



**Yarmouk University**  
**Faculty of Medicine**  
**MD Program Curriculum**

Course Title: **Musculoskeletal and Integumentary Systems  
2020-2021**

Course Code: M 322

Credit Hours: 6 credits

Calendar Description: 4 weeks/Sem. 1/ 3<sup>rd</sup> Year

Teaching Approaches: Integrated System Course

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**A. Course Description:**

M331 Musculoskeletal System (6 credit hours, 5 weeks)

This is Interdisciplinary integrated module of musculoskeletal system. Basic sciences of anatomy, biochemistry microbiology, pathology, pharmacology, and physiology of the musculoskeletal system are correlated with clinical disorder of this system. The goal of this integrated course is to provide the medical student with comprehensive knowledge about bones, joints muscles, tendons, ligaments, skin and associated soft tissues related to clinical manifestations of diseases. The teaching methods include lecture labs as well as seminars and small group discussions of clinical oriented problems to enhance self directed learning.

**B. General Objectives:**

1. Identify and describe bones, muscles and joints of the upper, lower limbs and the vertebral column and give nerve supply and actions of the muscles associated with them.
2. Describe normal development and congenital abnormalities of limbs and vertebral column.
3. Understand the metabolism and the biochemical and molecular basis of diseases affecting muscles and bones.
4. Describe the mechanism of muscle contraction.
5. Describe and understand the mechanism of action, pharmacokinetics and therapeutic use and adverse effects of drugs that affect the musculo-skeletal system and the skin.
6. Understand the pathogenesis and pathological features of infections and diseases that affect bones, joints, muscles, soft tissue and the skin.
7. Understand the epidemiology and control of the common injuries that may affect the human musculo-skeletal and skin
8. Describe the macroscopic and microscopic features of the skin and subcutaneous tissues.
9. The biochemical processes of normal skin and subcutaneous tissues.
10. Describe the commensals and pathogenic microbes affecting the skin, subcutaneous tissue and musculoskeletal system.
11. The pathological changes that occur in the skin, and the etiology, pathogenesis and pathologic features of selected major diseases of the skin.

### C. Specific Learning Objectives

After studying the relevant material in lectures, practical sessions, clinical seminars and case presentations, the student is expected to achieve the following specific objectives.

Unit	Topic	Specific
1	<b>Introductory Case presentation for</b>	
<b>Anatomy</b>	<b>Axial skeleton I</b>	Describe the bone skull Describe the joint of the skull Describe the temporomandibular joint
	<b>Axial skeleton II</b>	Describe the Vertebral column Describe the thoracic cage
	<b>Appendicular skeleton I</b>	Describe the pectoral girdle (clavicles and scapulae) Describe the upper limbs (arms)
	<b>Appendicular skeleton II</b>	Describe the pelvic girdle (coxal bones, sacrum, coccyx) Describe the lower limb (Legs)
	<b>Joints of the upper limb: Shoulder joint</b>	Describe the shoulder joint Describe the movements of the joint List the muscles that produce movement Describe the important relations of the shoulder joint
	<b>Elbow and wrist joint</b>	Describe the elbow joint Describe the movements of the joint List the muscles the produce movement Describe the important relations of the elbow joint Describe the wrist joint Describe the movements of the joint List the muscles the produce movement Describe the important relations of the wrist joint
	<b>Joints of the lower limb: Hip joint</b>	Describe the hip joint Describe the movements of the joint List the muscles that produce movement Describe the important relations of the hip joint
	<b>Knee joint</b>	Describe the knee joint Describe the movements of the joint List the muscles the produce movement Describe the important relations of the knee joint
	<b>Ankle &amp; foot joints</b>	Describe the ankle joint Describe the movements of the joint List the muscles the produce movement Describe the important relations of the ankle joint Describe the foot joints Describe the arches of the foot.
	<b>Skeletal muscles</b> <b>Muscles of the head</b>	Describe the muscles of the scalp Describe the muscles of the facial expression Describe the muscles of mastication

