**Musculoskeletal Module**

**First Professional Year MBBS**

**8 Weeks**

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**Introduction to Module**

Musculoskeletal system Module is designed to provide guidance on introduction to the basics of human musculoskeletal system. Moreover, the module is aligned to the general outcomes required at the exit level, and includes introductory sessions on preventive medicine, communication skills, professionalism, self- management, and developing scholarly skills. The module committee will facilitate the students with any issues that they have, while settling down in the new environment. You will also learn the skills required for practical implications in the field of medicine. Moreover, working within teams will enhance your co-operative and approachable working style

**General Learning Outcomes**

By the end of this module the students should be able to;

**Knowledge**

By the end of this module, students should be able to:

1. Develop an understanding of the fundamental components of the musculoskeletal system.

2. Explain the structure & function of the musculoskeletal (MSK) components of limbs and back.

3. Describe how injury and disease alter the MSK structure & function.

4. Integrate concepts relating to various metabolic processes, their disorders and relevant lab investigations in the study of human MSK system.

5. Describe the role of the limbs (upper/lower) in musculoskeletal support, stability and movements.

6. Describe the development of the limbs & correlate it with organization and gross congenital anomalies of the limbs.

7. Identify the anatomical features of bones, muscles & neurovascular components of the limbs and correlate them with their functions, injuries and clinical problems.

8. Describe the types, formation, stability, function & clinical significance of joints of the upper and lower limb.

9. Describe the basic histology of muscle fibers including its molecular structure (Sarcomere).

10. Explain the mechanism of excitation and contraction of skeletal and smooth muscles.

11. Describe the basis for the use of therapeutic agents to modulate neuromuscular transmission.

12. Describe the general principles of MSK pain management.

13. Describe ergonomics and its principles. Prevention of different MSK disorders.

14. Interpret the mechanism of post-mortem rigidity. (spiral II)

15. Give an overview of pathology of bones, muscles and joints.

16. Explain the role of different minerals, hormones and specific metabolic products related to the musculoskeletal system and correlate them with their relevant clinical metabolic disorders.

17. Interpret the relevant laboratory investigations for diagnosis of common musculoskeletal disorders. (Spiral two)

18. To develop the critical thinking and analysis in the context of various case scenarios pertaining to locomotors system.

**Skills**

By the end of this module, it is a core objective that students should have acquired the following skills:
1. Demonstrate the anatomical structures of the limbs in a dissected cadaver/Model/prosecuted specimen & X-ray.
2. Demonstrate the provision of first aid measures in case of a limb fracture.
3. Communicate effectively in a team with colleagues and teachers**.**

**Attitude**

While not necessarily taught explicitly, students are expected to develop following attitudes throughout the course:

1. Demonstrate respect and care for the cadaver and prosected parts.

2. Demonstrate humbleness and use socially acceptable language during academic and social interactions with colleagues and teachers.

3. Make ethically competent decisions when confronted with an ethical, social or moral problem related to MSKS in professional or personal life.

4. Discuss ethical issues social and preventive aspect of health care in the context of MSK system.

5. To create awareness about the ethical, social and preventive aspect of health care in the context of locomotor system.

**THEMES FOR MUSCULOSKELETAL MODULE**

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| **SNO** | **Theme** | **Duration**  |
| 1 | Orientation and shoulder pain | 2 weeks |
| 2 | Weak grip and painful hand | 1 week |
| 3 | Pain lower limb/limping | 2 weeks |
| 4 | Bony arches and fracture of foot | 1 week |
| 5 | Backache  | 1 week |
| 6 | Muscle weakness and fatigue | 1 week |

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| **Musculoskeletal MODULE** |
| **THEME –I** |
| **ORIENTATION AND SHOULDER PAIN** |

