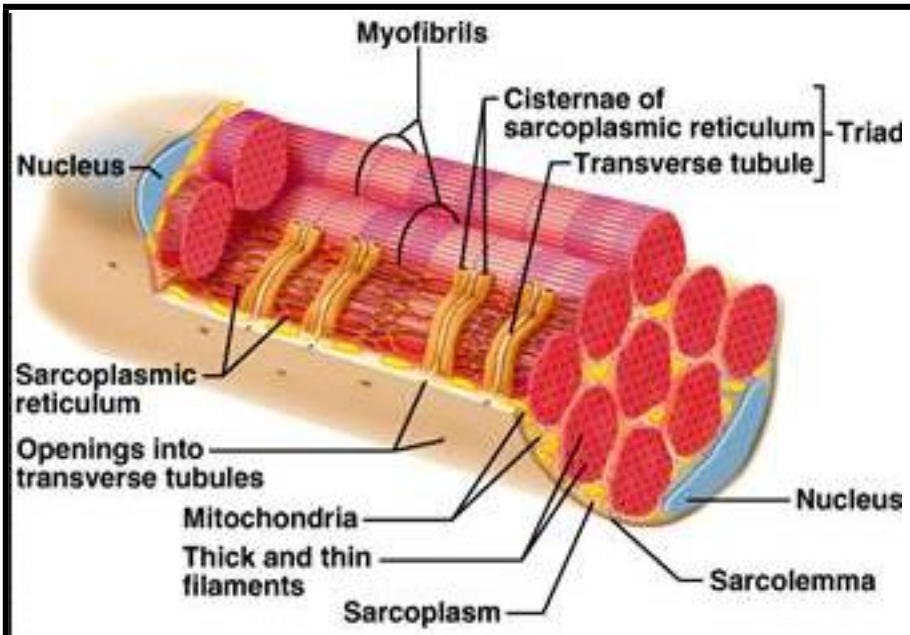


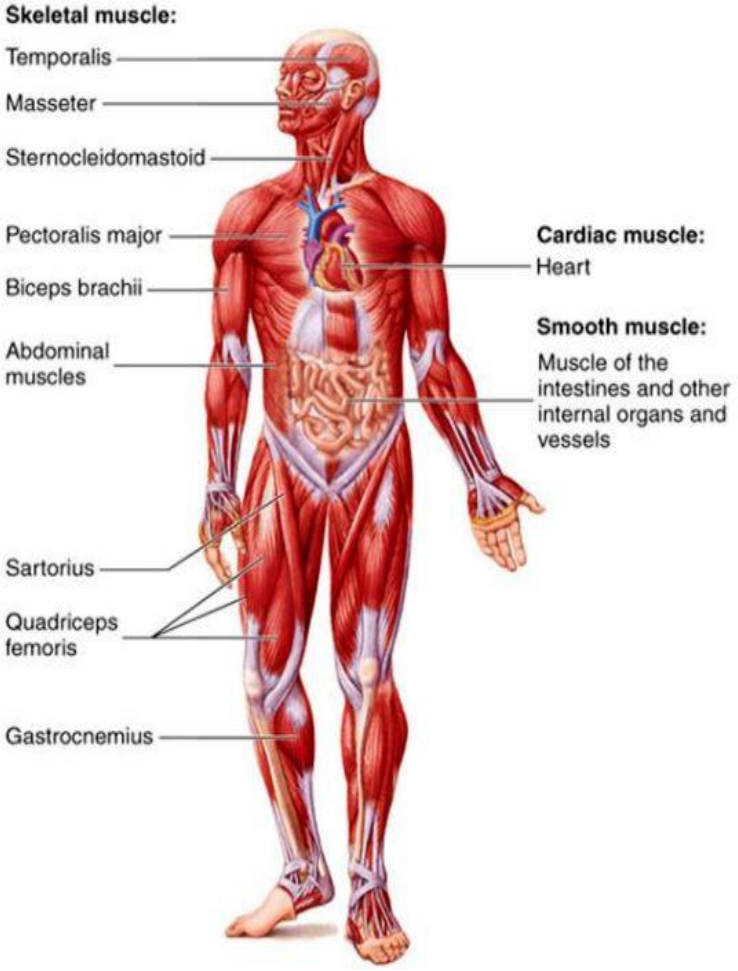
STUDY GUIDE

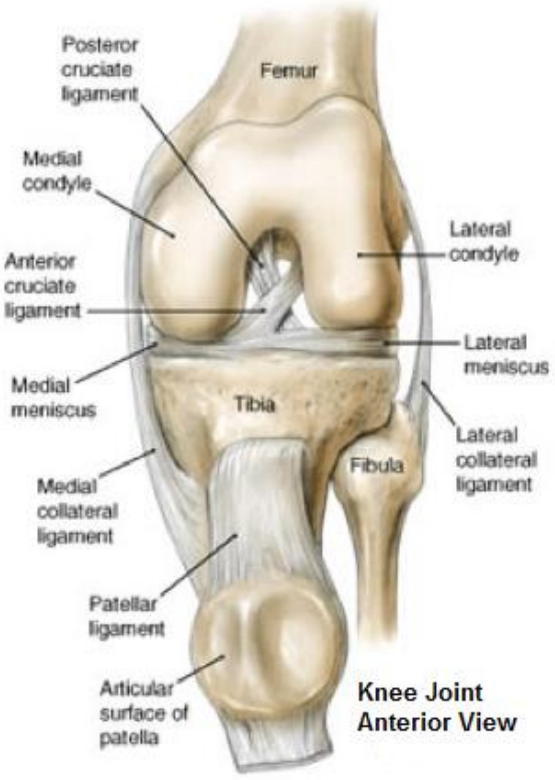
FIRST YEAR MBBS

14TH JUNE- 13TH AUG 2021

DURATION: 9 WEEKS

LOCOMOTOR MODULE





LIAQUAT NATIONAL HOSPITAL AND MEDICAL COLLEGE

Institute for Postgraduate Medical Studies & Health Science

STUDY GUIDE FOR LOCOMOTOR MODULE

Module name: **Locomotor** *Year:* ***One*** *Duration:* ***9 weeks (June – August 2021)***

