

ANATOMY
STUDENT HANDBOOK
2018/2019









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2018/2019

DEPARTMENT OF ANATOMY

FACULTY OF MEDICINE

SABARAGAMUVA UNIVERSITY OF SRI LANKA

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1. INTRODUCTION

Anatomy is an essential component in foundation study of medicine. The human body is made up of a number of organs and systems that have their own unique function yet interact with one another to make up the machinery of a complex living individual. Anatomy is the study of body structure. It is an extensive field of study that has various subdivisions and specialties such as Histology, Embryology, Genetics and Radiological Anatomy.

The gross structure of organs and systems studied as **macroscopic and topographical anatomy** deals with their morphological features, their arrangement within the body and their functions, with emphasis on their relevance to clinical medicine. It includes three-dimensional Anatomy together with its application in diagnostic and visual imaging procedures to understand how these organs and systems function in health and disease, it is necessary to study their structure at cellular, subcellular levels - **microscopic anatomy** and at the molecular level (molecular biology).

The intricate process of human prenatal development – **embryology**, will be dealt with in its early stages as basic embryology and later as a part of the development of the organs and systems referred to as **organogenesis**. Embryology is essential not only to learn about the normal process of development, but as a basis of understanding the various congenital defects that may occur the course in human genetics will cover the principles of basic medical genetics applicable to clinical medicine.

2. STAFF

Academic Staff

Head of the Department & Senior Lecturer

Dr. Nilantha Gamalathge

MBBS (S.L) MD (Res) DTCD (Col) MSc (UK)

DOHS (Col) MSc (Path),PGCME (Col) AET (UK)

Lecturer Probationary

Ms. T. Chamalika Sujeewani Weerakoon

BSc (J'pura) MSc (Pera)

Lecturer Probationary

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MBBS (Col)

Lecturer Probationary–

Dr. U.M.J.E Samaranayake

MBBS (SAITAM)

Non-Academic Staff

Mr. J.A.L. Chathuranga (Management Assistant)

Ms. H.M.N.K Senarath (Lab Assistant)

Mr. S.Opanayaka (Work Aid)

Mr. A Jayakanthan (Mortuary Labour)

2. RECOMMENDED READING MATERIAL

Text Books

Gross and Clinical Anatomy

- Gray's Anatomy for Students: with Student Consult Access by Richard Drake, A. Wayne Vogl, Adam W. M. Mitchell, 3rd edition
- BD Chaurasia's Handbook of General Anatomy, 4th Edition
- Clinical Anatomy: Applied Anatomy for Students and Junior Doctors- 13th Edition
By Harold Ellis, Vishy Mahadevan
- Clinical Neuroanatomy (Clinical Neuroanatomy for Medical Students Richard S Snell (7th edition)
- Clinically Oriented Anatomy / 7th Edition
Keith L. Moore, Arthur F. Dalley, A. M. R. Agur
- Grants atlas, Anne M. R. Agur, Arthur F. Dalley, 13th edition

Embryology

- Langman's Medical Embryology 13th Edition by Thomas W. Sadler

Histology

- Wheater's Functional Histology: A Text and Colour Atlas, By Barbara Young, Phillip Woodford, Geraldine O'Dowd, (6th edition)

Human Genetics

Basic Medical Genetics ,5th Edition , Rohan w.Jayasekara.

Dissection Guide

- Cunningham's Manual of Practical Anatomy: Volume I: Upper and Lower Limbs 16th Edition (Oxford Medical by Rachel Koshi)
- Cunningham's Manual of Practical Anatomy: Volume II: Thorax and Abdomen 16th Edition (Oxford Medical Publications by Rachel Koshi)
- Cunningham's Manual of Practical Anatomy: Volume III: Head, Neck and Brain 16th Edition (Oxford Medical by Rachel Koshi)

