

Locomotion module – Year 2 Semester 2

Credits – 7

Duration: 06 Weeks (30 days)

Topic/ concept	Objectives	Time	T/I activity	Department
	Student should be able to,			
2007-2/SBM-9/01 1. Introduction to locomotion	<ol style="list-style-type: none"> 1. The free upper limb- adaptation of the hand to serve multiple functions- fine movements and grip 2. Quadraped to biped 	1hr	Lecture	Anatomy
2007-2/SBM-9/02 2. Bones A. Types and general features of bone and cartilage	<ol style="list-style-type: none"> 1. Classify bones and cartilages 2. Describe the parts of a long bone 3. Describe the microscopic structure of bone and cartilage 4. State the structural and functional differences between the different types of cartilage 5. Recall the structure of the epiphyseal plate and the articular cartilage 	1 hr	Lecture	Anatomy
B. Axial skeleton	<ol style="list-style-type: none"> 1. Describe the axial and appendicular skeleton 2. Describe the general features of the vertebral column 3. Describe the general features of a typical vertebra 4. State the regional differences of the vertebrae and relate the functional significance of the differences mentioned 	3 hrs	Practical Using bones	Anatomy
D. Bone growth and remodeling (i). Introduction to growth and remodeling	<ol style="list-style-type: none"> 1. State the composition of bone and cartilage 2. Explain how the composition of bone and cartilage contribute to their function. 3. Name the bone cells and describe their role in bone formation (both matrix and bone mineral) 4. Outline the mechanism involved in bone mineralisation 5. Explain what is meant by bone remodeling and the advantage of this process to the body. 6. State the role of nutritional and other factors in bone remodeling 	2hr	Lecture	Biochemistry
(ii). Vitamins and minerals in relation to bone growth and remodeling	<ol style="list-style-type: none"> 1. Describe the synthesis, functions, dietary sources and recommended daily allowance of vitamin D. 2. State the effects of vitamin D deficiency and excess. 3. Recall the role of bone, kidney and the intestine in maintaining the calcium and phosphorus concentrations in the blood. 	2hrs	Lecture	Biochemistry

<p>(iii) Collagen and ground substance</p> <p>(iv) ossification</p>	<p>4. State the functions of calcium and phosphorus in the body. 5. Recall the sources that are rich in calcium in the Sri Lankan diet. 6. Describe the role of fluoride in bone mineralisation</p> <p>Ca⁺⁺ metabolism, role of nutrients in bone formation (vitamins A, D, K, C, fluoride etc.)</p> <p>1. State the basic steps involved in collagen synthesis and their defects. 2. State different types of collagen and their distribution. 3. State how the structures of collagen and ground substance of bone facilitate the deposition of bone mineral. 4. Explain the mechanism of calcification.</p> <p>1. Describe membranous and cartilagenous ossification 2. Explain the term 'epiphyseal plate' 3. Describe growth at epiphyseal plates 4. Be aware of temporal variation of the appearance of ossific centers</p>	<p>2hrs</p> <p>1 hr</p>	<p>SGD</p> <p>Lecture</p>	<p>Biochemistry</p> <p>Biochemistry</p> <p>Anatomy</p>
<p>E. Hormones involved in bone metabolism</p> <p>F. Markers of bone growth</p>	<p>Explain the Role of hormones on calcium metabolism</p> <p>State the effects of other hormones such as insulin, oestrogen, cortisol, thyroid hormones, growth hormone on bone</p> <p>1. Estimation of serum parameters used as markers of bone growth. 2. Alkaline phosphatase (isoform)- state types of</p>	<p>1 hr</p> <p>1hr</p> <p>3hrs</p>	<p>Lecture</p> <p>Lecture</p> <p>PD</p>	<p>Physiology</p> <p>Biochemistry</p> <p>Biochemistry</p>