	<b>Muscles of the neck</b>	Describe the muscles of the back Describe the muscular triangles of the back Describe the muscles of the neck Describe the cervical fascia Describe the muscular triangles of the neck Describe the cervical ligaments
	<b>Muscles of the shoulder region</b>	Describe the axilla. Describe the muscles of the shoulder. Describe the rotator cuff. Describe the quadrangular space.
	<b>Muscles of the upper arm</b> <b>Muscles of the forearm</b>	Describe the muscles of the upper arm Describe the fascial compartments of the upper arm Describe the cubital fossa. Describe the muscles of the forearm
	<b>Wrist and Hand</b>	Describe the flexor and extensor retinacula Describe the carpal tunnel Describe the muscles of the hand Describe the fibrous flexor sheaths. Describe the synovial flexor sheaths. Describe the insertion of the long flexor tendons. Describe the insertion of the long extensor tendons. Describe the palmar aponeurosis.
	<b>Muscles of the lower limb:</b> <b>Gluteal region</b>	Describe the muscles of the gluteal region Describe the sacrotuberous and the sacrospinous ligaments. Describe the greater and lesser sciatic foramina.
	<b>Thigh muscles</b>	Describe the muscles of the thigh. Describe the fascial compartments of the thigh. Describe the femoral triangle. Describe the femoral sheath. Describe the femoral canal. Describe the adductor canal. Describe the popliteal fossa.
	<b>Leg muscles</b> <b>Ankle</b>	Describe the muscles of the leg Describe the fascial compartments of the leg. Describe the flexor and extensor retinacula. Describe the peroneal retinacula.
	<b>Foot</b>	Describe the muscles of the sole of the foot. Describe the plantar aponeurosis. Explain the role of the muscles in the maintenance of the arches of the foot.
	<b>Development of the axial skeleton</b> <b>Development of the appendicular skeleton</b>	Describe the development of the skull and the vertebral column, ribs and sternum. Discuss related congenital anomalies Describe the development of the limbs. Discuss related congenital anomalies
	<b>Development of Muscular system.</b>	Describe the development of the skeletal muscles. Describe related congenital anomalies.

	<b>Skin</b>  <b>Skin Development</b>	Describe the structure of the the epidermis. Describe structure of the dermis. Compare the structure and distribution of hair follicles, nails , sebaceous and sweat glands Explain bases of skin color. Describe the development of the integumentary system. Describe related congenital anomalies.
<b>Public health</b>	Epidemiology of MSS injuries.  (Public health)	<ol style="list-style-type: none"> <li>1. Define : Epidemiology of accidents, hazards and injuries.</li> <li>2. Distinguish between risk and hazard.</li> <li>3. Identify the human, situational and environmental factors of accidents.</li> <li>4. Identify risk factors, risk groups and incidence rate of MSS injuries.</li> <li>5. Explain the factors that influence risk perception and risk acceptance of MSS injuries.</li> </ol>
<b>Physiology</b>	Muscle Physiology  (P Physiology)	<ol style="list-style-type: none"> <li>1. Overview of muscle mechanics</li> <li>2. To list contractile proteins.</li> <li>3. To describe the molecular mechanism of muscle contraction.</li> <li>4. To define isometric and isotonic contraction.</li> <li>5. To describe length tension relationship.</li> <li>6. To describe the relation between load and velocity of contraction.</li> <li>7. To understand force summation.</li> <li>8. <input type="checkbox"/>To apply the above principles to cardiac muscle in health and disease.</li> <li>9. To describe neuromuscular junction.</li> <li>10. To understand motor unit.</li> <li>11. To be familiar with types of muscle fibers.</li> <li>12. To describe the effect of exercise and hormones on skeletal muscle.</li> <li>13. To be familiar with electromyography.</li> <li>14. To explain the effect of muscle enervation,</li> <li>15. To explain rigor mortis and muscle fatigue.</li> </ol>