Supplementary Reading

- Lasts Human Anatomy: Regional and Applied Chummy S Sinnatamby, 12th edition
- McMinns Clinical Atlas of Human Anatomy, Peter H Abrahams, 7th edition
- An introduction to Medical Genetics, Roberts JAF, 3rd edition

3. GENERAL OBJECTIVES

At the end of the anatomy course unit, the student should be able to

1. Describe the normal structure of human organ systems, relate the structure to its function, and apply this knowledge as a foundation for clinical medicine
2. Explain the microscopic structure of human organ systems, analyzing how structure influences function, and apply this knowledge in clinical contexts.
3. Analyze the knowledge of basic and systemic embryology to interpret normal anatomical development and evaluate congenital anomalies, offering potential explanations for their origins.
4. Apply fundamental concepts of human genetics to diagnose common genetic disorders, and critically evaluate their implications for clinical practice.

4. DURATION OF THE COURSE:

	Year 1		Year 2		Year 3		Year 4		Year 5	
Semester										

Each semester 15 weeks (teaching/Learning activities)

5. ACADEMIC PROGRAMME

Academic programme		
Semester 1 15 weeks	Semester 2 15 weeks	Semester 3 15 weeks
Introduction to Anatomy Musculoskeletal system	Organs and systems- Splanchnology	Head & Neck Neuro-anatomy
Basic histology- study of cells and tissues	System based histology- microscopic structures of organs and systems	Histology of Central Nervous system
Basic embryology early human development	Organogenesis	Embryology of the head and neck and the nervous system
Human genetics		
Assessments		
Continuous assessment 1	Continuous assessment 2	Continuous assessment 3
Second MBBS Examination		

6. TEACHING/LEARNING (T/L) ACTIVITIES AND LEARNING MATERIAL

- **Lectures**

Lectures are designed to give students a broad understanding of the basic concepts of the topic.

They are conducted by the senior staff senior lecturers and are further augmented by the relevant small group discussions (SGD) and dissections.

(2 hours/Week)

- **Small Group Discussion (SGD) / Tutorial**

Small group discussions consist of groups of students of about 20 in number involved in detailed discussion of a topic or subtopic. Led by a junior staff member, the students are encouraged to develop and present their own ideas and observations. Interactive lectures are also conducted by the junior lecturers on specific topics along with cadaver demonstrations.

Lesson plans and learning outcomes are given to the students prior to the lecture and SGD

(2 hours/Week)

- **Cadaveric dissection and demonstration**

Whole body cadaver dissections consist of groups of students about 10 in number, assigned to a cadaver for dissection under supervision of a staff member. The dissection schedule is concurrent with the ongoing lecture and SGD topics

(6 hours/Week)

- **Self-Directed Learning (SDL)**

Students are also allotted time for self-study. Materials such as soft tissue specimens, prosected cadavers, latex models and work sheets are available to students for self-directed learning. These sessions are under staff guidance.

Study space is also available in Anatomy museum, which houses a wide array of prosected specimens and students are encouraged to examine the specimens during self-study sessions or any free time.

(3 hrs/week)

- **Laboratory sessions**

(2 hrs/week)

- **On line learning management systems (LMS system)**

- **Learning material-**

Bones, models, cadaveric dissections, prosected specimens, Atlases, study guides, handouts text books, lecture presentations, Radiological images, Clinical situation Fixed Learning modules

7. ACADEMIC HOURS

Teaching /Learning activity and Academic hours						
		Semester	1	2	3	
		Duration	15 weeks	15 weeks	15weeks	
Activity	Subject		hours	hours	hours	
Lecture	General anatomy		30	30	34	94
	Histology		16	26	10	52
	Embryology		12	12	6	30
	Genetics		18	-	-	18
Small group SGD Tutorials Practical	General Anatomy		30	30	30	90
	Histology		14	20	04	38
	Embryology/Genetics		13	-	-	13
Cadaveric dissection /Demonstration			90	90	90	270
SDL/ Cadaveric dissection			45	45	45	135
Total			265	255	213	740

8. EVALUATIONS

9.1 Assessments

1. Formative assessments

- Periodic assessments during the semester on different topics as scheduled tests or at the beginning of a lecture on previous lecture topics.
- The objective of these tests is to give feedback to students on how well they are progressing in their course work in Anatomy
- Marks will not be carried to the final examination
- Formative assessments are compulsory to sit for all students .