	<p>alkaline phosphatase, differences between them and their tissue distribution</p> <p>3. Hydroxyproline excretion,- significance of elevation</p> <p>4. Serum Ca²⁺ & phosphate 24 hr urinary Ca²⁺ & phosphate</p> <p>5. Alkaline phosphatase</p> <p>1. List and explain the factors that contribute to the development of rickets, osteomalacia, osteoporosis, osteoflorosis</p>			
G. Disorders of bone	<p>2. Explain the serum biochemical changes observed in rickets</p> <p>3. Explain the biochemical basis for the clinical signs observed in rickets</p> <p>Metabolic bone disorders</p>	2hr	SGD	Biochemistry
		5hrs	CCR	Anatomy
<p>2007-2/SBM-9/03</p> <p>3. Muscles</p> <p>P A. prime movers, synergist, antagonists</p>	<p>1.explain what is meant by a prime mover, synergist and an antagonist</p> <p>2. Understand that movements at joints are produced by groups of muscles which include a main muscle and two other groups of muscles either helping this movement or opposing it.</p>	1 hr	Lecture	Anatomy
Types and general features of muscle	<p>1. Describe the microscopic structure of the skeletal muscle.</p> <p>2. Describe the main ultra structural components of a skeletal muscle cell with special reference to sarcoplasmic reticulum, t tubules, terminal cisternae and actin and myosin filaments</p> <p>3. List the different types of movements produced by skeletal muscles</p> <p>4. Understand the relationship of muscles, joints and bones</p>	1 hr	Lecture	Anatomy
		3hrs	Histology Practical	
C. Contraction and relaxation of muscles	Describe the process of excitation and contraction coupling and muscle relaxation	2hrs	Lecture	Physiology

	In a muscle tracing, identify the following phenomena, muscle twitch, summation, tetanus, staircase phenomenon, muscle fatigue, effect of temperature on muscle contraction	2hrs	PD	Physiology
D. Muscle metabolism	<p>1. Recall the three major types of muscle and the distribution of cellular organelles in each and their function.</p> <p>2. State the major fuels used by skeletal muscle and describe the environment present to promote energy production.</p> <p>3. Describe the status of ATP/ADP ratio in a skeletal muscle fibre when it is resting and active, explaining how the ratio affects energy production under aerobic and anaerobic (hypoxic) conditions.</p>	1hr	Lecture	Biochemistry
E. Effect of exercise on muscles (i) biochemical effects of exercise	<p>Explain the principles of:</p> <ol style="list-style-type: none"> 1. Oxygen debt, 2. Changes in the muscle following muscle fatigue after exercise and lactic acidosis 3. Recovery from exercise 4. Energy cost of exercise in terms of BMR 5. Receptor changes in exercise (LDL, insulin etc) 6. Changes in blood lipids with exercise 7. Calculation of energy requirement for exercise 	3hr	Lecture	Biochemistry
		3hrs	PD	Biochemistry
(ii). Changes in muscle mass to meet the functional demand	<p>Describe morphological (ultra-structural) biochemical and physiological adaptations of skeletal muscle that occur in response to exercise</p> <ol style="list-style-type: none"> 1. Describe the characteristics of different muscle fiber types 2. Describe how these are adapted for activities requiring rapid, powerful movements or 	2hr	Lecture	Physiology