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| **SNO.** | **Topic**  | **Learning Outcomes** |
| **ANATOMY**  |
| 1 | Introduction  | * Define osseous tissue
* Classify the skeletal system (axial and
* appendicular)
* Name and locate different bones of
* axial and appendicular skeleton
* Classify bones
* Describe general features of bones
* Describe Nerve/blood supply of bone
* Describe bone marrow and its types
* Describe ossification and its types
* Describe surface markings of bones
* Define fracture, osteoporosis, rickets, osteomalacia
* Introduction to muscular system
* Classify the muscles according to the
* directions of fibers
* Classify the skeletal muscles according to their action.
* Types of skeletal muscle fibers(Type1 ,2,3)
* Describe the nomenclature of skeletal muscles
* Describe the principle of innervations
* and nerve supply of muscles
* Define paralysis, hyperplasia,hypertrophy,mysthena gravis
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| 2 | Introduction to locomotionand upper limb | Identify the extent of the upper limb.Identify various regions of upper limb.Describe the division of the regions into compartments.State the contents of compartments of arm, forearm & handDescribe the joints of upper limb.Describe the clinical anatomy of upper limb |
| 3 | Osteology of clavicle | Recognize the boneIdentify the site of boneState the bony land marks of clavicle: like borders, surfaces & land mark used for bone determinationDescribe & demonstrate the attachments of muscles. Describe the common fractures of the bone.Identify and describe the salient features of the bones scapula and clavicleDescribe the surface anatomy clavicleDescribe the radiological anatomy clavicle Describe the applied anatomy clavicle |
| 4 | Osteology of scapula  | Recognize the bone.Identify the site of bone. State the bony landmarks of scapula: like borders, surfaces & land mark used for bone determination.Demonstrate the attachment ofmuscles on scapula Describe the common fractures of the bone.Identify and describe the salient features of the bones scapula.Identify the attachments to scapulaDescribe the surface anatomy scapulaDescribe the radiological anatomy scapula.Describe the applied anatomy scapula. |
| 5 | Osteology of humerus | Recognize the bone.Identify the site of bone.State the bony landmarks of humerus: like borders, surfaces & land mark used for bone determination.Demonstrate the attachment of muscles & ligaments.  Describe the common fractures of the bone.  Identify and describe the salient features of the humerus Identify the attachments to humerusDescribe the surface anatomy humerusDescribe the radiological anatomyhumerusDescribe the applied anatomy humerus |
| 6 | Muscles of the pectoralgirdle | Recognize the role of muscles of pectoral region in stabilizing the pectoral girdle.List the muscle of pectoral girdle.Describe & Demonstrate the attachments of muscle of pectoral girdle, nerve supply and actions.  Describe the structural organization of the clavi-pectoral fascia.Identify the triangle of auscultation.Describe the nerves and blood vessels of this region |
| 7 | Muscles of the shoulderregion | Recognize the extent of shoulder region.Describe the muscle of shoulder region.List the muscles of shoulder region.State the detailed structures of each muscle with respect to Origin, Insertion, Nerve supply and Action of muscles with any characteristic features. |
| 8 | The shoulder joint & itsmovements | Classify the type 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 the clinical anatomy of thejoint |
| 9 | Brachial plexus | Mention the formation of brachial plexus (roots, trunk, division, and cords).Describe the relation of brachial plexus also in connection to clavicle (Supra, retro, infra clavicular parts). State the branches arising the different cords.Draw the brachial plexus.Describe the clinical correlates of the brachial plexus. Erb duchane palsy Klumpke palsy Saturday night palsy |
| 10 | Nerves of upper limb | Describe the course and branches of nerves of upper limbs.Axillary nerveMusculocutaneous nerveRadial NerveUlnar NerveMedian NerveExplain the injuries associated with these nerves.Identify the causes and motor and sensory loss associated with nerve injuries of upper limb.Apply knowledge of gross anatomy to identify the deformities associated with these nerves. |
|  | Axilla | Describe the position, shape of axilla.Describe the boundaries and content of axillaDescribe the boundaries and muscle forming the boundaries of axilla.Describe the formation, course and relations of axillary vessels.Describe arrangement and groups axillary lymph nod |
| 11 | Arm | Describe the compartments of arm and how they are formed.Identify and explain the muscles and their actions found in the arm.Describe the nerve supply of arm.Describe the course of the nervesIdentify the branches of the nervesRelate & integrate with the clinicalcorrelationsDescribe cutaneous supply of arm. |
| 12 | Brachial vessels | Describe the extension, relation and branches of the Brachial artery.Describe the course of the Basilic and cephalic veinsDescribe and explain the formation and purpose of the scapular anastomosis. |
| 13 | Elbow joint | Identify the type of the joint.State and Identify the muscles acting on the elbow joint.Describe the neurovascular supply of the joint.Describe the carrying angle and applied aspect of the joint.Describe the anastomosis and collateral circulation.Describe formation of anastomosisaround elbow joint |
| 14 | Osteology of ulna | Recognize the bone.Determine the side of bone.Identify the features of bone.Identify the muscles attached to bone.Describe the common fractures of the bone.Describe and Identify the salient features of the ulnaIdentify the attachments to ulnaDescribe the surface anatomy ulna and the radiological anatomy ulnaDescribe the applied anatomy ulna |
| 15 | Superficial veins, lymphatic’sand lymph nodes of upperlimb | Describe the normal anatomy of veins of upper limb.Differentiate between superficial and deep veins.Describe the features of individual superficial veins of upper limb.Correlate the applied anatomy with the gross anatomy of superficialVeins of upper limb.Describe the structure of a lymph node.Identify the groups of lymph nodes.Describe groups and area of drainage of each group of lymph nodes.Describe the commencement, course and termination of superficial lymphatic vessels.Describe the clinical conditions related to lymphatic channels of upper |