Timetable hours: **Interactive Lectures, Case-Based Learning (CBL), Self-Study, Practicals, Skills, Demonstrations**

MODULE INTEGRATED COMMITTEE

MODULE COORDINATOR:	• Dr Saima Athar (**Anatomy**)
CO-COORDINATORS:	• Dr Lubna Faisal (**Anatomy**)

DEPARTMENTS'& RESOURCE PERSONS' FACILITATING LEARNING

BASIC HEALTH SCIENCES
ANATOMY Professor Zia-ul-Islam
BIOCHEMISTRY Professor Kashif Nisar
PHYSIOLOGY Professor Syed Hafeezul Hassan
DEPARTMENT of HEALTH PROFESSIONS EDUCATION • Professor Nighat Huda • Professor Sobia Ali • Dr. Afifa Tabassum • Dr. M. Suleman Sadiq
LNH&MC MANAGEMENT Professor KU Makki, Principal, LNH&MC Dr. Shaheena Akbani, Director A.A & R.T LNH&MC
STUDY GUIDE COMPILED BY: Department of Health Professions Education

INTRODUCTION

WHAT IS A STUDY GUIDE?

It is an aid to:

- Inform students how student learning program of the module has been organized
- Help students organize and manage their studies throughout the module
- Guide students on assessment methods, rules and regulations

THE STUDY GUIDE:

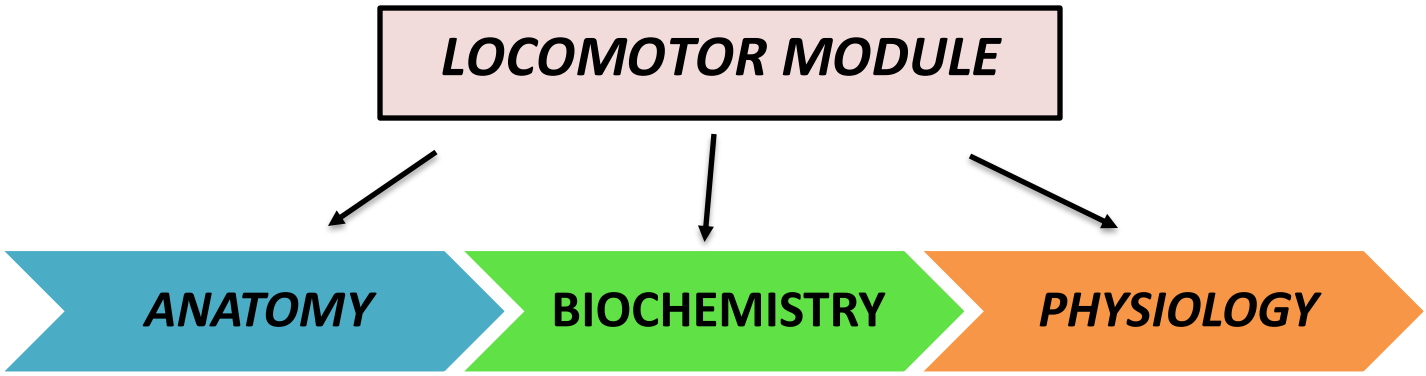
- Communicates information on organization and management of the module. This will help the student to contact the right person in case of any difficulty.
- Defines the objectives which are expected to be achieved at the end of the module.
- Identifies the learning strategies such as lectures, small group teachings, clinical skills, demonstration, tutorial and case based learning that will be implemented to achieve the module objectives.
- Provides a list of learning resources such as books, computer assisted learning programs, web-links, journals, for students to consult in order to maximize their learning.
- Highlights information on the contribution of continuous and semester examinations on the student's overall performance.
- Includes information on the assessment methods that will be held to determine every student's achievement of objectives.
- Focuses on information pertaining to examination policy, rules and regulations.

CURRICULUM FRAMEWORK

Students will experience integrated curriculum**.**

INTEGRATED CURRICULUM comprises of system-based modules such as Locomotor system, Respiratory System and Cardiovascular system which links basic science knowledge to clinical problems. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to have better understanding of basic sciences when they repeatedly learn in relation to clinical examples. Case-based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in skills lab are characteristics of integrated teaching program.

INTEGRATING DISCIPLINES OF LOCOMOTOR MODULE



LEARNING METHODOLOGIES

The following teaching/ learning methods are used to promote better understanding:

- Interactive Lectures
- Small Group Discussion
- Case- Based Learning
- Practicals
- Skills session
- E-Learning
- Self-Directed Learning

INTERACTIVE LECTURES

In large group, the Interactive Lecturer introduces a topic or common clinical conditions and explains the underlying phenomena through questions, pictures, videos of patients' interviews, exercises etc. Students are actively involved in the learning process.

SMALL GROUP DISCUSSION (SGD): This format helps students to clarify concepts acquire skills or attitudes. Sessions are structured with the help of specific exercises such as patient case, interviews or discussion topics. Students exchange opinion sand apply knowledge gained from Interactive Lectures, tutorials and self study. The facilitator role is to ask probing questions, summarize, or rephrase to help clarify concepts.