2. Summative assessment

- I. **End Semester Examination/Continuous Assessment (CA)** at the end of each semester. A percentage of marks will be carried to the final examination
- II. **Final Examination in Anatomy** will be held at the end of the 3rd semester on completion of the preclinical course
 - **Second MBBS main examination**
 - **Second MBBS repeat examination** for students who were unsuccessful at the main examination

This is a bar examination and students have to pass this examination before proceeding to the 4th semester.
(Maximum 4 attempts)

3. Assessment tools

- Multiple choice question (MCQ)
- Structured essay questions (SEQ)
- Objective structured Practical examination (OSPE)/ Spots
- Viva voce examination

9.2 Format and Marks for Examination

End Semester Examination / Continuous Assessment (CA)			
Method of Assessment	Number of Questions	Marks allocated	Time allocated
CA 1			
MCQ	30	30%	1 ½ hrs
SEQ	3	30%	1 hr
OSPEs	20	40%	2 min per question
Total Marks		100%	
CA 2			
MCQ	30	30%	1 ½ hrs
SEQ	3	30%	1 hr
OSPE	20	40%	2 min per question
Total Marks		100%	
CA 3			
MCQ	40	50%	2 hrs
OSPE	20	50%	2 min per question
Total Marks		100%	
Final Examination / Second MBBS Examination (Main)			
MCQ	40	25%	2 hrs
SEQ	6	25%	3 hrs
OSPE	40	20%	2 min per question
Structured viva		10%	10 min
CA		20%	
Total Marks		100%	
Final Examination / Second MBBS Examination (Repeat)			
MCQ	40	30%	2 hrs
SEQ	6	30%	3 hrs
OSPE	40	30%	2 min per question
Structured viva		10%	10 min
Total Marks		100%	

9.3 Rules and Regulations

1. No student can omit semester 1, 2 and 3 (End Semester Examination I, II & III) examinations. Students are permitted to be absent from one CA if a medical certificate approved by University Medical Officer or Medical Board had been submitted. In such a case, 20% from remaining two (2) Continuous Assessments will be taken for calculation of the final examination in Anatomy
However, if the medical certificate is not approved, such a student is not eligible to sit the final examination (Main). The student will be required to sit the repeat examination.
If they miss two or more, CAs **whatever the reason may be**, they will have to sit for the repeat examination.
2. In the final Examination students should complete all components of the examination within one attempt (in one sitting). If a student failed to do so the student must repeat the entire examination (final examination).
3. If a student is unable to attend the total/part of the final examination in Anatomy due to a valid medical reason the student should submit a recognized medical certificate. In such a case the student shall sit the Anatomy full repeat examination. This attempt will be considered his/her **first attempt**.
4. In order to '**Pass**' the student should have obtained a minimum of 50% in the Final Examination and a minimum of **45% in theory components** (the average of End Semester Examination I, II, III and the theory component of the Final Examination*).
*Theory components in final exam -MCQ and SEQ
5. **Final Examination (Repeat) procedure**

The first repeat attempt for the failures will be conducted after a period of 4/6 weeks.

The second repeat attempt will be with the immediate junior batch.

If a student fails Final examinations (proper and repeat), he/she is given two more attempts with the immediate junior batch as 3rd and the 4th attempt.

If a student fails in all 4 attempts, he/she will be deregistered.

9.4 Attendance required for Final examination (Main)

A student must achieve a **minimum of 80%** attendance for tutorials, dissections, practical, Self-Directed Learning (SDL) and Small Group Discussions (SGD). Failure to achieve the 80% attendance the student will not be allowed to sit the Final examination in Anatomy.

