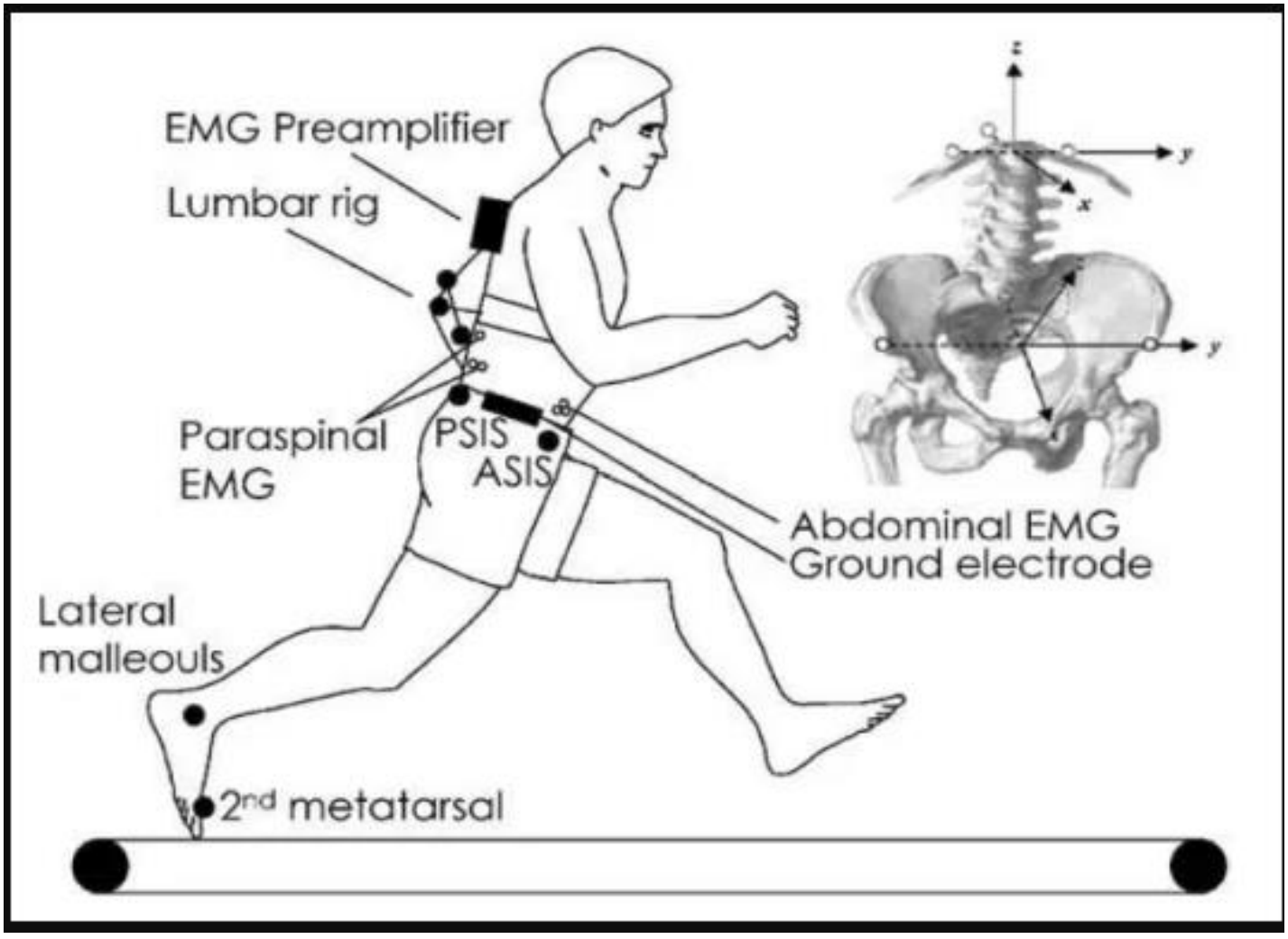
LIAQUAT NATIONAL HOSPITAL AND MEDICAL COLLEGE

INSTITUTE FOR POSTGRADUATE MEDICAL STUDIES & HEALTH SCIENCE

LOCOMOTOR MODULE I

8th May 2023 to 8th July 2023



STUDY GUIDE FOR LOCOMOTOR MODULE

Module name: **Locomotor** *Year:* ***One*** *Duration:* ***8 weeks (May – July 2023)***

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

MODULE INTEGRATED COMMITTEE

MODULE COORDINATOR:	• Prof. Zia-Ul-Islam
CO-COORDINATORS:	• Dr Faiza Agha

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BIOCHEMISTRY Professor Kashif Nisar	***NEUROLOGY*** Dr. Ahmed Asif
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PHARMACOLOGY Professor Tabassum Zehra	***RHEUMATOLOGY*** Dr. Tahira Perveen
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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 the 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:

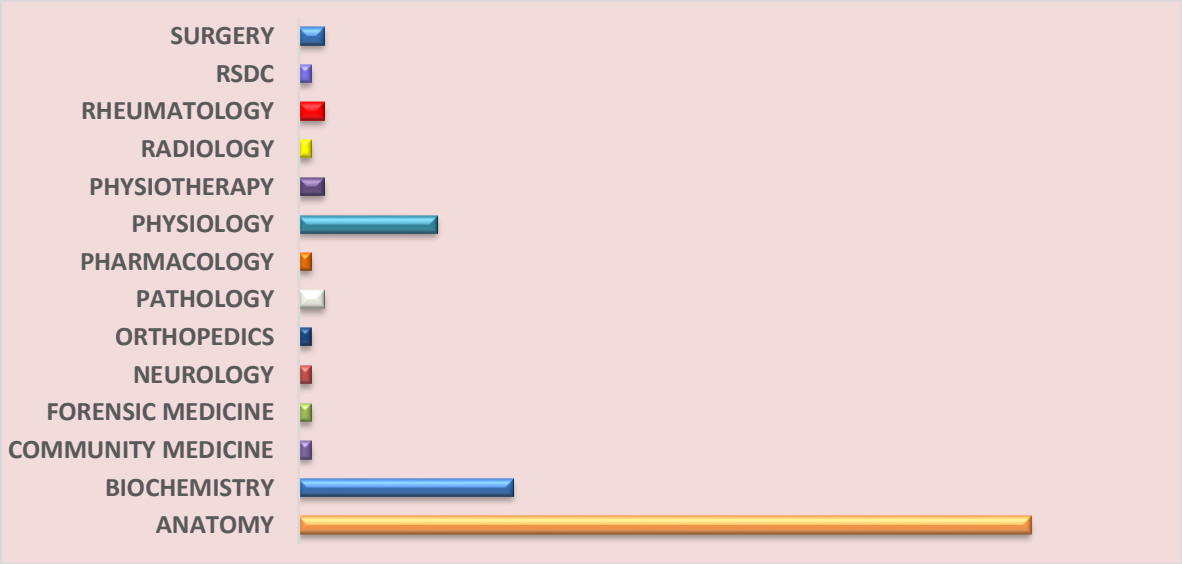
- Communicates information on the organization and management of the module. This will help the student to contact the right person in case of any difficulty.
- Define the objectives which are expected to be achieved at the end of the module.
- Identifies the learning strategies such as Interactive Lectures, small group teachings, clinical skills, demonstrations, tutorials, and case-based learning that will be implemented to achieve the module objectives.
- Provide a list of learning resources such as books, computer-assisted learning programs, web-links, and journals, for students to consult to maximize their learning.
- Highlights information on the contribution of continuous and module 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 about examination policy, rules, and regulations.

CURRICULUM FRAMEWORK

Students will experience an integrated curriculum**.**

INTEGRATED CURRICULUM comprises system-based modules such as the 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 a better understanding of basic sciences when they repeatedly learn concerning clinical examples.
Case-based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in skills lab are characteristics of integrated teaching programs.

INTEGRATING DISCIPLINES OF LOCOMOTOR MODULE



LEARNING METHODOLOGIES

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

- Interactive Lectures
- Tutorial
- Case- Based Learning (CBL)
- Clinical Experiences
  - Clinical Rotations
- Skills session
- Self-Directed Learning

INTERACTIVE LECTURES: In a large group, the Interactive Lectures introduce 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.

TUTORIAL: This format helps students to clarify concepts, and acquire skills or desired attitudes. Sessions are structured with the help of specific exercises such as patient cases, interviews, or discussion topics. Students exchange opinions and apply knowledge gained from Interactive Lectures, tutorials, and self-study. The facilitator's role is to ask probing questions, summarize, or rephrase to help clarify concepts.

CASE-BASED LEARNING (CBL): A small group discussion format where learning is focused on a series of questions based on a clinical scenario. Students discuss and answer the questions by applying relevant knowledge gained previously in clinical and basic health sciences during the module and constructing new knowledge. The CBIL will be provided by the concerned department.

CLINICAL LEARNING EXPERIENCES: In small groups, students observe patients with signs and symptoms in hospital wards, clinics, and outreach centers. This helps students to relate knowledge of basic and clinical sciences of the module and prepare for future practice.

- **CLINICAL ROTATIONS:** In small groups, students rotate in different wards like Medicine, Pediatrics, Surgery, Obs, and, Gyne, ENT, Eye, Family Medicine clinics, outreach centers & Community Medicine experiences. Here students observe patients, take histories and perform supervised clinical examinations in outpatient and inpatient settings. They also get an opportunity to observe medical personnel working as a team. These rotations help students relate basic medical and clinical knowledge in diverse clinical areas.