PRACTICAL: Basic science practicals related to anatomy, biochemistry and physiology are scheduled for student learning.

SKILLS SESSION: Skills relevant to respective module are observed and practiced where applicable in skills laboratory or Department of Physiotherapy.

SELF DIRECTED STUDY: Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, seeking information from Learning Resource Center, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self-study.

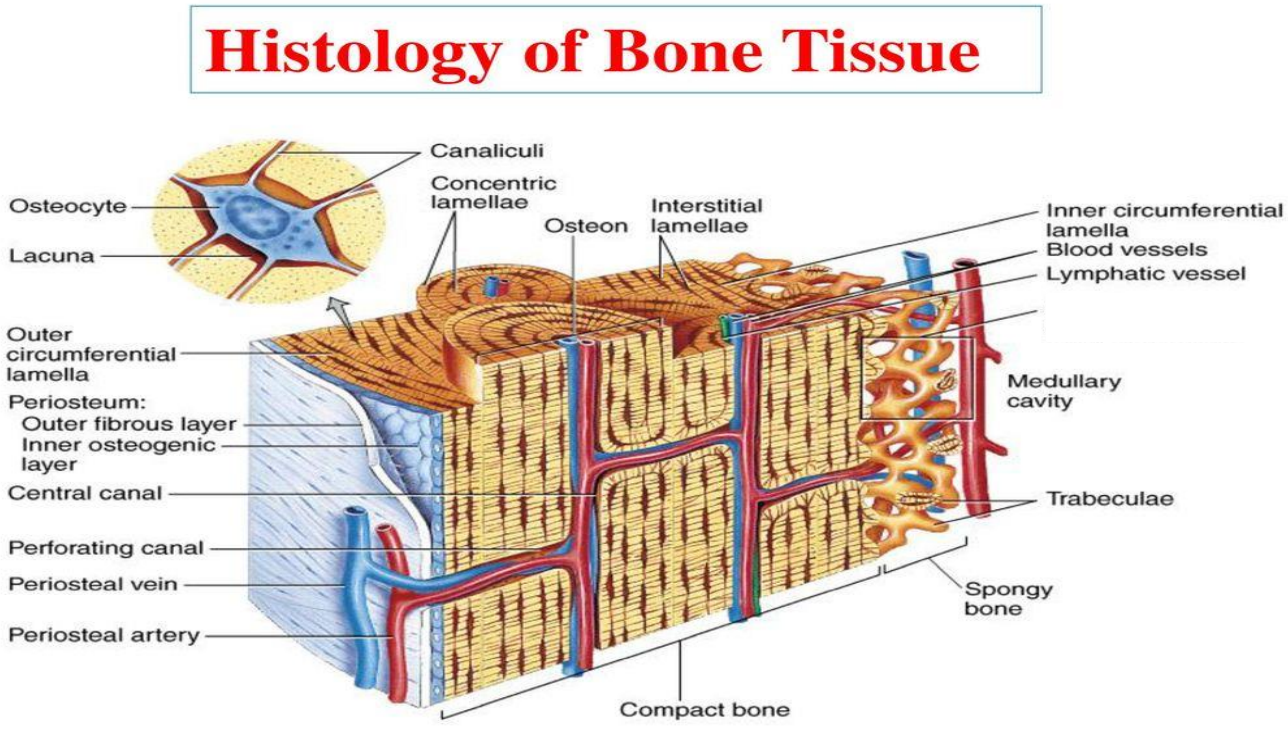
E-LEARNING: E-Learning is a strategy by which learning occurs through the utilization of electronic media, typically the Internet. The basic aspects of medical professionalism and ethics will be addressed through an e-learning course.

LOCOMOTOR MODULE

IMPORTANCE OF LOCOMOTOR SYSTEM

It is likely that individuals at some time suffer from a problem related to the musculoskeletal system, ranging from a very common problem such as osteoarthritis or back pain to severely disabling limb trauma or rheumatoid arthritis. Many musculoskeletal problems are chronic conditions as well. The most common symptoms are pain and disability, with an impact not only on individuals' quality of life but also, importantly, on people's ability to earn a living and be independent. It has been estimated that one in four consultations in primary care is caused by problems of the musculoskeletal system. Healthy life style such as exercise and diet recommended for maintaining good health.

Throughout this module, students will have the opportunity to link basic science knowledge to clinical problems. Teaching relevant basic sciences with clinical examples will help you make connections among concepts and retain the information for later clinical education.



TOPICS, OBJECTIVES AND STRATEGIES

By the end of the module students will be able to:

ANATOMY

OBJECTIVES	*LEARNING STRATEGY*
Introduction to the Musculoskeletal system	Interactive Lectures
• Discuss the division and functions of skeletal system	
• Enumerate the parts of axial and appendicular skeleton	
• Define pectoral & pelvic girdle	
• Describe the division and curvature of vertebral column	
• Discuss the types and number of vertebrae found in adults	
Embryology Development of Paraxial Mesoderm& muscles	
• Define epiblast and hypoblast	
• Explain the differentiation of trilaminar germ disc	
• Discuss the formation of mesoderm and paraxial mesoderm	
• Discuss the developmental relation of hypaxial and epaxial muscles	
• Describe the process of myogenesisin the 3 types of muscle	
UPPER LIMB	
Sternoclavicular and Acromioclavicular Joints	
• Classify types Sternoclavicular and Acromioclavicular of joint	
• Describe their structure	
• Name the muscles acting on these joint	
• Explain the movements at these joint	
• Explain clinical aspects of these joint	
Breast Development, Gross and Histology	Interactive Lectures/CBL
• Discuss the anatomy of breast	
• Explain the relation of breast within pectoral region	
• Describe the blood supply & lymphatic drain age of breast	
• Discuss the relation of breast disease with axilla	
• Explain the development of breast	
• Discuss the histological features of breast	
Brachial Plexus	Interactive Lectures/CBL/Small Group Discussion
• Describe the formation of brachial plexus, with its root value and divisions (roots, trunk, division, and cords)	
• Discuss the relation of brachial plexus also in connection to clavicle (Supra, retro, infra clavicular parts	
• Enumerate the branches arising from the cords	
• Draw the brachial plexus	
• Name the muscles and skin supplied by the branches of brachial plexus	