	<p>endurance events</p> <p>3. Describe the acute and chronic adaptations of muscles for exercise and training</p> <p>4. Explain how body's diverse energy systems interact to transfer energy during rest and different exercise intensities</p> <p>5. Describe the role of central and peripheral factors in development of fatigue in skeletal muscle fibers.</p>			
F. Physiological Basis of muscle disorders/dysfunctions	<p>1. State the different types of muscle disorders/dysfunction</p> <p>2. Describe the physiological basis of muscle dysfunction in different muscle disorders</p>	2hr	Lecture	Physiology
G. Identification of muscle Damage	<p>1. Name the enzymes that are useful in identifying skeletal muscle damage</p> <p>2. State the alteration in activity of the enzymes in serum following skeletal muscle damage</p> <p>3. Explain how skeletal muscle damage could be differentiated from cardiac muscle damage based on serum parameter changes</p> <p>4. Define the term 'myoglobinuria'</p> <p>5. State the effect of myoglobin on nephrons</p>	1hr	Lecture	Biochemistry
	<p>6. Outline the basis of the determination of enzymes used in the identification of muscle damage (creatine kinase, LDH, aminotransferases)</p> <p>7. Describe how myoglobinuria is detected in urine</p>	3hrs	PD	Biochemistry
2007-2/SBM-9/04 5. Joints Introduction	<p>1. Classify joints</p> <p>2. Describe the structure of a synovial joint</p> <p>3. Describe the factors that affect the stability of joints</p> <p>4. Describe the different types of synovial joints and how they move</p>	1hr	Lecture	Anatomy
B. Basic biomechanics (motion, range of movements, leavers,)	Understand the principles of levers in motion	1hr	Lecture	Anatomy to arrange
C. Joint injury	Appreciate that joint injury has an impact on movement			
D. Coordination of movement	<p>1. Discuss the role of the cerebellum on motor coordination</p> <p>2. Explain giving examples how coordination is affected in neurological diseases</p>	2hrs	Staff seminar	Physiology to arrange
Regional anatomy 2007-2/SBM-9/05	<p>1. Identify the bones that form the pectoral girdle and the upper limb</p> <p>2. Name their parts and general features</p>	3hrs	Practical using	Anatomy

1. Upper limb A. Osteology	3. Be able to correlate the basic organization of the upper limb skeleton to its function		bones	
2007-2/CLM-9/01 B. Surface anatomy	<ol style="list-style-type: none"> 1. Demonstrate the bony anatomical landmarks of the pectoral girdle and the upper limb 2. Surface mark the major nerves, arteries and veins 3. Describe the dermatomes of the upper limb 	2hr	Practical on self and volunteers	Anatomy
C. Regions of the upper limb 1. Scapular region (pages 17- 19)- 3hrs 2. Axilla and brachial plexus(pages 19- 22) -5hrs 3. Arm and cubital fossa (pages 22-26)- 3hrs 4. Flexor region of fore arm(pages 26-29)-3hrs 5. Palm of the hand (pages 30-35)3 hrs 6. Extensor region of forearm and dorsum of hand (pages 35-36)3hrs	<ol style="list-style-type: none"> 1. Describe the muscles that form the different regions of the upper limb 2. Describe the fascial compartments 3. Describe the organization of the brachial plexus 4. Describe how the nerves formed from the brachial plexus supply the upper limb muscles, joints and the skin 5. Describe the blood supply of the upper limb paying special attention to the collateral supply and its clinical significance 6. Describe the lymphatic drainage of the upper limb, paying special attention to the axillary lymph nodes 	20hrs	Dissections	Anatomy
D. Joints of upper limb and pectoral girdle (i) structure and stability of joints of the upper limb (ii) kinesiology of the upper limb	<ol style="list-style-type: none"> 1. Describe the structure, movements and stabilizing factors of the shoulder joint, elbow joint and wrist joint 2. Describe the movements of the small joints of the hand. 3. State the spinal segments for joint movements. <ol style="list-style-type: none"> 1. Understand the biomechanics involved in joint movements of the upper limb 	2hr	Tutorial	Anatomy
E. Clinical correlations of the upper limb	<ol style="list-style-type: none"> 1. Describe the collateral supply (arterial)of the upper limb and its clinical significance 2. Explain how fractures occur in the upper limb 3. Understand that the erect posture of the human has resulted in an increased risk for fracture 	1hr	Lecture	Anatomy