SKILLS SESSION: Skills relevant to the respective module are observed and practiced where applicable in the skills laboratory.

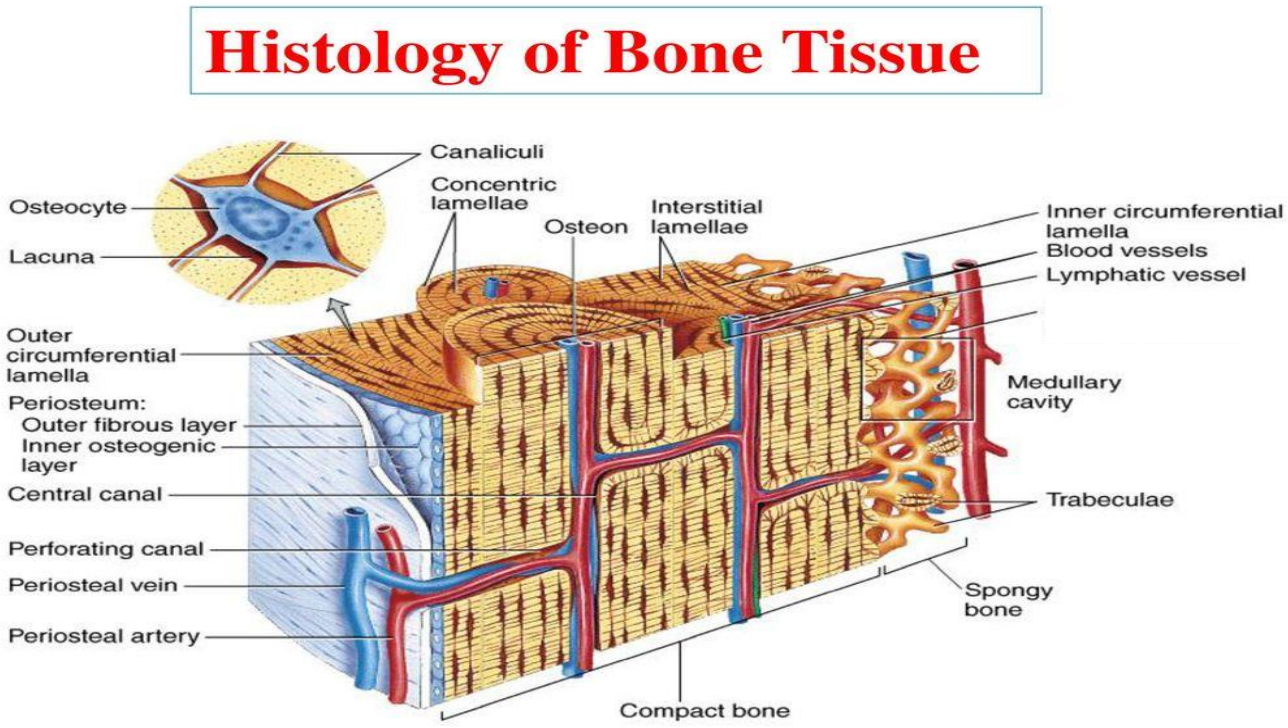
SELF-DIRECTED LEARNING Students assume responsibilities for their learning through individual study, sharing and discussing with peers, and seeking information from Learning Resource Center, teachers, and resource persons within and outside the college. Students can utilize the time within the college's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

LOCOMOTOR MODULE

IMPORTANCE OF LOCOMOTOR SYSTEM

Individuals at some time likely 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 with the musculoskeletal system. A healthy lifestyle such as exercise and diet is 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
1. Introduction to the Musculoskeletal system	Interactive Lecture
• Discuss the division and functions of the skeletal system	
• Enumerate the parts of the axial and appendicular skeleton	
• Define pectoral & pelvic girdle	
• Describe the division and curvature of the vertebral column	
• Discuss the types and number of vertebrae found in adults	
2. Embryology Development of Paraxial Mesoderm& muscles	Interactive Lecture
• Define epiblast and hypoblast	
• Explain the differentiation of tri-laminar germ disc	
• Discuss the formation of mesoderm and paraxial mesoderm	
• Discuss the developmental relationship between hypaxial and epaxial muscles	
• Describe the process of myogenesis in the types of muscle	
UPPER LIMB	Interactive Lecture
3. Sternoclavicular and Acromioclavicular Joints	
• Classify the types of Sternoclavicular and Acromioclavicular joint	
• Describe their structure	
• Name the muscles acting on these joint	
• Explain the movements at these joint	
• Explain the clinical aspects of these joint	
4. Breast Development, Gross and Histology	Interactive Lecture
• Discuss the anatomy of the breast	
• Explain the relation of breasts within the pectoral region	
• Describe the blood supply & lymphatic drainage of breast	
• Discuss the relation of breast disease with the axilla	
• Explain the development of breast	
• Discuss the histological features of breast	
5. Brachial Plexus	Interactive Lecture
• Describe the formation of the brachial plexus, with its root value and divisions (roots, trunk, division, and cords)	
• Discuss the relation of the brachial plexus also in connection to the 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 the brachial plexus	
6. Development of limbs & joints and their congenital anomalies	Interactive