Muscle relaxants (Pharmacology)	<ol style="list-style-type: none"> <li>1. Review the transmission process at the neuromuscular endplate and the points at which drugs can modify this process.</li> <li>2. Compare the pharmacodynamics and pharmacokinetics of nondepolarizing and the depolarizing neuromuscular blockers.</li> <li>3. Describe the main indications, major adverse effects and drug interaction of nondepolarizing and depolarizing neuromuscular blockers.</li> </ol>
Treatment of rheumatoid arthritis (Pharmacology)	<ol style="list-style-type: none"> <li>1. Classify the anti-inflammatory drugs.</li> <li>2. Describe the indications of each class</li> <li>3. Describe the mechanism of action, toxicity and contraindications of drugs used in each class.</li> <li>4. List the guidelines for the treatment of rheumatoid arthritis.</li> </ol>
Treatment of osteoarthritis (Pharmacology)	<ol style="list-style-type: none"> <li>1. Classify the different agents used in the treatment of osteoarthritis (OA).</li> <li>2. List the mechanisms of action, adverse effects and therapeutic indications of each agent.</li> <li>3. Identify the guidelines that address the treatment of OA.</li> </ol>
Treatment of gout and hyperuricemia (Pharmacology)	<ol style="list-style-type: none"> <li>1. Describe the non-pharmacological treatment of hyperuricemia</li> <li>2. Discuss drugs used for prevention and treatment acute gout attack</li> <li>3. Describe each drug mechanism of action , side effect and drug interaction</li> </ol>
Treatment of psoriasis (Pharmacology)	<ol style="list-style-type: none"> <li>1. Classify the different agents used in the treatment of psoriasis (OA).</li> <li>2. List the mechanisms of action, adverse effects and therapeutic indications of each agent.</li> <li>3. List the guidelines of the treatment of psoriasis.</li> </ol>
Common skin disorders (Pharmacology)	<ol style="list-style-type: none"> <li>1. Identify the classes of pharmaceutical agents used in the treatment of acne and dermatitis.</li> <li>2. List the mechanisms of action, adverse effects and therapeutic indications of each agent.</li> <li>3. Recognize the different lines of therapy in acne and dermatitis.</li> </ol>
Topical antimicrobial drugs (Pharmacology)	<ol style="list-style-type: none"> <li>1. Describe the characteristics of the topical preparations of antibacterial, antifungal and antiviral agents.</li> <li>2. List the therapeutic indications of the above mentioned agents.</li> </ol>
Biochemistry of Bone and connective tissue and bone metabolism  (Biochemistry)	<ol style="list-style-type: none"> <li>1. Describe the biochemical structure of bone tissue, the collagen matrix and the hydroxyapatite cement.</li> <li>2. List bone matrix proteins and describe their function.</li> <li>3. Describe the Composition of calcified tissues, calcification in bones and teeth and formation of hydroxyapatite.</li> <li>4. Understand the role of alkaline phosphatase, calcium and phosphate and vitamin D: 1,25-Dihydroxy-vit-D in bone formation and</li> </ol>
Metabolic disorders and clinical biochemistry of muscle and bone  (Biochemistry)	<p>Discuss the markers for bone formation and Resorption and their clinical use in diagnosis Describe the molecular basis of:</p> <ol style="list-style-type: none"> <li>1. Duchene Muscular Dystrophy.</li> <li>2. Glycogen storage diseases of muscle</li> <li>3. Muscle Mitochondrial diseases.</li> <li>4. Describe the molecular basis of Osteogenesis imperfecta and Ehler Danlos syndromes</li> </ol>

