substances appear on the list of banned substances. | 3 | The discussion should focus on the moral obligation of athletes to compete fairly and on the safety issue around the use of these substances. |
| A.3.5 | Discuss the proposed and actual benefits that some athletes would hope to gain by using anabolic steroids, erythropoietin (EPO), beta blockers, caffeine and diuretics. | 3 | The combined effects of taking two or more of the substances need not be considered.**TOK:** Decisions about what constitutes an acceptable level of risk could be discussed, together with differences between different groups and their views—scientists, sportsmen, doctors and spectators. |
| A.3.6 | Outline the possible harmful effects of long-term useof anabolic steroids, EPO, beta blockers, caffeine and diuretics. | 2 | **Aim 8:** Our understanding of the effects, both ergogenic and harmful, of many bannedsubstances (for example, anabolic steroids) has been hindered by the ethical concerns/problems about studying these agents in otherwise healthy individuals in randomized controlled trials. |

## Recovery from sports and exercise (HL only)

1. **hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.4.1 | Define *active recovery*. | 1 | Low-intensity exercise to promote recovery either immediately after, or in the days following, an intense training session or competition. |
| A.4.2 | Outline the reasons for active recovery immediately after a training session or competition. | 2 | Consider:* raised circulation rate
* enhanced blood lactate removal
* accelerated raising of blood pH.

**Link to topic 9:** Fatigue |
| A.4.3 | Describe the indicators of recovery. | 2 | Include:* physiological indicators (for example, reduced blood lactate concentration)
* symptomatic indicators (for example, reduced muscle soreness)
* psychological indicators (for example, improved preparedness for the next session/ competition).
 |
| A.4.4 | Outline the importance of planned recovery between workout sessions as part of a training programme. | 2 | Consider the fitness–fatigue model of training. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| A.4.5 | Outline the use of compression garments for sports recovery. | 2 | Compression garments (CGs) provide a means of applying mechanical pressure at the body surface, thereby compressing and supporting underlying tissue. They are relatively low cost, easy to useand are non-invasive. Although widely used across many different sports, evidence of any enhancement of recovery is inconclusive.**TOK:** The effectiveness of recovery interventions is difficult to quantify and these techniquesare seen by some as pseudoscience. How can we know the difference between science and pseudoscience? |
| A.4.6 | Define *cryotherapy*. | 1 | Body cooling for therapeutic purposes. |
| A.4.7 | Describe cryotherapy procedures used for recovery in sports. | 2 | Consider:* whole body cooling (WBC)
* cold water immersion (CWI)
* contrast water therapy (CWT)
* ice packs.

**Int:** Hot and cold treatments have been used for therapeutic purposes in various cultures across the world for centuries. |
| A.4.8 | Discuss the use of different types of cryotherapy for elite and recreational athletes. | 3 | Consider:* analgesic and anti-inflammatory effects for soft tissue
* perception of enhanced recovery rates and improved performance
* risks associated with exposure to prolonged or extreme cold
* costs of the different therapies.

There is pressure to maximize sporting performance, meaning that athletes often experiment with extreme interventions even if their safety and efficacy has not been established.**TOK:** Current recommendations for cryotherapy use are largely based on anecdotal ratherthan scientific research. What are the ethical considerations in allowing the use of these techniques? |

# Option B: Psychology of sports (15 hours SL, 25 hours HL)

## Individual differences

**5 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.1.1 | Define the term *personality*. | 1 | There are many definitions of personality; for the purpose of this course the following definition will be used.“Those relatively stable and enduring aspects of individuals which distinguish them from other people, making them unique but at the same time permit a comparison between individuals” (Gross 1992).**TOK:** There is significant disagreement in personality research regarding issues of validity, reliability and sophistication of theoretical models. |
| B.1.2 | Discuss social learning theory and personality. | 3 | Limit to Bandura’s (1977) social learning theory. |
| B.1.3 | Discuss the interactionist approach to personality. | 3 |  |
| B.1.4 | Outline issues associated with the measurement of personality. | 2 | Limit to:* data collection (interviews, questionnaires, observing behaviour)
* validity and reliability issues
* ethical issues: confidentiality, use of results, predicting performance.

**TOK:** Issues relating to measurement. |
| B.1.5 | Evaluate the issues in personality research and sports performance. | 3 | Consider:* athletes versus non-athletes
* personality and sports type
* predicting performance.