| 16 | Cubital fossa | Describe the boundaries, the contents and the relationship among structures of Cubital fossa.Demonstrate the surface anatomy of the Cubital fossa.Explain the clinical importance of the Cubital fossa. |
| 17 | Anterior compartment offorearm | List the muscles of forearm.State the nerve supply of these muscles.Explain actions of the muscles of anterior compartment of forearm.Describe attachment and functions of flexor retinaculumIdentify/Describe muscles of the anterior compartment of the arm (origin, insertion, nerve supply, blood supply, and action) |
|  18 | Posterior compartment offorearm | Explain the organization of muscles of posterior compartment of forearmIdentify/Describe muscles of the posterior compartment of the arm (origin, insertion, nerve supply, blood supply, and action)State the nerve supply of these muscles.Explain the actions of the muscles of posterior compartment of forearm.Describe the structural organization of the Extensor Retinaculum |
| 19 | Blood vessels & nerves ofthe forearm | Describe the different vessels & nerves in forearm.Describe the location, destination, course & relations of radial and ulnar arteries & their branches in forearm.Describe the deep veins of forearm and their tributaries.Describe the location, destination, course & relations of ulnar, radial and median nerves & their branch. |
| 20 | Radio-ulnar joint | Recognize the details of Radio-ulnar joint.Describe and explain the movements occurring on Radio-ulnar joint.Name the muscles acting in pronation and supination.Describe the nerve supply and blood supply of Radio-ulnar joint.Describe clinical problems related to Radio-ulnar joints. |
| 21 | Surface anatomy of upperlimb | Demonstrate the surface markings for various arteries of upper limb |
| **Embryology**  |
| 22 | Somitogenesis | Define the process of gastrulation.Describe the development of mesoderm.Describe the process of somitogenesis.Describe the formation of cartilage |
| 23 | Development of bone ,cartilage and joints | Describe histogenesis of BoneDescribe the Intramembranous OssificationDescribe the Endochondral OssificationDescribe the Ossification of limb bonesDescribe the development of jointsDescribe the development of cartilageDescribe developmental events of fibrous jointsDescribe developmental events ofcartilaginous jointDescribe developmental events of synovial jointsDescribe important congenital correlates |
| 24 | Development of upper limb | Describe the early stages of upper limb developmentDescribe the development of upper limb budsDescribe the final stages of upper limb developmentDescribe and explain the anomalies of the upper limb |
| 25 | Development of muscles | Describe the development of skeletal muscle.Describe the development of Myotomes and derivatives of epaxial divisions of myotomes and derivatives of hypaxial divisions of myotomes |
| **HISTOLOGY**  |
| 26 | Bone histology | Define and identify compact and spongy boneDescribe and identify bone matrix (organic and inorganic component)Describe and identify cells of boney tissue i.e. (osteoprogenitor, osteoblasts, osteoclast, and osteocytes)Describe and identify periosteum andendosteumDescribe and identify the microscopic structure of bone i.e. (primarybone, secondary bone and haversian system)Describe Functions of various bone cellsDescribe important Functions and its role in calcium metabolism |
| 27 | Classification & histology ofcartilage | Describe the General properties of cartilageDescribe the Different types of cartilageDescribe the Hyaline, Elastic and FibrocartilageExplain the growth of cartilage |
| 28 | Histology of cartilage | Identify types of cartilages on microscopy, including distinctive features of each.Describe the structural basis.Classify and distinguish three types of cartilagesDescribe the microscopic structure of hyaline cartilageDescribe the microscopic structure of Elastic cartilageDescribe the microscopic structure of fibrous cartilageDescribe important functional correlates of three types of cartilages |
| 29 | Classification & histologyof bone | Recognize bone and its functions and ncomposition.Differentiate between woven bone and lamellar bone.Differentiate between compact bone and spongy bone.Describe the applied aspect of bone |
| 30 | Histology of bone | Identify three types of bone on microscopy, including distinctive features of each.Describe the structural basis of classification. |
| 31 | Histology of muscles | Identify three types of muscles on microscopy, including distinctive features of each muscle fiber.Describe the structural basis of muscle striations.Recognize the structural elements that produces muscle contraction and brings the movement of a body part.Recognize the function and organization of the connective tissue in muscle.Classify and distinguish three types of musclesDescribe the microscopic structure ofskeletal muscleDescribe important functional correlates of skeletal, smoothDescribe the microscopic structure ofsmooth muscleIdentify/Describe the microscopic structure of cardiac muscle fiberDescribe important functional correlates of cardiac muscle fiber |
| **Physiology** |
| 32 | Skeletal vs smooth muscle | Differentiate between skeletal muscle and smooth muscle. |
| 33 | Mechanism of musclecontraction | Describe the general mechanism of muscle contraction.Describe the molecular mechanism of muscle contraction |
| 34 | Energetics of musclecontraction | Describe the energetics of muscle contraction. |
| 35 | Terms related to MSK | Describe the following terms related to MSKExcitable tissueStimulusThresholdDepolarizationHyperpolarizationPresynaptic potentialPost synaptic potentialGoldmann EquationNernst Equation |
| **Biochemistry**  |
| 36 | Connective tissues | Explain in detail the biochemistry of connective tissues. |
| 37 | Glycosaminoglycan | Discus the role of glycosaminoglycan (GAG) in the formation of the connective tissues, cartilage, skin, blood vessels and tendons |
| 38 | Collagen | Describe the chemical structures of cellular matrix of collagen and elastin |
| 39 | Chemistry of Amino acids and Proteins  | * Describe structure of amino acids & Proteins
* Classify proteins
* Describe different types of Plasma proteins
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| **Biochemistry Practical** |
| 40 | Detection of Sulphur containing amino acids | Define Sulphur containing amino acids their structure and typesLead Sulphate test |