• Discuss the site and time of appearance of upper and lower limb buds	Lecture
• 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 in 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	
7. Muscles of the anterior compartment of the arm & neurovascular supply	Interactive Lecture
• Enumerate the muscles of the anterior compartment of the arm	
• Discuss the attachment of muscles, their nerves supply, and their actions	
• Explain the course of the muscular cutaneous nerve, its branches, and distribution	
• Discuss the large nerves of the arm	
• Predict the impact of lesions of the main nerves of the compartment	
8. Muscles of the Posterior compartment of the arm & neurovascular supply	Interactive Lecture
• Name the muscles present in the posterior compartment of the arm	
• Describe the actions performed by the muscles of the posterior compartment of the 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	
9. Muscles of the anterior compartment of the forearm & neurovascular supply	Interactive Lecture
• Name the muscles present in the anterior compartment of the forearm	
• Explain the division of muscle layer in the anterior compartment	
• Explain the actions of the muscles of the anterior compartment of the 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	
10. Muscles of the posterior compartment of the forearm & neurovascular supply	Interactive Lecture
• Name the muscles present in the posterior compartment of the forearm	
• Explain the division of muscle layer in the posterior compartment	
• Explain the actions of the muscles of the posterior compartment of the 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	
11. Wrist joint, Radioulnar & small joints of the hand	Interactive Lecture
• Describe the morphology of the wrist joint	
• Discuss the neurovascular supply of wrist joint	
• Describe radioulnar joints and discuss their neurovascular supply	
• Discuss the movements occurring at these joints	

• Classify the intercarpal, metacarpal, and interphalangeal joint	
• Discuss the clinical aspect related to the topic	
12. Blood vessels and nerves of the hand	Interactive Lecture
• 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 the superficial and deep palmar arch, veins of the hand, and their tributaries	
• Describe the nerves of the hand and their injuries	
13. Cutaneous supply of upper limb	Interactive Lecture
• Describe in detail the cutaneous supply and dermatomes of the upper limb	
14. Venous and lymphatic drainage of the upper limb	Interactive Lecture
• Explain the course of major superficial veins of the upper limb	
• Describe the applied anatomy of superficial veins of the upper limb	
• Describe the group and area of drainage of each group of lymph nodes	
15. Nerve injuries of the Upper limb	Interactive Lecture
• Recall the different nerves of the upper limb and their root value	
• Discuss the causes of nerve injuries in the 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 Lecture
16. Formation of lumbosacral plexus, & its injuries	
• Discuss the formation of the lumbar plexus	
• List the branches of the lumbar plexus with their root values	
• Discuss relation of the nerves with psoas major muscle	
• Structures supplied by lumbar plexus	
• Explain the formation of the sacral plexus	
• Describe the composition and relations of the sacral plexus	
• Enumerate branches of this plexus	
• Discuss the cutaneous supply of lower limb	
17. Muscles of the Anterior compartment of the thigh (Femoral triangle, femoral sheath & Neurovascular supply)	Interactive Lecture
• Discuss the arrangement of the thigh into compartments	
• Explain the muscles of the anterior compartment of the thigh and their respective actions	
• Describe the innervation and blood supply of muscles of the anterior compartment of the thigh	
• Describe the Femoral triangle, its boundaries and contents, and the Femoral sheath and its contents	
• Discuss the clinical conditions associated with an anterior compartment of the thigh, femoral triangle, and femoral sheath	
18. Gluteal Region	Interactive Lecture
• Describe the location of the gluteal region	
• Discuss bones and ligaments of the 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	