He/ She will be permitted to sit with the repeat examination and this attempt will be considered as a repeat attempt.

9.5 Distinctions

The student will be awarded a 'Distinction in Anatomy' if he/she obtained a minimum of 60% for End Semester Examinations (End Semester examination I, II and III) and a minimum of 70% in the final examination, provided that the student has obtained these marks at his/her first sitting.

9. OUTLINE OF COURSE WITH BROAD OBJECTIVES

Semester 1
Introduction to Anatomy The student should, <ul style="list-style-type: none">• be conversant with the anatomical terminology• be able to describe the anatomical position and its significance in description• understand the relative directional terms used in topographical relations of structures - superior, inferior• define the terms of movement• understand the structural levels of the body and the basic tissues• recognise the accepted subdivisions
Musculoskeletal /locomotor system The student should be able to, <ul style="list-style-type: none">• outline the morphological components of the system• describe the arrangement of the supporting skeletal framework• describe the joints, the ligaments, muscles and tendons that move and stabilise the joint• describe the nerves that innervate these muscles• understand the mechanics of joint movement• analyse the loss of motor function based on the above modalities• recognise other functions of the system such as weight bearing. protection
Basic histology- study of cells and tissues The cell The student should be able to <ul style="list-style-type: none">• have a comprehensive knowledge of the structure of the components of a typical cell at light microscopic and ultrastructural level• correlate the components of the cell with the different functions of the cell• explain the different mechanisms of transport across the cell membrane• describe the varying cell to cell contacts• identify and describe the basic tissues and outline their adaptation to their functions

Basic embryology early human development
The student should be able to <ul style="list-style-type: none">• outline the importance of embryology and its application in the study of medicine• outline the stages in human development
Genetics – basic concepts of human genetics

Semester 2
Splanchnology and Systemic histology
Study of the anatomy of the internal organs and system and their development (organogenesis)
The student should be able to <ul style="list-style-type: none">• describe the organization, topographical relations and of the internal organs and systems• describe the macroscopic and microscopic structure of the systems and organs relate these structural and ultrastructural features to their function• use this knowledge to understand the appearance of these organs in disease states• describe the developmental processes involved and anomalies that can occur

Semester 3
Anatomy of the Head and Neck
Neurology
The normal development and organization of the nervous system, control of movement, integration of sensory modalities, special sensations, higher cerebral function
<i>The student should be able to</i> <ul style="list-style-type: none">• describe the organization of the nervous system• recall the development of the nervous system• describe the morphology and functions of the different parts• coordinate its role in control of movement• understand its role in the integration of sensory modalities both centrally and at a peripheral level

- use this knowledge to analyze and explain the common disorders of the nervous system

10. COURSE TOPICS AND INTENDED LEARNING OUTCOMES

SEMESTER 1

INTRODUCTION TO STUDY OF ANATOMY

Anatomical terminology, terms of direction, terms of movement, structural levels and basic concepts that would be useful in understanding the structure of the body

The student should

- be conversant with the anatomical terminology
- be able to describe the anatomical position and its significance in description
- understand the relative directional terms used in topographical location of structures
- define the terms of movement
- understand the structural levels of the body and the basic tissues of the body
- recognize the accepted subdivisions of Anatomy

LOCOMOTOR SYSTEM AND MUSCULOSKELETAL SYSTEM

Study of Locomotor apparatus will include skeletal framework, joints, ligaments, muscles, tendons, innervations of muscles and their actions

The student should be able to

- outline the morphological components of the locomotor system
- describe the arrangement of the supporting skeletal framework
- describe the joints, the muscles, tendons and ligament that move and stabilize joints
- describe the nerves that innervate these muscles
- understand the mechanics of joint movement
- analyze the loss of locomotor function based on the above modalities
- recognize other functions of the LM system such as weight bearing, protection