Development of limbs & joints and their congenital anomalies	Interactive Lectures/CBL
• Discuss the site and time of appearance of upper and lower limb buds	
• Define apical ectodermal ridge (AER)	
• Describe the mesenchymal proliferation under the influence of AER and differentiation into cartilaginous models of future limb bones	
• Define the source of mesoderm forming the limb muscles	
• Discuss the hand plate and formation of digital rays resulting into digits	
• Describe the muscles involved in and process of rotation of both limbs	
• Discuss the differentiation of mesenchyme to form fibrous, cartilaginous and synovial joints	
• Discuss the congenital anomalies of both limbs & joints	
Muscles of anterior compartment of arm & neurovascular supply	Interactive Lectures/Small Group Discussion
• Enumerate the muscles of anterior compartment of arm	
• Discuss the attachment of muscles, their nerves supply and their actions	
• Explain the course of muscular cutaneous nerve, its branches and distribution	
• Discuss the large nerves of arm	
• Predict the impact of lesions of main nerves of compartment	
Muscles of Posterior compartment of arm & neurovascular supply	
• Name the muscles present in the posterior compartment of arm	
• Describe the actions performed by the muscles of posterior compartment of arm	
• Name the nerve supply of the muscles of this compartment	
• Explain the course of vessels present in this compartment along with the supply to the structures in this compartment	
• Discuss the clinical aspect related to the topic	
Muscles of the anterior compartment of forearm & neurovascular supply	
• Name the muscles present in the anterior compartment of forearm	
• Explain the division of muscle layer in the anterior compartment	
• Explain actions of the muscles of anterior compartment of forearm	
• Discuss the nerve supply of the muscles of this compartment	
• Describe the course of vessels present in this compartment along with the supply to the structures in this compartment	
• Discuss the clinical aspect related to the topic	
Muscles of the posterior compartment of forearm & neurovascular supply	
• Name the muscles present in the posterior compartment of forearm	
• Explain the division of muscle layer in the posterior compartment	
• Explain actions of the muscles of posterior compartment of forearm	
• Discuss the nerve supply of the muscles of this compartment	
• Describe the course of vessels present in this compartment along with the supply to the structures in this compartment	
• Discuss the clinical aspect related to the topic	

Wrist joint, Radioulnar & small joints of hand	Small Group Discussion
• Describe the morphology of wrist joint	
• Discuss the neurovascular supply of wrist joint	
• Describe radioulnar joints and discuss its neurovascular supply	
• Discuss the movements occurring at these joints	
• Classify the intercarpal, metacarpal and interphalangeal joint	
• Discuss the clinical aspect related to the topic	
Blood vessels and nerves of hand	Interactive Lectures
• Enumerate the arterial supply of hand	
• Describe the course and relations of radial and ulnar arteries, and branches of radial and ulnar arteries, with relation to hand	
• Discuss the formation of superficial and deep palmar arch, veins of hand and their tributaries	
• Describe the nerves of the hand and their injuries	
Cutaneous supply of upper limb	
• Describe in detail the cutaneous supply and dermatomes of upper limb	
Superficial veins and Lymphatic drainage of upper limb	Interactive Lectures/CBL
• Discuss the normal Anatomy of veins of upper limb	
• Difference between superficial and deep veins	
• Explain the course of major superficial veins of upper limb	
• Describe the applied anatomy of superficial veins of upper limb	
• Describe group sand area of drain age of each group of lymph nodes	
• Discuss the commencement, course and termination of superficial lymphatic vessels	
• Discuss the clinical conditions related to lymphatic channels of upper limb	
Nerve injuries of Upper limb	CBL
• Recall the different nerve of upper limb and their root value	
• Discuss the causes of nerve injuries in upper limb	
• Enumerate the common sites of injury of the most commonly injured nerves	
• Discuss the symptoms caused by these nerve injuries	
LOWER LIMB	Interactive Lectures
Formation of lumbosacral plexus, & its injuries	
• Discuss the formation of lumbar plexus	
• List the branches of lumber plexus with their root values	
• Discuss relation of the nerves with psoas major muscle	
• Structures supplied by lumbar plexus	
• Explain the formation of sacral plexus	
• Describe the composition and relations of sacral plexus	
• Enumerate branches of this plexus	
• Discuss the cutaneous supply of lower limb	