19. Muscles of the Posterior compartment of the thigh and neurovascular supply	Interactive Lecture
• Discuss the arrangement of the thigh into compartments	
• Explain the muscles of the posterior compartment of the thigh and their respective actions	
• Describe the innervation and blood supply of muscles of the posterior compartment of the thigh	
• Discuss the greater and cruciate anastomoses at the back of the thigh	
• Discuss the clinical conditions associated with the posterior compartment of the thigh	
20. Anterior & Lateral compartment of leg (muscles, nerves, and vessels)	Interactive Lecture
• Discuss the facial compartments of the leg	
• Explain muscles of the anterior and lateral compartment with its neurovascular supply	
• Describe clinical like the compartment syndrome	
21. Posterior compartment of the leg	Interactive Lecture
• Enumerate the muscles of the posterior compartment of the leg	
• Discuss the actions of muscles of the posterior compartment of the leg	
• Describe the nerves and vessels of the compartment and their supply	
23. Sole of foot & nerves and vessels of foot	Interactive Lecture
• Describe the architecture of the sole of the foot	
• Enumerate the layers of the sole of the foot	
• Discuss the muscle presenting the sole of the foot	
• Discuss the blood supply and nerve supply of the sole of the foot	
22. Cutaneous supply of lower limb	
• Describe in detail the cutaneous supply of lower limb	
23. Venous and lymphatic drainage of the lower limb	
• Enumerate the superficial veins	
• Discuss the course of great and small saphenous veins and their connections with the deep veins of the leg	
24. Injuries of the lower limb	Interactive Lecture
• Recall the different nerves of the 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 the lower limb	
• Explain injuries of lower leg and ankle	
• Discuss Pott's fracture	
• Explain Sprained ankle	
UPPER LIMB	Interactive Lecture
25. Clavicle (Osteology & muscle attachments)	
• Identify the features of Clavicle borders, surfaces, and landmarks used for side determination	
• Discuss the attachments of muscles on the Clavicle, their nerve supply, and actions	
26. Scapula (Osteology & muscle attachments)	Interactive Lecture
• Identify Scapula and its sites	
• Mention the bony landmarks of Scapula like borders, surfaces & landmarks used for side determination	
• Discuss the attachment of muscles on the Scapula, their nerve supply, and actions	
• Discuss the Clinical anatomy of the Scapula	
27. Humerus (Osteology & muscle attachments)	Interactive

• Identify Humerus and its site	Lecture
• Mention its bony landmarks like borders, surfaces & landmarks used for side determination	
• Discuss the attachment of muscles on the Humerus, their nerve supply, and actions	
• Explain the clinical conditions associated with Humerus anatomy	
28. Pectoral Region	Interactive Lecture
• Enumerate the muscles of the pectoral girdle	
• Describe the attachments of the muscle of the pectoral girdle and its neurovascular supply	
• Explain the role of muscles of the 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	
29. Anatomy of Shoulder joint & its movements	Interactive Lecture
• Classify the types of the shoulder joint	
• Describe the structure of the shoulder joint	
• Name the muscles acting on the joint/rotator cuff muscles	
• Explain the range of mobility	
• Describe the movements of the shoulder joint	
• Explain clinical aspects of the joint	
30. Axilla, boundaries, and contents along with axillary artery and veins	Interactive Lecture
• Describe the position and shape of the axilla	
• Name the boundaries of the 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	
31. Radius (Osteology & muscle attachments)	Interactive Lecture/ Practical
• Identify the bones of the forearm & hand	
• Determine the side of bones	
• Identify the features of bones & muscles attached to bones	
• Describe the nerve supply and actions of muscles	
• Discuss the clinical significance of bones	
32. Ulna (Osteology & muscle attachments)	
• Identify the bone	
• Determine the side of the 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 the clinical significance of this bone	
33. Cubital fossa & Anastomosis around the elbow	Interactive Lecture
• Describe the boundaries, contents, and relationships among structures of the cubital fossa	
• Identify the surface anatomy of the cubital fossa	
• Discuss the clinical importance of the cubital fossa	
• Describe the formation of anastomosis around the elbow joint	
• Describe the significance of anastomosis and collateral circulation	

34. Elbow Joint	Interactive Lecture
• 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 aspects of this joint	
35. Osteology of hand	Interactive Lecture
• Describe the bony arrangement of hand	
36. Muscles & Spaces of Hand	
• Discuss the muscles of the hand	
• Locate the different spaces of the hand on both palmar and dorsal aspects	
• Describe the spaces of the hand	
• Discuss the clinical importance of these spaces	
37. Surface Anatomy of Upper limb	
• Perform surface markings for main vessels of the upper limb	
38. Radiology of upper limb	
• Identify the normal bony landmarks on X-Ray	
LOWER LIMB	Interactive Lecture
39. Hip Bone (Osteology & muscle attachments)	
• Enumerate the parts of the hip bone	
• Discuss its size determination	
• Describe in detail the osteology of each part of the hip bone	
• Discuss its muscle and ligamentous attachments	
• Discuss the clinical conditions related to Hip bone	
40. Femur (Osteology & muscle attachments)	Interactive Lecture
• 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	
41. Hip joint; movements & anastomoses around hip joint	Interactive Lecture
• Describe the formation of the hip joint	
• Discuss the characteristics and features of synovial joint	
• Describe the articular surfaces of the 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	
42. Deep fascia of the thigh	Interactive Lecture
• Explain the arrangement and attachment of the deep fascia of the thigh	
• Discuss the location of the saphenous opening and its relations	
• Describe the attachments of the inguinal ligament	