Refer to the positions adopted by the skeptical and credulous groups of psychologists. |

* 1. **Motivation**

**3 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.2.1 | Define the term *motivation*. | 1 | Motivation is “the internal mechanisms and external stimuli which arouse and direct our behaviour” (Sage 1974). |
| B.2.2 | Outline the types of motivation. | 2 | Limit to intrinsic and extrinsic motivation theory. |
| B.2.3 | Discuss the issues associated with the use of intrinsic and extrinsic motivators in sports and exercise. | 3 | Limit to how extrinsic rewards influence intrinsic motivation.Extrinsic rewards seen as controlling of behaviour.Extrinsic rewards providing information about their level of performance.Extrinsic rewards will enhance intrinsic motivation when the reward provides positiveinformation with regard to the performer’s level of competence. |
| B.2.4 | Describe Atkinson’s model of achievement motivation. | 2 |  |
| B.2.5 | Outline goal orientation theory. | 2 | Limit to:* reasons for participation (achievement goals)
* differing meanings that success or failure has for the performer (task versus outcome orientation).
 |
| B.2.6 | Describe attribution theory and its application to sports and exercise. | 2 | Limit to Weiner’s classification for causal attributions.* Locus of stability
* Locus of causality
* Locus of control
* Self-serving bias
* Learned helplessness
 |

* 1. **Mental preparation for sports**

**4 hours**

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.3.1 | Define the term *arousal*. | 1 |  |
| B.3.2 | Describe the theoretical approaches to arousal. | 2 | Limit to:* drive reduction theory
* inverted-U hypothesis
* catastrophe theory.
 |
| B.3.3 | Draw and label a graphical representation of the arousal– performance relationship. | 1 | Refer to the theories of arousal in B.3.2. |
| B.3.4 | Discuss the emotions that may influence an athlete’s performance or experience in a physical activity. | 3 | Participation in sports and exercise influences a range of participant emotions such as depression, anxiety and pleasure. Limit to a discussion ofthe emotions that may be prevalent in physical activity. This may include:* positive emotions such as excitement, relief, pride
* negative emotions such as anger, guilt, shame, anxiety, boredom
* specific emotions that have a discrete effect on performance (for example, a negative mood is more likely to prime us to remember negative memories of

past failures, and thus reduce our feelings of confidence to perform; similarly, a positive mood is more likely to prime us to remember positive previous outcomes, and increase our confidence to perform). |
| B.3.5 | Define the term *anxiety.* | 1 |  |
| B.3.6 | Distinguish between*cognitive* and *somatic anxiety*. | 2 |  |
| B.3.7 | Distinguish between *trait*and *state anxiety*. | 2 |  |
| B.3.8 | Evaluate how anxiety is measured. | 3 | Limit to:* trait anxiety: Sport Competition Anxiety Test (SCAT)
* state anxiety: Competitive State Anxiety Inventory-2 (CSAI-2R).

**TOK:** Issues relating to measurement. |

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.3.9 | Describe the stress process in sports. | 2 | Defined as a substantial imbalance between the demand (physical and/or psychological) and response capability, under conditions where failure to meet that demand has important consequences.Include:* causes of stress (environmental demand)
* stress response (person’s reactions)
* stress experience (psychological interpretation)
* actual behaviour (outcome).
 |

* 1. **Psychological skills training**

**3 hours**

The competitive process is complex and multifaceted. A performer is affected by a range of factors (personality, motivation, arousal, emotional effect). One aim of a sports psychologist is to manipulate these factors to enhance optimal performance. This section examines several fundamental interventions and evaluates their benefits and limitations.

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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.4.1 | Discuss psychological skills training (PST). | 3 | Refers to the systematic and consistent practice of mental or psychological skills.Include the following issues. PST:* is not just for elite athletes
* is not just for problem athletes
* does not provide quick-fix solutions. Consider the three phases of a PST programme:
* education
* acquisition
* practice.
 |
| B.4.2 | Outline goal setting. | 2 | Include:* associated with enhancing self-confidence and motivation
* SMARTER (specific, measurable, achievable, realistic, time, evaluate, review) goals
* types of goals (outcome, performance, process).
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|  | **Assessment statement** | **Obj** | **Teacher’s notes** |
| B.4.3 | Evaluate mental imagery. | 3 | Associated with concentration enhancement, self- confidence, skill acquisition, emotional control, practice strategy and coping with pain and injury.Include:* external and internal imagery
* protocol for imagery interventions.
 |
| B.4.4 | Outline relaxation techniques. | 2 | Associated with arousal regulation, reducing somatic and cognitive anxiety.Include:* progressive muscular relaxation (PMR)
* breathing techniques
* biofeedback.
 |
| B.4.5 | Outline self-talk techniques. | 2 | Associated with concentration, attention, cognitive regulation and motivation enhancement.Include:* positive and negative self-talk
* thought stopping.
 |