Muscles of Anterior compartment of thigh (Femoral triangle, femoral sheath & Neuro vascular supply)	Small Group Discussion
• Discuss the arrangement of thigh into compartments	
• Explain the muscles of anterior compartment of thigh and their respective actions	
• Describe the innervation and blood supply of muscles of anterior compartment of thigh	
• Describe Femoral triangle, its boundaries and contents, and Femoral sheath and its contents	
• Discuss the clinical conditions associated with anterior compartment of thigh, femoral triangle and femoral sheath	
Gluteal Region	Interactive Lectures
• Describe the location of gluteal region	
• Discuss about bones and ligaments of gluteal region	
• Discuss the muscles of the gluteal region and their respective actions	
• Discuss the nerves and blood vessels of the gluteal region	
• Enumerate different structures entering and leaving the gluteal region	
• Discuss the clinical conditions associated with the gluteal region	
Muscles of Posterior compartment of thigh and neurovascular supply	Small Group Discussion
• Discuss the arrangement of thigh into compartments	
• Explain the muscles of posterior compartment of thigh and their respective actions	
• Describe the innervation and blood supply of muscles of posterior compartment of thigh	
• Discuss the greater and cruciate anastomoses at the back of thigh	
• Discuss the clinical conditions associated with the posterior compartment of thigh	
Muscles, Nerve and vessels of medial compartment of thigh	CBL
• Explain the muscles of medial compartment of thigh and their respective actions	
• Describe the innervation and blood supply of muscles of medial compartment of thigh	
• Discuss the clinical conditions associated with the medial compartment of thigh	
Anterior & Lateral compartment of leg (muscles, nerves and vessels)	Small Group Discussion
• Discuss the facial compartments of leg	
• Explain muscles of anterior and lateral compartment with its neurovascular supply	
• Describe clinical like the compartment syndrome	
Posterior compartment of leg	Small Group Discussion
• Enumerate the muscles of posterior compartment of leg	
• Discuss the actions of muscles of posterior compartment of leg	
• Describe nerves and vessels of compartment and their supply	
Cutaneous supply of lower limb	Interactive Lectures
• Describe in detail the cutaneous supply of lower limb	

Superficial veins and lymphatic drainage of lower limb	Interactive Lectures
• Enumerate the superficial veins	
• Discuss the course of great and small saphenous veins and their connections with the deep veins of the leg	
• Explain clinical conditions related to the Superficial veins; like venous thrombosis	
• Describe the lymphatic drainage of lower limb	
Injuries of lower limb	CBL
• Recall the different nerves of lower limb and their root value	
• Discuss the causes of their injuries	
• Enumerate the sites of injury of the most commonly injured nerves	
• Discuss the symptoms caused by these nerve injuries	
• Discuss the fracture of bones of lower limb	
• Explain injuries of lower leg and ankle	
• Discuss Pott's fracture	
• Explain Sprain ankle	
UPPER LIMB	Small Group Discussion
Clavicle (Osteology & muscle attachments)	
• Identify the features of Clavicle like borders, surfaces and land marks used for side determination	
• Discuss the attachments of muscles on Clavicle, their nerve supply and actions	
Scapula (Osteology & muscle attachments)	
• Identify Scapula and its sites	
• Mention the bony landmarks of Scapula like borders, surfaces & land mark used for side determination	
• Discuss the attachment of muscles on Scapula, their nerve supply and actions	
• Discuss the Clinical anatomy of Scapula	
Humerus (Osteology & muscle attachments)	
• Identify Humerus and its site	
• Mention its bony landmarks like borders, surfaces & land mark used for side determination	
• Discuss the attachment of muscles on Humerus, their nerve supply and actions	
• Explain the clinical conditions associated with Humerus anatomy	
Pectoral Region	
• Enumerate the muscles of pectoral girdle	
• Describe the attachments of muscle of pectoral girdle and its neurovascular supply	
• Explain the role of muscles of pectoral region in stabilizing the pectoral girdle	
• Discuss the clavi-pectoral fascia	
• Describe the triangle of auscultation	
• Name the nerves and blood vessels of this region	

Anatomy of Shoulder joint & its movements	Interactive Lectures & Tutorial
• Classify the types of shoulder joint	
• Describe the structure of shoulder joint	
• Name the muscles acting on the joint/rotator cuff muscles	
• Explain the range of mobility	
• Describe the movements of shoulder joint	
• Explain clinical aspects of the joint	
Axilla, boundaries and contents along with axillary artery and veins	Interactive Lectures & CBL
• Describe the position and shape of axilla	
• Name the boundaries of axilla, and the muscles forming these boundaries	
• Discuss the formation, course and relations of axillary vessels	
• Describe the groups of axillary lymph nodes and their arrangement	
Radius (Osteology & muscle attachments)	Small Group Discussion
• Identify the bones of forearm &hand	
• Determine side of bones	
• Identify the features of bones & muscles attached to bones	
• Describe the nerve supply and actions of muscles	
• Discuss clinical significance of bones	
Ulna (Osteology & muscle attachments)	
• Identify the bone	
• Determine the side of bone	
• Describe the surfaces, borders and ends of the bone	
• Identify the bony landmarks of bone & muscles attachment sites on the bone	
• Describe the nerve supply and actions of muscles	
• Discuss clinical significance of this bone	
Cubital fossa & Anastomosis around elbow	Interactive Lectures
• Describe the boundaries, contents and relationship among structures of cubital fossa	
• Identify the surface anatomy of cubital fossa	
• Discuss the clinical importance of the cubital fossa	
• Describe formation of anastomosis around elbow joint	
• Describe the significance of anastomosis and collateral circulation	
Elbow Joint	Small Group Discussion/ Tutorial
• Identify the morphology of the join.	
• Discuss the muscles acting on the elbow joint	
• Explain the neurovascular supply of the joint	
• Describe the carrying angle and applied aspect of this joint	
Osteology of hand	Small Group Discussion
• Describe the bony arrangement of hand	
Muscles & Spaces of Hand	Interactive Lectures
• Discuss the muscles of the hand	
• Locate the different spaces of the hand on both palmar and dorsal aspects.	
• Describe the spaces of hand.	
• Discuss the clinical importance of these spaces	