<p>Acquired bone diseases (Pathology)</p>		<ol style="list-style-type: none"> <li>1. List the causes of metabolic bone diseases and examples of resulting diseases.</li> <li>2. Discuss the pathology of metabolic bone disorders (Definition, classification, etiology, pathogenesis, morphology, manifestation and complications). List the types of bone fractures (Traumatic and Pathological).</li> <li>3. Discuss the pathology of bone fractures (Definition, classification, etiology, morphology and manifestation).</li> <li>4. Describe the mechanism of bone healing and enumerate the factors that affect bone healing.</li> <li>5. Discuss the pathology of Paget's disease of the bone (Definition, causes, pathogenesis, morphology, manifestation and complications).</li> <li>6. Discuss the pathology of osteomyelitis (Definition, classification, etiology, pathogenesis, morphology, manifestation and complications).</li> <li>7. Describe the specific types of bone infections (TB, Salmonella, Syphilis ...). Understand the classification of bone and cartilage tumors.</li> <li>8. Discuss the pathology of the commonest bone and cartilage tumors (Definition, etiology, pathogenesis, morphology, manifestation and complications).</li> </ol>
	<p>Diseases of joints (Pathology)</p>	<ol style="list-style-type: none"> <li>1. Classify the different types of arthritis (Septic arthritis, Osteoarthritis, Rheumatoid arthritis, Gout and pseudogout).</li> <li>2. Discuss the pathology of different types of arthritis (Definition, classification, etiology, pathogenesis, morphology, manifestation, complications and prognosis).</li> <li>3. List joint tumors and tumor-like lesions.</li> </ol>
	<p>Soft tissue tumors &amp; Diseases of skeletal muscles (Pathology)</p>	<ol style="list-style-type: none"> <li>1. Describe the soft tissue tumors.</li> <li>2. List the types of soft tissue tumors</li> <li>3. Discuss the pathology of the commonest soft tissue tumors (Definition, etiology, pathogenesis, morphology, manifestation and complications).</li> <li>4. Understand the importance of cytological and histological features of soft tissue tumors in identifying type and behavior</li> <li>5. Overview the histology of skeletal muscle.</li> <li>6. List the main types of the skeletal muscle diseases.</li> <li>7. Discuss the two main types of muscle atrophy.</li> <li>8. Discuss the main inflammatory myopathies. Discuss muscular dystrophy.</li> </ol>
	<p>Acute and chronic inflammatory dermatoses (Pathology)</p>	<ol style="list-style-type: none"> <li>1. Describe the macroscopic and microscopic terms of skin pathology.</li> <li>2. Define etiology, pathogenesis and pathologic features of urticaria, acute eczema, acne vulgaris and pathologic features of panniculitis.</li> <li>3. Define etiology, pathogenesis and pathologic features of psoriasis and lichen planus.</li> </ol>
	<p>Bullovesicular skin diseases and skin tumors Pathology</p>	<ol style="list-style-type: none"> <li>1. Define etiology, pathogenesis and pathologic features of bullovesicular diseases (Pemphigus vulgaris, Bullous pemphigoid, Dermatitis herpetiformis).</li> <li>2. List the types of skin tumors</li> <li>3. Discuss the pathology of the commonest skin tumors (Definition, etiology, pathogenesis, morphology, manifestation and complications).</li> </ol>

<p>Anaerobes and clostridium perfringens and Gas gangrene Trichinella Spiralis</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Describe the morphological, bacteroides and trichinella features, pathogenesis and virulent factors, laboratory diagnosis, treatment and prevention of clostridium perfringens which is the main cause of gas gangrene.</li> <li>2. Describe the role of cl. Perfringens and Bacteroides in gas angrene and the role of Trichinella in muscle infection. Explain their laboratory diagnosis, pathogenesis and treatment.</li> <li>3. Describe the morphological features, pathogenesis and virulent factors, laboratory diagnosis treatment and prevention of clostrium perfringens</li> <li>4. Describe the role of aerobes in the formation of deep wound infection and abscess.</li> <li>5. Describe the role of Trichenella in muscle infection and explain their laboratory diagnosis, pathogenesis and treatment.</li> <li>6. Describe the role of bacteria in the pathogenesis of osteoarthritis arthritis, specimen collection identification and treatment.</li> </ol>
<p>Bacterial infections of the skin.</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Describe cultural characteristics of skin an pathogenesis of skin commensals and pathogens</li> <li>2. Describe the antibiotic sensitivity of each organism (<i>Diphtheroids</i> ,<i>Staphylococci</i> , <i>Streptococci</i>,<i>Propionobacterium acnes</i> , <i>Mycobacteria</i></li> <li>3. Explain types, pathogens of wound infection methods specimen collection for proper dignosis of types Bacteria and laboratory diagnosis.</li> </ol>
<p>Viral infections of the skin.</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Explain morphology and pathogenesis as well as diagnostic procedures of viruses infecting skin.</li> </ol>
<p>Viral infection of the skin.</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Describe the Herpe's and childhood exanthens.</li> </ol>
<p>Parasitic infecting the skin.</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Discuss the parasites that infest the skin ( <i>Scabes</i> <i>Leishmania</i> and <i>Onchocerca</i> ). Briefly describe the life cycle, treatment and prevention of each parasite.</li> <li>2. Describe parasites that infest the skin, their life cycle, treatment and prevention. (<i>Scabes</i> <i>Leishmania</i>, <i>Oncocerca</i> fleas, loaloo, and cutaneous larva migrans).</li> </ol>
<p>Fungal infections of the skin</p> <p>(Microbiology)</p>	<ol style="list-style-type: none"> <li>1. Describe the fungi that infect the skin and subcutaneous tissue, their identification and treatment (<i>Dermatophytes</i> , <i>Candida</i> and <u><i>Mycetoma agents</i></u> )</li> <li>2. Describe the fungi that infect the skin, their clinical classification, their identification and treatment (cutaneous, subcutaneous and apportunistics).</li> </ol>
<p>Introduction to clinical dermatology</p> <p>(Dermatology)</p>	
<p>Introduction to clinical orthopedics</p> <p>(Orthopedics)</p>	