THE TRUNK	
1.	Vertebral column and muscles of the back
	<ul style="list-style-type: none"> • Column as a whole • Functions of the vertebral column and its structural adaptations to these functions • Erect posture and weight bearing • Typical vertebra, variations in regions and their special features in relation to their function • Ligaments and their contribution to function • Intervertebral disc • joints and movements • Groups of muscles in relation to column-Actions and nerve supply • Vertebral canal and intervertebral foramen <p>special arrangement of vertebrae and ligaments in cervical region</p>
Intended learning outcomes	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the vertebral column, its adaptation to its function of weight bearing and support and the maintenance of erect posture • describe the location of the curvatures and their importance • describe the parts of a typical vertebra and the regional characteristics • outline the structure of an intervertebral disc and its functions • describe the ligaments and joints of vertebral column and its movements • describe the arrangement of muscles in relation to the vertebral column and outline their nerve supply and their action • outline the movements of the vertebral column • discuss the factors contributing to the stability of the column • outline the boundaries of an intervertebral foramen for the passages of spinal nerve • note the possibility of a nerve being compressed by disease of a vertebra or by a prolapsed intervertebral disc resulting in neurological symptoms • outline the development of the column • recognize deformities that are possible in the vertebral column 	
2.	Thoracic cage
	<ul style="list-style-type: none"> • Bony thorax as a whole • Arrangement of the vertebrae and ribs • Functions of the thoracic cage • Ligaments and joints of thoracic cage • Intercostal space • Muscles of the thoracic cage

	<ul style="list-style-type: none"> • Movements of thoracic cage in respiration • Diaphragm
Intended Learning outcomes	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the features of bony thoracic cage and the arrangement of component bones • describe a typical rib • outline the boundaries of the inlet and outlet • describe the joints and ligaments of the thoracic cage • describe the mechanisms of increase in diameters of thoracic cage during respiration • describe the attachments of the diaphragm and its nerve supply • describe the intercostal space • outline the groups of muscle attached to the thoracic cage 	
3.	Abdominal wall and Pelvis
	<ul style="list-style-type: none"> • Bony framework lower thoracic cage, lumbar vertebrae and pelvis • Lumbar fascia • Attachment of muscles of the anterior and posterior abdominal walls • Layers of the anterior abdominal wall • Inguinal canal • Bony pelvis- bony components, and its surfaces • inner surfaces in relation to the greater pelvis, lesser pelvis, perineum • external surface in relation to gluteal region and thigh inlet, outlet joints • sacroiliac articulation • Adaptation to its functions • arrangement of muscles (lateral wall and floor) <p>greater pelvis, lesser pelvis and perineum</p>
Intended Learning outcomes	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • recall the arrangement of the lower part of the thoracic cage and the lumbar vertebral column • describe the layers of the lumbar fascia and its attachment and the arrangement of muscles in the posterior abdominal wall • Identify the origins of the diaphragm from the vertebrae, ribs and lumbar fascia • outline the arrangement of muscles and aponeurosis in the anterolateral abdominal wall • define the inguinal ligament and outline the arrangement of the walls of the inguinal canal • describe the inguinal canal and discuss its significance • discuss the importance of the sacroiliac joint in transmission of bodyweight • outline the boundaries of the perineum • describe the limits of the perineal pouches 	

<ul style="list-style-type: none"> describe the muscles of the pelvic wall outline the importance of the muscles of the pelvic floor as a support to pelvic viscera 	
UPPER LIMB	
General considerations	
<ul style="list-style-type: none"> Mobility of the upper limb slung to chest by one small joint -the sternoclavicular joint Main attachment is by a large number of muscles that control and execute movement Free movement at shoulder Pronation and supination of forearm and its effects on position of hand Grasp and grip by fingers and Precision movements of fingers Movements of thumb 	
1.	Skeletal framework of upper limb
	<p>In general</p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> discuss the functions of the upper limb describe the anatomical features of each bone as a functioning unit of a particular joint and movement define the regions of the upper limb, the skeletal framework and muscles that move the joints and their innervations
2.	Pectoral region, axilla and brachial plexus
	<p>Pectoral region,</p> <ul style="list-style-type: none"> Surface anatomy Bones - clavicle, scapula, humerus (studied as one unit) their location, palpable parts and external features Arrangement of bones and joints of the pectoral girdle -sternoclavicular, acromio clavicular Joints and ligaments of clavicle, scapula, humerus (upper end) Attachment and actions of pectoral muscles
	<p>Axilla</p> <ul style="list-style-type: none"> What / where is the axilla? outline its contribution to the function of upper limb Structures that form its walls Apex -Boundaries of area of entry from neck Site of exit into arm Contents of the axilla and their arrangement