Surface Anatomy of Upper limb	Practical
• Perform surface markings for main vessels of upper limb	
Radiology of upper limb	Small Group Discussion
• Identify the normal bony land marks on X-Ray	
LOWER LIMB	
Hip Bone (Osteology & muscle attachments)	
• Enumerate the parts of hip bone	
• Discuss its side determination	
• Describe in detail the osteology of each part of hip bone	
• Discuss its muscle and ligamentous attachments	
• Discuss the clinical conditions related to Hip bone	
Femur (Osteology & muscle attachments)	
• Identify Femur and its side	
• Describe its anatomical position	
• Identify its bony landmarks	
• Discuss the muscles and ligaments attached to Femur	
• Discuss the clinical conditions related to it	
Hip joint; movements & anastomoses around hip joint	Interactive Lectures & Small Group Discussion
• Describe the formation of hip joint	
• Discuss the characteristics features of synovial joint	
• Describe the articular surfaces of hip joint	
• Discuss the attachment of its joint capsule	
• Explain the ligaments stabilizing the hip joint	
• Discuss the muscles acting on the hip joint and different movements performed at it	
• Describe its innervations and blood supply	
• Describe the arterial anastomosis around the hip joint.	
• Discuss the clinical conditions associated with the hip joint.	
Deep fascia of thigh, its modification (Inguinal ligament)	Interactive Lectures
• Explain the arrangement and attachment of deep fascia of thigh	
• Discuss the location of saphenous opening and its relations	
• Describe the attachments of inguinal ligament	
• Discuss the clinical conditions associated with deep fascia of thigh and inguinal ligament	
Tibia (Osteology & muscle attachments)	Small Group Discussion
• Identify the Tibia and its side	
• Describe its anatomical position	
• Identify its bony landmarks	
• Discuss the muscles and ligaments attached to Tibia	
• Describe the ossification of tibia and its primary and secondary ossification centers	
• Discuss the fractures and other clinical conditions associated with it	

Fibula (Osteology & muscle attachments)	Small Group Discussion
• Identify Fibula and its side	
• Mark the attachment of muscles and ligaments	
• Elaborate the joints formed by it	
• Describe the nerve injuries related to it	
Popliteal Fossa & its contents	Interactive Lectures
• Discuss the boundaries of popliteal fossa	
• Enumerate the contents of popliteal fossa	
• Describe the relationship of the contents.	
• Explain how popliteal artery can be palpated	
• Discuss clinical conditions related to popliteal fossa (e.g. the Baker's cyst)	
Knee joint, genicular anastomosis and locking, unlocking	Interactive Lectures & Tutorial
• Classify the knee joint	
• Discussits articular surfaces, the synovial capsule	
• Explain types of movement performed at knee joint and the muscles responsible for that movement	
• Describe the locking and unlocking mechanism	
• Discuss the neurovascular supply of knee joint	
Osteology of foot	Small Group Discussion
• Describe the bony arrangement of foot	
Sole of foot &nerves and vessels of foot	Interactive Lectures & Small Group Discussion
• Describe the architecture of sole of foot.	
• Enumerate the layers of sole of foot.	
• Discuss the muscle presenting the sole of foot.	
• Discuss the blood supply and nerve supply of sole of foot.	
Arches of foot	Interactive Lectures
• Describe the architecture of arches of foot and the fact responsible for their maintenance	
• Elaborate the bones which are responsible for forming these arches	
• Describe the ligaments which are holding these arches	
• Describe the function of the arches of foot	
• Describe Plantar Fascitis and relevant injuries	
Ankle joint, superior & Inferior tibio fibular joint	Interactive Lectures
• Describe the Ankle Joint, the type, articular surface and the synovial capsule	
• Discuss the Superior and Inferior Tibio-Fibular Joints, Sub-talar Joint, transverse tarsal Joint or mid-tarsal joint.	
• Describe the movement performed and the muscles responsible for these movement	
• Discuss the neurovascular supply of the joints	
Surface anatomy of lower limb	Practical
• Mark the different joints of lower limb	
• Mark the course of blood vessels of lower limb	
• Palpate the blood vessels	
• Mark the course of important nerves of lower limb	

Radiology of lower limb	Small Group Discussion
• Identify the normal bony landmarks as seen on X-Ray	
Histology of bone	Practical
• Define bone tissue	
• Classify bone macroscopically (compact &spongy)and microscopically	
• Differentiate compact and spongy bone on the basis of cells and matrix	
• Describe the arrangement of spongy and compact bone in different parts of long bones	
• Define Periosteum & Endosteum	
• Discuss bone formation, growth, remodeling &repair	
Histology of cartilage	
• Describe the components of cartilage that is cells, fibers and ground substance	
• Differentiate the 3 types of cartilage on the basis of differences in components and presence or absence of perichondrium	
• Discuss chondrogenesis, growth and repair	