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## Clinical cases for small group discussions

### Two topics will be discussed:

#### 1. Carpal tunnel syndrome

A 40-years-old woman visited her physician complaining of severe burning pain "pins and needles" in the hand and lateral fingers. The condition was becoming progressively worse and was more severe at night. She said she had experienced difficulty in buttoning up her clothes when dressing.

On physical examination, the patient pointed to the thumb, index, middle, and lateral half of the ring fingers as the area where she felt the discomfort.

No objective impairment of sensation could be detected over the theaner muscle; however the sensation was mildly decreased in the lateral three and half finger.

The muscles of the thenar eminence appeared to have some wasting with less power compared to the other muscle of the hand manifested by weakness of resisted thumb abduction.

Q- What anatomic structure was diseased in this patient?

Q- Explain the altered sensation felt in the skin over the palmer aspect of the lateral three and half finger. Q- Explain the absence of paresthesia over the palmer aspect of theaner eminence.

Q- Explain the difficulty she experience in buttoning up her clothes.

#### 2- Rheumatoid Arthritis

A female patient complained of deformity of the small joints of the hand. One year later she suffered from painful swelling of the knee joints. Biopsy examination showed perivascular inflammatory infiltrate composed of plasma cells and lymphocytes with formation of lymphoid follicles.

what is the most likely diagnosis?

What are the risk factors of the disease?

Mention the systemic manifestation of this disease?

What are investigations used for diagnosis?

Enumerate other causes of chronic arthritis?



## Summary of the teaching activities of M322

<b>Topic</b>	<b># of Lectures</b>	<b># of Practical</b>	<b>Small Group Discussion</b>
Anatomy	24	4	1
Physiology	3		
Biochemistry	2		
Pathology	7	2	1
Microbiology	6	2	
Pharmacology	8		
Public Health	1		
Introduction to MSS	1		
<b>Total</b>	<b>51</b>	<b>8</b>	<b>2</b>