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| **Musculoskeletal MODULE** |
| **THEME –II** |
| **Weak grip and painful hand** |

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| **SNO.** | **Topic**  | **Learning Outcomes** |
| **ANATOMY**  |
| 1 | Osteology of radius & hand | Recognize the bones of forearm & handDetermine side of bones.Identify the features of bones.Identify the muscles attached to bones.Describe the ossification of bonesExplain the clinical significance of bones.Describe the common fractures of the bone.Describe and Identify the salient features of the radiusIdentify the attachments to radiusDescribe the surface anatomy radius and the radiological anatomy radius Describe the applied anatomy radiusDescribe and Identify the salient features bones of handIdentify the attachments to bones of handDescribe the surface anatomy main bones of hand and the radiological anatomy of main bones* Describe the applied anatomy main bones of hand including carpal tunnel and fractures
 |
| 2 | Muscles of hand | Recall the structure and functions of palmar aponeurosis.Describe the attachments, nerve supply & actions of muscles of hand.Describe the thenar Muscles.Correlate the movements of thumb with hand anatomy.Identify the anatomical snuffbox.Relate applied with gross anatomy of few structures of handEnumerate, describe and identify the small muscles of the handDescribe Surface anatomy of important muscles of handIdentify structures on transverse MRI hand taken at various levelsDescribe relevant clinical anatomy of important musclesIdentify/Describe joints of the hand and fingers (intercarpal joints, carpometacarpal and intermetacarpal joints, carpometacarpal joint of the thumb, and metacarpophalangeal jointsDescribe surface , radiological and clinical anatomy of important joints |
| 3 | Vessels & nerves of thehand | Identify different vessels in hand.Describe the location, destination course relations of radial and ulnar arteries in hand.State the branches of radial and ulnar arteries in hand.Describe the formation of superficial and deep palmar arch, veins of hand and their tributaries.Describe the nervous supply of the hand. |
| 4 | Wrist joint | Recognize the details of wrist joints.Describe and explain the movements occurring on wrist joints.Name the muscles acting in pronation and supination.Describe the nerve supply and blood supply of wrist joints.Describe wrist joint, nerve supply and blood supply.Describe clinical problems related to Wrist joints. |
| 5 | Spaces of the palm | Identify the different spaces of the hand on both palmar and dorsal aspects.Describe the clinical importance of these spaces |
| **Physiology**  |
| 10 | Describe the importantterms | Describe the followingMotor unitSummationTetanizationStaircase effectSkeletal muscle toneMuscle fatigueAgonistAntagonistsCoactivation of agonist and antagonis |
| 11 |  Excitation contractioncoupling in skeletalmuscles | Discuss the process of excitation contraction coupling in skeletal muscles.Explain Transverse tubule-sarcoplasmic reticulum systemDescribe Release of Calcium ions by sarcoplasmic reticulumExplain Role of Calcium pumpDescribe Excitatory pulse of Ca+ |
| 12 | Muscle action potential | Describe the muscle action potential. |
| 13 | Excitation contraction coupling | Describe excitation contraction coupling of skeletal muscle. |
| **BIOCHEMISTRY** |
| 14 | Role of calcium andphosphorus | Explain the role of calcium and phosphorous in formation of cellular matrix and bone |
| 15 | Vitamins | Vitamins and their roleDefine vitaminsClassify vitaminsDifferentiate between Fats and water soluble vitaminsDescribe role of Vitamin AExplain the role of Vitamin DDescribe the role of Vitamin EDescribe the role of water soluble vitamins |
| 16 | Introduction to minerals | Define Minerals,Define major and minor mineralsDescribe classification of minerals |
| **Biochemistry Practical’s** |
| 17 | Detection of Cyclic aminoAcids | Define Cyclic amino AcidsUnderstand their structure and typesXanthoproteic Test |