BIOCHEMISTRY

TOPICS & OBJECTIVES	*LEARNING STRATEGY*
EXTRACELLULAR MATRIX	Interactive Lecture/Small Group Discussion
Glycosaminoglycans	
• Describe the biochemical structure and composition of extracellular matrix	
• Discuss the functions of extracellular matrix	
• Describe the structure of Glycosaminoglycans	
• Classify the Glycosaminoglycans	
• Discuss the biochemical functions of Glycosaminoglycans.	
• Discuss the clinical significance of the diseases associated with Glycosaminoglycans	
Collagen & Elastin	
• Describe the structure of Collagen & Elastin	
• Classify Collagen & Elastin.	
• Discuss the biochemical functions of Collagen & Elastin	
• Discuss the clinical significance of the diseases associated with Collagen & Elastin	
Vitamin C	
• Explain the dietary sources and daily recommended allowance of Vitamin C.	
• Discuss the metabolism of vitamin C in the human body.	
• Describe the physical and chemical properties of vitamin C	
• Discuss the biochemical functions of vitamin C specially with respect to Collagen and extracellular matrix	
• Discuss the clinical significance of vitamin C deficiency	

BONE METABOLISM	Interactive Lecture/Small Group Discussion
Vitamin D	
• Explain the dietary sources and daily recommended allowance of Vitamin D.	
• Discuss the metabolism of vitamin D in the human body.	
• Discuss the regulation of serum calcium in relation to bone metabolism.	
• Discuss the biochemical functions of vitamin D	
• Discuss the clinical significance of vitamin D deficiency and its prevention.	
Calcium & PO4- Metabolism	
• Explain the dietary sources and daily recommended allowance of Calcium & PO4-	
• Discuss the metabolism of Calcium & PO4- in the human body.	
• Discuss the regulation of serum calcium in relation to bone metabolism.	
• Discuss the biochemical functions of Calcium & PO4-	
• Discuss the clinical significance of Calcium & PO4- deficiency and its prevention.	
PROTEIN METABOLISM	
Reactions of Amino acids	
• Describe various sources and utilization of amino acid.	
• Define and explain the reactions of amino acids (Domination, Transamination etc.)	
• Explain the nitrogen balance in the body	
• Discuss the diagnostic value of plasma Aminotransferees	
• Discuss the clinical significance of biomarkers	
Ammonia Metabolism	
• Discuss the major sources of ammonia.	
• Discuss the utilization, formation and secretion of ammonia in human body.	
• Explain Ammonia metabolism and its detoxification	
• Discuss the clinical significance and management of Ammonia toxicity	
Urea Cycle	
• Discuss the process of amino acid oxidation and the production of urea.	
• Describe the metabolic pathway of Urea synthesis	
• Discuss the fate of urea	
• Describe the regulation of urea cycle	
• Discuss the clinical significance of urea cycle disorders	
Phenylalanine & Tyrosine Metabolism	
• Discuss the metabolism of Phenylalanine & Tyrosine and its related disorders	
• Discuss the metabolism of Melanin and its related disorder (Albinism)	
• Discuss the metabolism of Thyroid hormones and their related disorder	
• Discuss the metabolism of neurotransmitters and their related disorder	
Metabolism & Disorders of Tryptophan	
• Discuss the metabolism of tryptophan and its related disorders	
• Describe the importance of tryptophan derived biologically important compounds	
• Explain clinical significance of disorders of tryptophan	

Metabolism of Sulphur Containing Amino Acids	Interactive Lecture/Small Group Discussion
• Discuss the metabolism of Sulphur containing amino acids	
• Describe the functions of sulphur containing amino acids	
• List the steps of formation of cysteine and methionine	
• Explain clinical significance of disorders ofsulphur containing amino acids	
Metabolism of Branched Chain Amino Acids	
• Discuss the metabolism of branched chain amino acids	
• Describe the functions of branched – chain amino acids	
• Explain the clinical significance of disorders of branched chain amino acids	
Catabolism of Carbon Skeleton of Amino Acids	
• Explain the catabolism of carbon skeleton of aminoacids	
• List the Glucogenic & Ketogenic amino acids	
• Explain the significance of carbon skeleton of Amino acids	
• Describe the mechanism of entry of carbon skeleton in amino acid metabolism	
• Discuss the process of vitamin B12 as a co-factor and methyl donor in metabolism of amino acids	
Estimation of Calcium & Phosphate	Practical
• Outline the bio-techniques for detection of Calcium & Phosphate in a sample	
• Perform the estimation of serum Calcium & Phosphate.	
• Interpret clinical conditions correlated with their laboratory investigations.	
Estimation of Alkaline Phosphatase	
• Outline the bio-techniques for detection of Alkaline Phosphatase in a sample	
• Perform the estimation of serum Alkaline Phosphatase.	
• Interpret clinical conditions correlated with their laboratory investigations	
Chromatography	
• Describe the principle of chromatography	
• Describe different types of chromatography and HPLC	
• Describe the instruments used in different types of chromatography	
• Interpret clinical conditions correlated with their laboratory investigations	
Paper Chromatography	
• Describe the principle of paper chromatography	
• Describe the method of performance of paper chromatography	
• Perform amino acids detection on paperchromatography.	
• Interpret clinical conditions correlated with their laboratory investigations	

PHYSIOLOGY

TOPICS & OBJECTIVES	*LEARNING STRATEGY*
Membrane Potential	Interactive Lectures & Small Group Discussion
• Define Nernst Potential, Nernst equation	
• Explain the significance of Nernst potential	
• Define the origin of resting membrane potential	
• (Role of Na, K & Cl, Na-K ATPase pump)	
Action Potential (phases, generation & propagation)	Interactive Lectures/Small Group Discussion/Practical
• Identify different phases of action potential	
• Define the generation & propagation of action potential	
• Define threshold potentials	
• Define all or none law	
Physiological properties of skeletal muscle	
• Define contractility (isometric & isotonic) & excitability	
• Define fatigue	
• Define summation (spatial & temporal)	
• Differentiate between tetanization, tetanus & tetany	
• Briefly describe the staircase phenomenon (treppe)	
• Define motor unit	
Mechanism of skeletal muscle contraction	
• Briefly describe the structure of Sarcomere	
• Explain sliding filament mechanism & power stroke	
• Define troponin tropomyosin complex	
Neuromuscular Junction Transmission	Interactive Lectures/Small Group Discussion
• List the components of neuromuscular junction	
• Explain the sequence of events during transmission	
• Define end plate potential	
• Describe excitation contraction coupling	
• Briefly describe the role of Sarcoplasmic reticulum	
Disorders of Neuromuscular Junction	Interactive Lectures/CBL
• Identify disorders of neuromuscular junction ((Myasthenia gravis, Lambert Eaton syndrome)	