	<ol style="list-style-type: none"> 4. list the structures that maybe damaged due to different fractures 5. Describe the upper limb nerve injuries 	1hr	Lecture	Anatomy
F. Overview of the upper limb	Be able to contribute to discussion based on the regions dissected and studied/identified	1hr	SGD	Anatomy
2007-2/SBM-9/06 2. Lower limb A .Osteology	<ol style="list-style-type: none"> 1. Name the bones that form the lower limb and pelvic girdle 2. Identify and orientate the bones of the lower limb and pelvic girdle giving reasons 3. Identify the special features of bones of the lower limb and pelvic girdle 	2hr	PD Using bones and articulated skeleton :	Anatomy
B. Surface anatomy	<ol style="list-style-type: none"> 1. Demonstrate bony landmarks reference points and reference lines of the lower limb that are used in describing the anatomy in the living subject 2. Describe the surface projections of important structures in the lower limb 3. Describe the dermatomes of the lower limb 	2hr	PD Practice on self and volunteers	Anatomy
2007-2/SBM-9/07 C. Regions of the lower limb 1. Front and medial aspect of the thigh (p122-130)-5hrs 2. Gluteal region (p130-133)-3hrs 3. Back of the thigh and popliteal fossa (p133-136)-5hrs 4. Leg and dorsum of the foot (p 136-142)- 5hrs 5. Sole of the foot - including arches of the foot (p142-144)- 6hrs	<ol style="list-style-type: none"> 1. Understand the general organization of groups of muscles in the lower limb and pelvic girdle 2. State the attachments , nerve supply, and actions of lower limb and pelvic girdle muscles 3. Define the bony attachments of the muscles using bones of the lower limb 4. Describe the arrangement of fascial compartments. 5. Describe the arterial supply, venous drainage and lymphatic drainage of the lower limb. 6. Describe the formation, distribution and the immediate relations of 	24hrs	Dissections	Anatomy

	the ,femoral, sciatic ,peroneal and tibial nerves and their major branches 7. Be able to delineate the dermatomes of the lower limb			
D. Joints of the lower limb (i) structure and Stability	1. Describe the structure, movements and stabilizing factors of the hip joint, knee joint and ankle joint 2. Define the bony attachments of the ligaments and the capsules of respective joints where necessary 3. Describe the movements of inversion and eversion of the foot 4. State the spinal segments responsible for joint movements 5. Understand the biomechanics involved in movement of the lower limb joints	2hrs	Tutorial	Anatomy
(ii) kinesiology of the Lower limb	1. Weight bearing function of the lower limb including foot arches and weight distribution in the foot 2. Walking cycle and adaptations of the lower limb to walking, running and landing	1hr	Lecture	Anatomy
e. Gait and posture		1hr	Lecture	Anatomy
F. Clinical correlations	1. Describe the collateral supply (arterial) of the lower limb and its clinical significance 2. Describe clinical correlations of venous drainage of lower limb 3. Describe the anatomical basis of compartment syndromes 4. Describe how fractures occur in the lower limb. 5. list the structures that maybe damaged due to different fractures 6. describe the anatomical basis for lower limb nerve injuries	1hr	Lecture	Anatomy to arrange
		1hr	Lecture	Anatomy
2007-2/SBM-9/08 Overview of the lower limb	Be able to contribute to discussion based on the structures dissected and observed	2hr	SGD	Anatomy
Overview of the locomotion module	Be able to answer questions based on Anatomy knowledge related to locomotion module and contribute to discussion based on the questions	2hr	SGD	Anatomy

Radiology of the upper and lower limbs		2hrs	Lecture	Radiology
2007-2/SBM-9/09 Embryology of the limbs		2 hrs	lectures	Anatomy

Locomotion Module – (Year 2 Semester 2)

Module Summary

	Lectures (hrs)	PD (hrs)	SGD (hrs)	CCR (hrs)	Tutorial (hrs)	Staff Seminar (hrs)	Total (hrs)
Anatomy	16	59	5	5	4		89
Physiology	7	2				2	11
Biochemistry	11	9	4				24
Radiology	2						
Total	36	70	9	5	4	2	126

Names and departments of the teachers involved in the teaching programme:

Dept. of Anatomy

Prof. M Chandrasekera
Dr. Deepthi Nanayakkara
Dr S B Adikari
Dr. H Amarathunge
Dr J Dissanayake
Dr. Ajith Sominanda

Dept. of Biochemistry

Prof. R. Sivakanesan
Dr. HKI Perera
Dr. P.H.P. Fernando
Dr JGS Ransinghe
Dr. S.B.P. Athauda

Dept. of Physiology

Prof. V S Weerasinghe
Dr. S Rajaratne
Dr. A A J Rajaratne

Radiology

Dr B Hewawithane

Examination Format

Module	Credits	Total duration of examination	MCQ	SAQ	OSPE
Locomotion	7	4	1	1 ½	1 ½