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| **Musculoskeletal MODULE** |
| **THEME –III** |
| **Pain lower limb/limping** |

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| **SNO** | **Topic**  | **Learning Outcome** |
| **1** | **Introduction to lower limb** | **Recognize different parts of lower limb.****Describe regions of lower limb.****List the bones of lower limb.****Describe the vessels and nerves of lower limb.****Identify different land marks in different regions of lower limb** |
| **2** | **Hip bone** | **Identify the different parts of the bone.****Describe side determination.****Describe muscle attachments.****Describe ligamentous attachments.****Describe the different bones articulating with the hip bone****Identify the different parts of the bone.****Describe the common fractures of the bone.****Identify and describe the salient features of the bones of hip bone****Identify the attachments of hip bone****Describe the surface anatomy of hip bone****Describe the radiological anatomy of hip bone****Describe the applied anatomy of hip bone.** |
| **3** | **The hip joint and****movements** | **Describe the characteristics features of synovial joint****Describe the Articular surfaces of hip****joint****Identify the capsule of hip joint****Describe the synovial membrane,****cavity & fluid of hip joint****Enumerate the ligaments of hip joint****& describe their attachments****Describe the movements possible at****hip joint****Describe the clinical correlates of the****hip joint****Describe surface and radiological anatomy (X-rays and MRI) and clinical of hip joints** |
| **4** | **Gluteal region** | **Describe the boundaries of gluteal****region****Describe bones and ligaments of gluteal region****Describe the different structures entering and leaving gluteal region****Describe muscles of the gluteal region.****Describe Vessels of the gluteal region.****Describe nerves of the gluteal region.****Describe about certain clinical correlates regarding gluteal region****Describe Surface anatomy of important muscles****Identify structures on transverse MRI of gluteal region taken at various levels****Describe clinical anatomy of important muscles** |
| **5** | **Femur** | **Identify different parts of the femur****Determine the side of the bone****Identify the surfaces and borders of****the bone****Describe the common fractures of the bone.****Describe the attachments of the different muscles and ligaments on the bone****Describe the arterial supply of the bone****Relate to the general idea about fractures of femur and other clinical conditions Identify and describe the salient features of the bones of hip bone****Describe the surface anatomy of femur****Describe the radiological anatomy of****femur****Describe the applied anatomy of femur** |
| **6** | Nerves of lower limb and their injuries | Identify the names of nerves and their main branches innervating lower limbIdentify the nerves closely related toa bone or other structure of lower limbRecognize the main nerves commonly vulnerable to injuryIdentify the main area and loss offunction if particular nerve is injuredDefine and understand terms neuritis, anesthesia, par aesthesia, paralysis,neuralgia, sciatica |
| 7 | Superficial vessels and lymphatic’s of lower limb | Enumerate and describe the superficial arteries of lower limbName and Describe superficial veins of lower limb* List and Describe the superficial lymphatic vessels and lymph nodes of lower limb
 |
| 8 | Deep fascia of thigh,iliotibialtract and superficialvessels | Describe the arrangement of deepfascia in thighDescribe how the iliotibial tract participates in walking and runningDescribe the location of saphenous opening and its relationsDescribe the great saphenous vein.* Describe clinical correlates of saphenous vein
 |
| 9 | Muscles of the anterior fascial compartment ofthigh | Describe the muscles of anterior compartment of thigh.Describe the nerve supply of anteriorCompartment.* Describe the action of these muscles
 |
| 10 | Nerves and vessels ofanterior compartment ofthigh | Describe the nerve supply of the anterior compartment of thigh.Describe the blood supply and the venous drainage of anterior compartment of thigh* Describe the action of these muscles
 |