	<p>Brachial plexus</p> <ul style="list-style-type: none"> • A typical spinal nerve • Why a plexus? • Plan of plexus, location of parts posterior triangle of neck, arrangement in axilla and in relation to axillary artery, and branches • main nerves that leave axilla into arm, musculocutaneous, median, ulnar and radial <p><i>lesions of nerves and effects will be discussed later</i></p>
	<p>Other contents</p> <ul style="list-style-type: none"> • Axillary artery its branches possible anastomosis • Axillary lymph nodes, their location and their importance • Axillary fascia <p><i>Muscles and their actions will be studied with shoulder</i></p>
Intended Learning outcomes	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • identify the bones of shoulder girdle- clavicle scapula and upper end of the humerus as one functional unit • identify the muscles attached to these bones and outline their actions • describe the sternoclavicular and acromioclavicular joints and the ligaments associated with these joints • describe the position of the clavicle and scapula • outline the functions of the clavicle • define the axilla • outline its contribution to the functioning of the upper limb • describe its walls, its entrance from the neck and the arrangement of structures • draw and describe the formation of the brachial plexus and the plan of distribution • list the main nerves of the plexus that enter the arm • describe the axillary artery and its branches and the possible anastomoses • describe the arrangement of the lymph nodes, their location and their importance 	

3.	Scapular region and Shoulder joint
	Scapular and upper end of humerus <ul style="list-style-type: none"> • Location, position, features of scapula and humerus • Articulations • Scapular muscles -Thoraco scapular muscles Scapulo humeral muscles • Attachment and actions of muscles and nerve supply • Movements of the shoulder • Movements of scapula per se and in relation to movements of the shoulder joint
	<ul style="list-style-type: none"> • Features of long bones • Development and growth of a long bone
	The shoulder joint <ul style="list-style-type: none"> • articular surface, capsular attachment, ligaments • synovial membrane and bursa • Mobility and stability • Rotator cuff • Movement of upper limb at shoulder - movements at shoulder joint and accompanying movements of scapula and clavicle at acromioclavicular and sternoclavicular joints • Relations of joint • Dislocation • Fracture of neck of humerus
Intended learning outcome	
Scapula <i>The student should be able to</i> <ul style="list-style-type: none"> • demonstrate and describe the movements of the scapula • list the muscles involved, their attachments and nerve supply • outline the origin, course and distribution of the suprascapular nerve, subscapular nerves thoracodorsal nerve, axillary nerve and spinal accessory • what are the effects of injury to these nerves? • outline the origin and course of arteries involved in the anastomoses around the scapula • describe the features of a long bone • outline the process of bone formation and growth in length of a bone 	
Pectoral girdle <ul style="list-style-type: none"> • describe the muscles of the pectoral region and the shoulder and give their nerve supply 	

- explain the importance of joints of the pectoral girdle and movements of scapula in movements of the arm

Shoulder joint

- describe the shoulder joint in relation to its morphology and movement
- discuss the factors that control mobility and stability of the joint
- name the muscles of the rotator cuff and explain their action
- discuss the movements involved in abduction of the arm at the shoulder
- discuss the possible effects of a dislocation of the shoulder joint
- analyse the effects of paralysis serratus anterior, deltoid and trapezius with regard to movements of the shoulder