Muscle adaptation to exercise	Interactive Lectures/Small Group Discussion
• Identify the types of muscle fibers (type I & II)	
• Describe the effect of exercise on muscular blood flow	
• Define the effect of training, endurance & resistance on muscle fibers	
Introduction to power lab & performance of Nerve conduction velocity	Practical
• Describe different parts of power lab & their application in different experiments.	
• Determine nerve conduction velocity in human	
Electromyogram (EMG)	
• Explain the physiology of muscle contraction & changes during EMG recording	
Simple muscle twitch (SMT) & Fatigue	
• Define simple muscle twitch & summation	
• Identify the graphs of SMT & summation	
Summation & Tetanization	
• Define tetanization & fatigue	
• Identify the graphs of tetanization & fatigue	

LEARNING RESOURCES

SUBJECT	*RESOURCES*
ANATOMY	**A. GROSS ANATOMY** 1. K.L. Moore, Clinically Oriented Anatomy 2. Neuro Anatomy by Richard Snell **B. HISTOLOGY** 1. B. Young J. W. Health Wheather's Functional Histology **C. EMBRYOLOGY** 1. KeithL. Moore. The Developing Human 2. Langman's Medical Embryology
BIOCHEMISTRY	**A. TEXTBOOKS** 1. Harper's Illustrated Biochemistry 2. Lehninger Principle of Biochemistry 3. Biochemistry by Devlin
PHYSIOLOGY	**A. TEXTBOOKS** 1. Textbook Of Medical Physiology by Guyton And Hall 2. Ganong' S Review of Medical Physiology 3. Human Physiology by Lauralee Sherwood 4. Berne & Levy Physiology 5. Best &Taylor Physiological Basis of Medical Practice **B. REFERENCE BOOKS** 1. Guyton & Hall Physiological Review 2. Essentials Of Medical Physiology by Jaypee 3. Textbook Of Medical Physiology by Indu Khurana 4. Short Textbook Of Physiology by Mrthur 5. NMS Physiology

ASSESSMENT METHODS:

- **Best Choice Questions(BCQs)** also known as MCQs (Multiple Choice Questions)
- **Objective Structured Practical/Clinical Examination (OSPE or OSCE)**

BCQs:

- A BCQ has a statement or clinical scenario of four options (likely answers).
- **Correct answer carries one mark, and incorrect 'zero mark'. There is NO negative marking.**
- Students mark their responses on specified computer-based sheet designed for LNHMC.

OSCE:

- All students rotate through the same series of stations in the same allocated time.
- At each station, a brief written statement includes the task. Student completes the given task at one given station in a specified time.
- Stations are observed, unobserved, interactive or rest stations.
- In unobserved stations, flowcharts, models, slide identification, lab reports, case scenarios may be used to cover knowledge component of the content.
- Observed station: Performance of skills /procedures is observed by assessor
- Interactive: Examiner/s ask questions related to the task within the time allocated.
- In Rest station, students in the given time not given any specific task but wait to move to the following station.

Internal Evaluation

- Students will be assessed comprehensively through multiple methods.
- 20% marks of internal evaluation will be added to JSMU final exam. That 20% may include class tests, assignment, practicals and the internal exam which will all have specific marks allocation.

Formative Assessment

Individual department may hold quiz or short answer questions to help students assess their own learning. The marks obtained are not included in the internal evaluation

For JSMU Examination Policy, please consult JSMU website!

	More than 75% attendance is needed to sit for the internal and final examinations	

LNMC EXAMINATION RULES & REGULATIONS

- Student must report to examination hall/venue, 30 minutes before the exam.
- **Exam will begin sharp at the given time.**
- No student will be allowed to enter the examination hall after 15 minutes of scheduled examination time.
- Students must sit according to their roll numbers mentioned on the seats.
- **Cell phones are strictly not allowed in examination hall.**
- If any student is found with cell phone in any mode (silent, switched off or on) he/she will be not be allowed to continue their exam.
- No students will be allowed to sit in exam without University Admit Card, LNMC College ID Card and Lab Coat
- Student must bring the following stationary items for the exam: Pen, Pencil, Eraser, and Sharpener.
- Indiscipline in the exam hall/venue is not acceptable. Students must not possess any written material or communicate with their fellow students.

SCHEDULE:

WEEKS	1ST YEAR	MONTH
WEEK 1	LOCOMOTOR MODULE	14th June 2021
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		
WEEK 6		
WEEK 7		
WEEK 8		
WEEK 9		13th Aug 2021
WEEK 1	RESPIRATORY MODULE	16th Aug 2021
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		18th Sep 2021
WEEK 1	CVS MODULE	20th Sep 2021
WEEK 2		
WEEK 3		
WEEK 4		
WEEK 5		
WEEK 6		30th Oct 2021
PRE PROF EXAM*		

*Final dates will be announced later