| 11 | The medial compartmentof thigh | Describe the muscles of medial compartment of the thigh.Describe the nerve supply of these muscles.Describe the actions of the muscles of medial compartment of thigh* Describe the vessels of medial compartment of the thigh
 |
| 12 | Posterior compartment ofthigh | Describe the muscles of posteriorcompartment of thighDescribe the arterial supply of posterior compartment of thighDiscuss the trochanteric and cruciateanastomosis at the back of thighDescribe the venous drainage of thisregionDescribe the nerve supply of posterior compartment of thigh and* Relate to the clinical conditions effecting the region
 |
| 13 | Popliteal fossa | Describe the boundaries of popliteal fossa.Describe the contents of the popliteal fossa.* Describe some clinical correlates regarding popliteal fossa
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| 14 | Femoral triangle and its contents | Describe the boundaries of femoraltriangleList the contents of femoral triangleDescribe the femoral sheath & canalDescribe the clinical correlates of the Femoral triangle.* Describe the location, boundaries and contents of adductor canal
 |
| 15 | Tibia bone | Describe the division of tibia bone in3 partsIdentify the surfaces and borders oftibiaDescribe the attachments of muscleson the tibia boneDescribe the ossification of tibia andits primary and secondary ossification centersDescribe the common fractures of the bone.Identify and describe the salient features of the bone of legIdentify the attachments to the bone of the legDescribe the surface anatomy of legDescribe the radiological anatomy ofleg* Describe the applied anatomy of leg
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| 16 | Fibula & bones of foot | Determine the side of bone.Describe the bony features along with its different attachments on the fibula.Name and describe the tarsal bonesand their arrangementName and describe the metatarsal bones and phalangeal bones.Describe the common fractures of the bone.Describe the muscles of the sole ofthe foot (origin, insertion, nerve supply, blood supply, and action)Describe the muscles of the dorsum of the foot (origin, insertion, nerve supply, blood supply, and action)Describe Surface anatomy of important musclesIdentify structures on transverse MRIof foot taken at various levelsDescribe clinical anatomy of important muscles |
| 17 | Anterior and lateralcompartment of leg | identify the boundaries of the compartments of legState the muscles of anterior and lateral compartment of legDescribe the vessels of anterior andlateral compartment of legDescribe the nerves of lateral and anterior compartment of leg* Describe action of these muscles
 |
| 18 | Posterior compartment ofleg | Explain the muscles of posteriorCompartment of leg.Describe nerve supply of these muscles.Explain the actions of the muscles of* posterior compartment of leg
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| 19 | Knee joint | Describe the type of knee jointDescribe the articular surfaces of thisjointDescribe the articular capsuleDescribe the synovial membrane andthe synovial cavityEnumerate the ligaments of kneejointDescribe the bursa around the kneejointDescribe the blood and nerve supplyof the knee jointDescribe the mechanism of locking and unlocking of knee joint.Describe surface and radiologicalanatomy (Xrays and MRI) and clinical* of knee joints
 |
| 20 | Surface anatomy of lower limb | Demonstrate the surface anatomy of arteries of lower limb.Demonstrate the surface anatomy of superficial & deep veins lower limb.Demonstrate the surface anatomy of nerves of lower limb |
| **Embryology**  |
| 21 | Development of lower limb | Describe the early stages of lower limb developmentDescribe the development of lower limb budsDescribe the final stages of lower limb developmentDescribe and explain the anomalies of the lower limb |
| Biochemistry |
| 22 | Sodium, potassium andchlorine in biology | Discuss RDA, serum LevelsEnlist sources of Sodium, Potassium and chlorine,Describe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount ofSodium, Potassium and chlorine |
| **Biochemistry Practical’s**  |
| 23 | Salt Saturation Test | Perform Salt Saturation Test |

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| **Musculoskeletal MODULE** |
| **THEME –IV** |
| **Bony arches and fracture of foot** |