4. Arm and Cubital fossa

- Fascial compartments of arm
- Arrangement of muscles in anterior and posterior compartments
- Course of the peripheral nerves that enter arm
- Course and branches of brachial artery
- Anastomoses around neck of humerus and elbow joint
- Course of radial nerve, relation to the humerus, its branches at different levels and structures supplied
- Site of likely lesions
- The elbow joint and superior radio-ulna joint, articular surfaces, capsule, ligaments and movements
- Superficial veins
- Cubital fossa location, boundaries and contents
- The elbow joint and superior radio-ulna joint, articular surfaces, capsule, ligaments and movements
- Effects of supracondylar fracture

Intended learning outcome

The student should be able to

- describe the bones of the arm and forearm and their articulations
- the arrangement of deep fascia of the arm and its division into functional muscular compartments with its own nerve supply
- name the muscles in these compartments and outline their actions
- outline the course of brachial artery and list the possible sites of compression
- outline the vessels that take part in an anastomoses around the shoulder and elbow and the significance of this anastomosis
- list the peripheral nerves that enter the arm from the axilla and outline their course and branches
- outline the positions of peripheral nerves at elbow and their entry into the forearm

	<ul style="list-style-type: none"> list the nerves that lie in contact with the humerus and the sites of contact and explain its clinical significance outline the course of radial nerve its branches at different levels and structures supplied, site of likely lesions describe the elbow joint and superior radio-ulna joint, articular surfaces, capsule, ligaments and movements describe the region of the cubital fossa, its boundaries, contents and its important relations
5.	Forearm and wrist
	Surface anatomy Bony landmarks Tendons in front and back of wrist Anatomical snuff box
	Flexor and extensor aspect forearm <ul style="list-style-type: none"> Muscle layers – Insertion of the muscles (Flexor and extensor) Structures that can be identified at wrist in living person Median nerve, ulnar nerve and radial nerves - Course of site of branches, structures supplied Radial and ulnar arteries- pulsations Tendons at wrist Movements at elbow, Radio ulna and wrist joints Pronation and supination Extensor tendons
Intended learning outcome	
Forearm and wrist <i>The student should be able to</i> <ul style="list-style-type: none"> recall the arrangement of the bones of the forearm in an anatomical position and the arrangement of bones in an articulated hand palpate the following bony points – medial and lateral epicondyles of humerus, head of radius, styloid process of radius, head and styloid process of ulna, hook of hamate, pisiform, subcutaneous border of ulna recall the two muscular compartments- anterior flexor and posterior extensor outline the arrangement of flexors in layers the names and origins of these muscles and their pattern of innervations 	

- describe the course of the median and the ulnar nerves, the site of the branches and the structures supplied
- describe the course and branches of the radial and ulnar arteries
- outline the arrangement of structures at the wrist in a cadaver and relate this to a living person
- describe the arrangements of these tendons at the wrist
- identify the positions of the median nerve, ulnar nerve and radial artery in relation to the above tendons
- locate the site where radial pulse is palpable
- outline the effects of a cut injury at the wrist

Pronation and Supination of forearm

The student should be able to

- in the proximal and distal radioulna joints outline the arrangement of the articular surfaces, ligaments and cartilage ((In distal joint) that would facilitate this movement
- describe the position of the forearm and hand during pronation and supination
- describe the movements that occur in these two joints to bring the arm from a supine to a prone position
- list the muscles involved in these movements

Extensors of forearm and dorsum of hand

The student should be able to

- classify extensors into superficial and deep and recognize their origins and their nerve supply
- describe the origin and insertion of the supinator muscle
- outline the course of the radial nerve and its branches and structures supplied in the extensor compartment
- identify the extensor retinaculum and the tendons that pass through the compartments on the dorsum of the wrist
- describe and demonstrate in the living the arrangement of the tendons at the lateral margin of the wrist- anatomical snuff box
- describe the extensor expansion, its attachments and the tendons inserted into it
- describe the actions of the extensor muscles of the forearm and give their nerve supply