• Discuss the clinical conditions associated with the deep fascia of the thigh and inguinal ligament	
43. Tibia (Osteology & muscle attachments)	Interactive Lecture
• 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 the tibia and its primary and secondary ossification centers	
• Discuss the fractures and other clinical conditions associated with it	
44. Fibula (Osteology & muscle attachments)	
• Identify Fibula and its side	
• Mark the attachment of muscles and ligaments	
• Elaborate on the joints formed by it	
• Describe the nerve injuries related to it	
45. Popliteal Fossa & its contents	Interactive Lecture
• Discuss the boundaries of the popliteal fossa	
• Enumerate the contents of the popliteal fossa	
• Describe the relationship of the contents.	
• Explain how the popliteal artery can be palpated	
• Discuss clinical conditions related to popliteal fossa (e.g. the Baker's cyst)	
46. Knee joint, genicular anastomosis, and locking and unlocking	Interactive Lecture
• Classify the knee joint	
• Discuss its articular surfaces, the synovial capsule	
• Explain types of movement performed at the knee joint and the muscles responsible for that movement	
• Describe the locking and unlocking mechanism	
• Discuss the neurovascular supply of knee joint	
47. Osteology of foot	Interactive Lecture
• Describe the bony arrangement of the foot	
48. Sole of foot & nerves and vessels of foot	Interactive Lecture
• Describe the architecture of the sole of the foot.	
• Enumerate the layers of the sole of the foot.	
• Discuss the muscle presenting the sole of the foot	
• Discuss the blood supply and nerve supply of the sole of the foot	
49. Arches of the foot	
• Describe the architecture of arches of the foot and the fact responsible for their maintenance	
• Elaborate on the bones which are responsible for forming these arches	
• Describe the ligaments which are holding these arches	
• Describe the function of the arches of the foot	
• Describe Plantar Fascitis and relevant injuries	
50. Ankle joint, superior & Inferior tibiofibular joint	Interactive Lecture
• Describe the Ankle Joint, the type, the articular surface, and the synovial capsule	
• Discuss the Superior and Inferior Tibio-Fibular Joints, Sub-talar joints, transverse tarsal joints, or mid-tarsal joints.	
• Describe the movement performed and the muscles responsible for this movement	

• Discuss the neurovascular supply of the joints	
51. Surface anatomy of lower limb	Interactive Lecture/Practical
• Mark the different joints of the lower limb	
• Mark the course of blood vessels of the lower limb	
• Palpate the blood vessels	
• Mark the course of important nerves of the lower limb	
52. Radiology of lower limb	
• Identify the normal bony landmarks as seen on the X-Ray	
53. Histology of bone	Practical
• Define bone tissue	
• Classify bones macroscopically (compact & spongy) and microscopically	
• Differentiate compact and spongy bones based on cells and matrix	
• Describe the arrangement of spongy and compact bones in different parts of long bones	
• Define Periosteum & Endosteum	
• Discuss bone formation, growth, remodeling & repair	
54. Histology of cartilage	Practical
• Describe the components of cartilage that is cells, fibers, and ground substance	
• Differentiate the 3 types of cartilage based on differences in components and the presence or absence of perichondrium	
• Discuss chondrogenesis, growth, and repair	

BIOCHEMISTRY

OBJECTIVES	LEARNING STRATEGY
EXTRACELLULAR MATRIX	Interactive Lecture/Tutorial
1. Glycosaminoglycans	
• Describe the biochemical structure and composition of the extracellular matrix	
• Discuss the functions of the 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	
• Discuss the clinical importance of Glycosaminoglycans	
• Correlate the laboratory investigations with relevant clinical conditions	
2. Collagen & Elastin	Interactive Lecture
• 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	Interactive Lecture/Tutorial
3. 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, especially concerning Collagen and extracellular matrix	
• Discuss the clinical significance of vitamin C deficiency	
• Discuss the clinical importance of Vitamin C	
• Correlate the laboratory investigations with relevant clinical conditions	
BONE METABOLISM	Interactive Lecture/Tutorial
4. 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 concerning bone metabolism	
• Discuss the biochemical functions of vitamin D	
• Discuss the clinical significance of vitamin D deficiency and its prevention.	
• Discuss the clinical importance of Vitamin D	
• Correlate the laboratory investigations with relevant clinical conditions	
5. Calcium & PO4- Metabolism	Interactive Lecture/Tutorial
• 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 concerning bone metabolism.	
• Discuss the biochemical functions of Calcium & PO4-	
• Discuss the clinical significance of Calcium & PO4- deficiency and its prevention.	
• Discuss the clinical importance of Calcium & PO4- abnormalities	
• Correlate the laboratory investigations with relevant clinical conditions	
PROTEIN METABOLISM	Interactive Lecture
6. Reactions of Amino acids	
• Describe various sources and utilization of amino acids.	
• Define and explain the reactions of amino acids (Domination, Transamination, etc.)	
• Explain the nitrogen balance in the body	
• Discuss the diagnostic value of plasma Aminotransferase	
• Discuss the clinical significance of biomarkers	
7. Ammonia Metabolism	Interactive Lecture
• Discuss the major sources of ammonia.	
• Discuss the utilization, formation, and secretion of ammonia in the human body.	
• Explain Ammonia metabolism and its detoxification	
• Discuss the clinical significance and management of Ammonia toxicity	
8. Urea Cycle	Interactive Lecture/Tutorial
• 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 the urea cycle	
• Discuss the clinical significance of urea cycle disorders	
• Discuss the clinical importance of the Urea Cycle	
• Correlate the laboratory investigations with relevant clinical conditions	