**b. Practical Laboratory Sessions:**

#	PRACTICE TITLE	OBJECTIVES
1	Anatomy Lab 1	<ul style="list-style-type: none"> <li>- Identify the components of the skull.</li> <li>- Identify the components of the vertebral column.</li> <li>- Identify the parts of each particular vertebra.</li> <li>- Identify bony features of the vertebral column in X-rays.</li> <li>- Identify different parts of each bone in the upper limb.</li> <li>- Identify the features of the upper limb bones in X-rays.</li> <li>- Identify different parts of each bone in the lower limb.</li> <li>- Identify the features of the lower limb bones in X-rays.</li> </ul>
2	Anatomy Lab 2	- Identify the muscles of the upper limb:
3	Anatomy Lab 3	- Identify the muscles of the lower limb:-
4	Anatomy lab 4	<ul style="list-style-type: none"> <li>- Identify the following               <ol style="list-style-type: none"> <li>1. Thick skin and thin skin</li> <li>2. The layers of epidermis</li> <li>3. Components of the dermis</li> <li>4. Epidermal derivatives</li> </ol> </li> </ul>
5	Pathology Lab 1	<ul style="list-style-type: none"> <li>- Describe the morphology of the following soft tissue tumors               <ol style="list-style-type: none"> <li>1. Lipoma and liposarcoma</li> <li>2. Fibromatosis</li> <li>3. Malignant fibrous histiocytoma</li> <li>4. High grade sarcoma</li> </ol> </li> <li>- Describe the morphology of the following bone tumors               <ol style="list-style-type: none"> <li>1. Osteochondroma</li> <li>2. Osteosarcoma</li> <li>3. Chondrosarcoma</li> <li>4. Ewing,s sarcoma</li> <li>5. Giant cell tumor</li> <li>6. Metastatic carcinoma</li> </ol> </li> <li>- Describe the morphology of the following               <ol style="list-style-type: none"> <li>1. Osteomyelitis</li> <li>2. Paget,s disease of bone</li> </ol> </li> </ul>
6	Pathology Lab 2	Describe the main morphological features of the following skin diseases <ol style="list-style-type: none"> <li>1. Dermatitis and urticaria</li> <li>2. Erythema multiform</li> <li>3. Psoriasis</li> <li>4. Lichen planus</li> <li>5. Pimphigus vulgaris</li> <li>6. Bullous pemphegoid</li> <li>7. Dermatitis herpeticiformis</li> </ol>
7	Microbiology Lab Wound Culture	Describe types: <ol style="list-style-type: none"> <li>1. Describe specimen collection methods</li> <li>2. Lists the most common aerobic and anaerobic organisms causing the infection and their laboratory identification.</li> </ol>

### C. Small Group Discussions

Students in each subgroup will attend a small group discussion after finishing all theory and practical session.

### D. Assessment:

EVALUATION DATES AND DISTRIBUTION OF MARKS:

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- /--/2019      **First in-course exam (written) \* = 50%**
- /--/2020      **Final end-course exam at the end of the semester (written) \* = 50%**

**\* All exams are in integrated form.**

### E. Recommended Text Books & Atlases:

#### 1. Anatomy:

- Clinical Anatomy for Medical Students. By R.S. Snell, 4<sup>th</sup> edition (or latest) OR essential clinical anatomy by Moore and Agur.
- Clinical Anatomy by Systems by Richard S. Snell, Lippincott Williams & Wilkins, 2007
- Langman's Medical Embryology, 13th Ed. by T.W. Sadler, Wolters Kluwer, 2014
- Junqueira's Basic Histology: Text & Atlas, 13th Ed. by Anthony L. Meschner, McGraw Hill, 2014
- Grants Atlas of Anatomy or any other Atlas of Human Anatomy.
- Basic Histology 9<sup>th</sup> edition by Junqueira.
- Any good Atlas of Human Histology.
- Before we are born. By K.L. Moore and T.V.N. Persaud, 6<sup>th</sup> edition 2003. (or latest).

#### 2. Physiology:

- Textbook of Medical Physiology. By Guyton & Hall, **13<sup>th</sup> edition**.

#### 3. Biochemistry:

- Harper's Biochemistry. By Robert K. Murray and Co., 1999.
- Supplementary Departmental Handouts.

#### 4. Pharmacology:

- Lippincott's Illustrated Reviews: Pharmacology, Latest edition.
- Pharmacotherapy. Principles and Practice. Chisholm-Burns et al. Latest edition.

#### 5. Pathology:

- Basic Pathology. By Kumar, Cotran & Robbins, last edition.

#### 6. Microbiology:

- Medical Microbiology. An Introduction to Infectious Diseases. By Sheries, latest edition.

#### 7. Public Health:

- Supplementary Departmental handouts.