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| **SN0** | **Topic**  | **Learning Outcome** |
| **ANATOMY**  |
| 1 | Muscles and neurovascularsupply of the foot | Describe the dorsal muscles of foot.Describe the origin and insertion of planter muscles of foot.Describe their nerve supply and actions.Describe vascular and nervous supplyof sole and dorsum of footDescribe their course through footDescribe relationshipsIdentify and describe the salient features of the bone of footIdentify the attachments to the boneof the footDescribe the surface anatomy of footDescribe the radiological anatomy offootDescribe the applied anatomy of foot |
| 2 | Arches of foot | Describe the arches of footDescribe the factors responsible for their maintenance of the arches of the footRecognize the injury when it occurs and be able to evaluate plantar fasciitis.Describe about counselling regardingthe rehabilitation for plantar fasciitis |
| **Biochemistry**  |
| 3 |  Role of vitamin c & D | Describe the role of Vitamin C and Vitamin D in the formation of connective tissues and bones. |
| 4 | Iodine in Biology | Discuss RDA, serum Levels IodineEnlist sources ofDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of Iodine |
| **PATHOLOGY** |
| 5 | introduction to Bone pathology | Define and differentiate osteopenia, osteoporosis, osteomalaciaDefine osteomyelitisEnlist various forms of arthriti |
| Forensic Medicine |
| 6 | Injury    | Define injury on medico legal basis.Classify injury.Define mechanical injuryClassify mechanical injuryDescribe mechanisms of injury.Interpret the nature (manner) of injury. |
| 7 | Wound | Define wound.Define hurt.Identify factors affecting appearance of wound |

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| **Musculoskeletal MODULE** |
| **THEME –V** |
| **Backache**  |

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| **SN0** | **Topic**  | **Learning Outcome** |
| **ANATOMY**  |
| 1 | Typical spinal nerve | Define a spinal nerve.Recognize the spinal nerve as a part of PNS.Enumerate the spinal nerves in different regionsIdentify their location and site of emergence.Identify various components of a typical spinal nerve.Recall the fate of rami.Associate the rami communicans with typical spinal nerveRecall the distribution of gray rami |
| 2 | Vertebral column | Describe the muscles of back (origin,insertion, nerve supply, blood supply,and action)Describe Surface anatomy of important musclesIdentify structures on CT/MRI of vertebral column taken at various levelsDescribe clinical anatomy of important muscles |
| 3 | Lumbo sacral plexus,cutaneous nerves | Describe the formation of lumbar Plexus.List the branches of lumber plexus with their root values.Describe relation of the nerves with Psoas major muscle.List the structures supplied by lumbar plexus.Describe the formation of sacral plexus.Describe the composition and relations of sacral plexus.List the branches of this plexus |
| **Biochemistry** |
| 4 | Phosphorus and Magnesiumin biology | Discuss RDA, serum LevelsEnlist sources of Phosphorus and MagnesiumDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of Phosphorus and Magnesium |
| 5 | Sulphur in biology | Discuss RDA, serum LevelsEnlist sources of SulphurDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of sulphur |
| 6 | Copper and cobalt inbiology | Discuss RDA, serum Levels Copper and cobaltEnlist sources ofDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of Copper and cobalt |
| Community Medicine |
| 7 | Back pain | Explain the causes of low backpainz Describe the prevention of lowback painz Describe the causes & preventionof msd related to child labor |

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| **Musculoskeletal MODULE** |
| **THEME –VI** |
| **Muscle weakness and fatigue** |