9. Phenylalanine & Tyrosine Metabolism	Interactive Lecture/Tutorial
• 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	
• Discuss the clinical importance of metabolic abnormalities of the above amino acids	
• Correlate the laboratory investigations with relevant clinical conditions	
10. Metabolism & Disorders of Tryptophan	Interactive Lecture/Tutorial
• Discuss the metabolism of tryptophan and its related disorders	
• Describe the importance of tryptophan-derived biologically important compounds	
• Explain the clinical significance of disorders of tryptophan	
• Discuss the clinical importance of metabolic abnormalities of the above amino acids	
• Correlate the laboratory investigations with relevant clinical conditions	
11. Metabolism of Sulphur Containing Amino Acids	Interactive Lecture/Tutorial
• Discuss the metabolism of Sulphur containing amino acids	
• Describe the functions of Sulphur containing amino acids	
• List the steps of the formation of cysteine and methionine	
• Explain the clinical significance of disorders of Sulphur containing amino acids	
12. Metabolism of Branched Chain Amino Acids	Interactive Lecture/Tutorial
• 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	
13. Catabolism of Carbon Skeleton of Amino Acids	Interactive Lecture
• Explain the catabolism of the carbon skeleton of amino acids	
• List the Glucogenic & Ketogenic amino acids	
• Explain the significance of the 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 the metabolism of amino acids	
14. Estimation of Calcium & Phosphate	Practical
• Outline the bio-techniques for the detection of Calcium & Phosphate in a sample	
• Perform the estimation of serum Calcium & Phosphate.	
• Correlate the laboratory investigations with relevant clinical conditions	
15. Estimation of Alkaline Phosphatase	
• Outline the bio-techniques for the detection of Alkaline Phosphatase in a sample	
• Perform the estimation of serum Alkaline Phosphatase.	
• Correlate the laboratory investigations with relevant clinical conditions	
16. Chromatography	
• Describe the principle of chromatography	
• Describe different types of chromatography and HPLC	
• Describe the instruments used in different types of chromatography	
• Correlate the laboratory investigations with relevant clinical conditions	

17. Paper Chromatography	
• Describe the principle of paper chromatography	
• Describe the method of performance of paper chromatography	
• Perform amino acids detection on paper chromatography	
• Correlate the laboratory investigations with relevant clinical conditions	

COMMUNITY MEDICINE

OBJECTIVES	LEARNING STRATEGY
Prevention of road traffic accidents	Interactive Lecture
• Describe the accident prevention strategies and road safety	

FORENSIC MEDICINE

OBJECTIVES	LEARNING STRATEGY
Traumatic injuries to upper & lower limbs	Interactive Lecture
• Discuss the injuries to upper and lower limbs due to trauma	

NEUROLOGY

OBJECTIVES	LEARNING STRATEGY
Neurologic lesions of upper limb nerves	Interactive Lecture
• Describe the nerve injuries related to upper limb	
• Discuss the clinical conditions related to nerves of the upper limb	

ORTHOPEDICS

OBJECTIVES	LEARNING STRATEGY
Clinical presentation of common fractures and dislocations of upper and lower limb	Interactive Lecture
• Discuss the clinical presentation of common fractures and dislocations of upper and lower limb	

PATHOLOGY

OBJECTIVES	LEARNING STRATEGY
1. Bone fracture & repair	Interactive Lecture
• Discuss the bone fracture & process of repair	
2. Osteoporosis	
• Describe osteoporosis and its clinical presentation	

PHARMACOLOGY

OBJECTIVES	LEARNING STRATEGY
Pain Management	Interactive Lecture
• Discuss joint & bone pain management in different clinical conditions of the upper limb	

PHYSIOLOGY

OBJECTIVES	LEARNING STRATEGY
1. Membrane Potential	Interactive Lecture
• Define Nernst Potential, Nernst equation	
• Explain the significance of Nernst's potential	
• Define the origin of resting membrane potential	
• Describe the role of Na, K & Cl, Na-K ATPase pump	
2. Action Potential (phases, generation & propagation)	Interactive Lecture
• Identify different phases of action potential	
• Describe the generation & propagation of action potential	
• Define threshold potentials	
3. Physiological properties of skeletal muscle	
• Define contractility (isometric & isotonic) & excitability	
• Define fatigue	
• Define summation (spatial & temporal)	
• Differentiate between tetanization, tetanus & tetany	
• Describe briefly the staircase phenomenon (treppe)	
• Define motor unit	
4. Mechanism of skeletal muscle contraction	
• Describe briefly the structure of Sarcomere	
• Explain the sliding filament mechanism & power stroke	
• Define troponin tropomyosin complex	
5. Neuromuscular Junction Transmission	Interactive Lecture
• List the components of the neuromuscular junction	

• Explain the sequence of events during the transmission	
• Define end plate potential	
• Describe excitation-contraction coupling	
• Describe briefly the role of the Sarcoplasmic reticulum	
6. Disorders of Neuromuscular Junction	Interactive Lecture
• Identify disorders of the neuromuscular junction (Myasthenia gravis, Lambert Eaton syndrome)	
7. Muscle adaptation to exercise	Interactive Lecture
• 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	
8. 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	
9. Electromyogram (EMG)	
• Explain the physiology of muscle contraction & changes during EMG recording	
10. Simple muscle twitch (SMT) & Fatigue	
• Define simple muscle twitch & summation	
• Identify the graphs of SMT & summation	
11. Summation & Tetanization	
• Define tetanization & fatigue	
• Identify the graphs of tetanization & fatigue	

PHYSIOTHERAPY

OBJECTIVES	LEARNING STRATEGY
1. Clinical manifestation of common shoulder problems	Tutorial
• Describe the common shoulder problems	
2. Hip & knee problems	
• Describe common knee problems	
• Discuss clinical conditions related to it.	

RADIOLOGY

OBJECTIVES	LEARNING STRATEGY
Radiologic anatomy of bones & joints of upper limb	Tutorial
• Discuss the fracture and other clinical conditions related to it.	

RHEUMATOLOGY

OBJECTIVES	LEARNING STRATEGY
1. Arthritis & its types	Interactive Lecture
• Classify arthritis	
• Discuss clinical conditions associated with it	
2. Gout	
• Discuss the clinical presentation of the disease	

RESEARCH & SKILLS DEVELOPMENT CENTER

OBJECTIVES	LEARNING STRATEGY
Capeline bandage arm sling and care of amputated digit	Tutorial
• Perform the application of Capeline bandage on the arm or amputated stump	
• Perform figure of eight turn wrap technique to the upper limb	

SURGERY

OBJECTIVES	LEARNING STRATEGY
1. Clinical presentation of common breast disease	Interactive Lecture
• Discuss the clinical presentation of common breast diseases	
2. Gluteal Abscess	
• Describe the abscess on the gluteal region and discuss clinical conditions related to it.	

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. Keith L. 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 Arthur 5. NMS Physiology

ASSESSMENT METHODS:

- MCQs (Multiple Choice Questions)
- **Objective Structured Practical/Clinical Examination (OSPE or OSCE)**
- MCQs and unobserved OSPE will be conducted on the LNH&MC Moodle platform
- Observed OSPE will constitute multiple examiner-based stations

Internal Evaluation

- Students will be assessed comprehensively through multiple methods.
- 20% marks of internal evaluation will be added to JSMU final exam. That 20% includes mid-module & end of module examinations, mid-term & pre-professional examinations.

Formative Assessment

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

For JSMU Examination Policy, please consult the JSMU website!

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

LNMC EXAMINATION RULES & REGULATIONS

- Students must report to the examination hall/venue, 30 minutes before the exam.
- **The exam will begin sharply at the given time.**
- No student will be allowed to enter the examination hall after 15 minutes of the scheduled examination time.
- Students must sit according to their roll numbers mentioned on the seats.
- **Cell phones are strictly not allowed in the examination hall.**
- If any student is found with a cell phone in any mode (silent, switched off, or on) he/she will not be allowed to continue their exam.
- No students will be allowed to sit in exams without University Admit Card, LNMC College ID Card, and Lab Coat.
- Students 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
8 WEEKS	LOCOMOTOR MODULE	8th May 2023 To 8th July 2023
4 WEEKS	RESPIRATORY MODULE	10TH July 2023 To 5th Aug 2023
5 WEEKS	CVS MODULE	7th Aug 2023 To 9th Sep 2023
*PRE-PROF EXAM		

***21-09-2023 to 23-09-2023**