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| **SN0** | **Topic**  | **Learning Outcome** |
| **Physiology**  |
| 1 | Physiologic anatomy of theskeletal muscle fiber | Explain the physiologic anatomy of the skeletal muscle fiber.Skeletal muscle fiberSarcolemmaMyofibrilsI bandA bandZ diskM lineSarcomereTitin microfilament moleculesSarcoplasmSarcoplasmic reticulum |
| 2 | Characteristics of wholemuscle contraction | Identify the characteristics of whole muscle contraction.Compare isotonic and isometric exercises.Compare and contrast slow and fast muscle fibers.Describe the mechanics of skeletal muscle contraction.Describe muscle tone and muscle fatigue.Describe lever systems of the body and positioning of a body part.Describe remodeling of muscle to match function. |
| 3 | Neuromuscular junction | Describe the transmission of impulses from nerve endings to skeletal muscle fibers.Explain the physiologic anatomy of the neuromuscular junction |
| 4 | NeuromuscularTransmission | Explain the mechanism of transmission of impulses from nerve endings to muscle fibersExplain Formation and Secretion of acetylcholine at nerve terminalsDescribe Action of acetylcholine at postsynaptic membraneDescribe Degradation/Destruction of released acetylcholine Describe End plate potential Describe Fatigue of junction |
| 5 | Neuromuscular drugs | Describe the physiologic basis of the drugs used in the neuromuscular disorders (Drugs that enhance or block the transmissionat neuromuscular junction)Enlist the excitatory and inhibitorytransmitter substances secreted at the smooth muscle neuromuscular junctionDrugs that stimulate the muscle fiber by acetylcholine like actionDrugs that stimulate neuromuscular junction by inactivating acetylcholinesteraseDrugs that block transmission atthe neuromuscular junctionEnlist the excitatory and inhibitory transmitter substances secreted at the smooth muscle neuromuscular junction |
| 6 | Myasthenia gravis | Describe the pathophysiology ofmyasthenia gravis |
| 7 | Smooth muscle | Classify smooth musclesDescribe the physiologic anatomy of the smooth muscle neuromuscular junction |
| 8 | Skeletal Muscle fiber | Discuss in detail types of muscles and arrangement of skeletal muscle fibers. |
| 9 | Contraction of smooth muscle | Describe the contractile mechanisms in smooth musclesDescribe excitation and contraction of smooth muscle.Identify the types of smooth muscles.Describe the chemical and physical basis for smooth muscle contraction.Compare smooth and skeletal muscle contraction.Chemical basis of smooth musclecontractionPhysical basis of smooth muscle contractionExplain how the calcium ions regulate the contraction.Regulation of smooth muscle contraction by the calcium ionsEnlist the excitatory and inhibitory transmitter substances secreted at the smooth muscle neuromuscular junction |
| 10 | Nervous and hormonalcontrol of smooth musclecontraction | Describe the nervous and hormonal control of smooth musclecontraction |
| 11 | Resting MembranePotential | Enumerate the intracellular and extracellular concentrations of sodium, potassium, chloride and calcium ions in a resting/normal cell.Describe the characteristics of major membrane ion channels and their role in the membrane potentialDescribe the resting membranepotential in a cell/nerve fiber |
| 12 | Muscle Remodeling | Describe following Muscle hypertrophyMuscle atrophyMuscle hyperplasiaRigor mortisMuscle dystrophyRecovery of muscle contraction in poliomyelitis |
| 13 | Membrane potentials and action potentials in smooth muscles | Describe the membrane potentials and action potentials in smooth muscles.Describe Spike potentialsDescribe Action potentials with plateausDescribe Role of calcium channels in generating the smooth muscle action potentialDescribe Slow wave potentialsDescribe Excitation of visceral smooth muscle by muscle stretchDescribe Depolarization of multi-unit smooth muscle without action potentials |
| 14 | Control of smooth musclecontraction | Describe the mechanism nervous, hormonal and local control of smooth muscle contraction. |
| 15 | Smooth muscle and skeletalmuscle contraction | Compare the smooth musclecontraction and skeletal muscle contraction |
| 16 | Skeletal muscle contraction | Describe the three sources of energy for muscle contractionCompare isometric and isotonic contractionsCompare characteristics of fast and slow muscle fibers.Sources of energy for muscle contractionCompare isometric and isotonic contractionsCompare characteristics of fast and slow muscle fibers |
| Biochemistry |
| 17 | Hormonal regulation | Explain the hormonal regulation ofcalcium and phosphorous to maintainmusculoskeletal system |
| 18 | Sodium, potassium and chlorine in biology | Discuss RDA, serum LevelsEnlist sources of Sodium, Potassium and chlorine,Describe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of Sodium, Potassium and chlorine |
| 19 | Calcium in Biology | Discuss RDA, serum LevelsEnlist sources of CalciumDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of Calcium |
| 20 | Fluoride and Lithium in biology | Discuss RDA, serum Levels FluorideEnlist sources ofDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease in amount of FluorideBrief description on role of lithium in biology |
| 21 | Molybdenum, Selenium, Zinc, chromium,manganese,silicon, vanadium in biology | Enlist sources ofDescribe functionsDiscuss absorption excretion,Describe disorders related to increase and decrease of the said elements |
| 22 | Toxic element Aluminum , Arsenic,Antimony, Boron, Bromine, Cadmium, Cesium, Germanium, Lead, Mercury, Silver, Strontium | Discuss different effects of toxicelements |
| Pharmacology |
| 23 | Drug used in MSK | Define & classify NSAIDSClassify neuromuscular blocking agents.Enlist more most comomly used analgesia aspirin , iburrofen , diclofenac, paracetamol, COX-2 SalicoxClassify corticosteroids |
| Community Medicine |
| 24 | MSK diseases | Explain the risk factors for different types of msd’sDescribe the preventive measures for different types of risk factors for msd’s |
| 25 | Epidemiology andprevention of MSD | Describe work related msd’sIdentify risk factors of msd at workplace.Describe prevention of exposure to risk factors related to workplace.Describe the preventive strategies and safety guidelines in order to reduce the incidence of msds related to work place.Describe the burden /epidemiology of work related msd’sDescribe application of ergonomics in the prevention of work related msd’s |