6. Hand

	<p>Special features of the hand are</p> <ul style="list-style-type: none"> ➤ Ability to grasp ➤ Fine controlled accuracy of fingers ➤ Free mobility of thumb ➤ Chief tactile organ
	<ul style="list-style-type: none"> • Surface anatomy palmar and dorsal aspects • Fascia in the hand • Flexor retinaculum and carpal tunnel • Arterial arches • Extrinsic muscles of the hand • Intrinsic muscles of hand and their nerve supply • Innervations of skin of hand • Anatomy of a finger • Joints of the hand and movements of the fingers • Movements of the thumb <p><i>Carpal tunnel syndrome</i> <i>Infections of the hand</i> <i>Cut injury at wrist</i></p>
Intended learning outcome	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • identify <ul style="list-style-type: none"> - the thenar and hypothenar eminences - the skin creases - prominences of the carpal bones - the prominences of the heads of the metacarpals - the attachments of the flexor retinaculum <p>Deep fascia Carpal tunnel</p> <ul style="list-style-type: none"> • outline the arrangement of deep fascia in the hand • describe the carpal tunnel and its contents • analyse the symptoms that result from a progressive compression of the median nerve in a carpal tunnel syndrome • describe the insertion of the flexor tendons in the wrist • describe the arrangement and insertion of the flexor digitorum superficialis and profundus to the phalanges • describe the course of the median nerve and ulnar nerve in the hand • outline the nerve supply to the skin of the hand • name the intrinsic muscles of the hand and their nerve supply 	

- describe the origins and insertions of the lumbricals and interossei and explain their actions and nerve supply
- define fibrous flexor sheaths, synovial bursa, fascial spaces (mid palmar and thenar) and their significance as sites of infection
- describe the arrangement of fascia in the pulp of the fingers
- describe the arrangement of arteries in the hand

Joints and movements of wrist and fingers

- outline the appearance of the articular surfaces and the attachments of ligaments of the wrist joint, metacarpophalangeal joints and the interphalangeal joints
- demonstrate movements at these joints

Movements of the thumb

- describe the articular surfaces, ligaments and movements at the carpometacarpal joint of the thumb
- demonstrate the position of rest of the thumb and the movements of flexion extension, abduction, adduction and opposition. state the nerves

Skin of the hand

- outline how the microscopic structure of the skin of the hand is adapted to its functions
- outline the factors that contribute to the tactile functions of hand
- fascial spaces in the hand and infections of the hand

7.	Innervations of the upper limb and effects of nerve lesions at all levels	
	The patterns of innervations - segmental (Peripheral nerve, Cutaneous, Movement)	
	Anatomical basis of analysing nerve lesions At segmental level Peripheral nerve level	

LOWER LIMB	
Introduction	
<p>Lower limb is adapted for</p> <ul style="list-style-type: none"> ➤ locomotion ➤ weight bearing ➤ maintaining erect posture ➤ gait <p>Weight of trunk transmitted through sacrum through almost immobile strong, stable sacroiliac joint to pelvic bones through stable but mobile hip joints to femora. Each femur is directed downwards and medially through the thigh to the knee joint, tibia, ankle joint to foot Lower limb stable and therefore able to carry the weight while standing/walking</p>	
Intended learning outcomes	
In general	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • define the regions of the lower limb and identify bones of these regions • describe each of these bones as part of the skeletal framework of the lower limb and outline their articulations and anatomical position • discuss the functions of the lower limb • outline the arrangement of fascia, intramuscular septa and muscular compartments in the lower limb • outline the structures that help in the maintaining of the erect posture • outline the arterial supply and venous drainage and the pattern of innervations 	
1.	Front of thigh
	<p>Bony pelvis and femur and articulation</p> <ul style="list-style-type: none"> • Superficial fascia in thigh • Deep fascia in thigh and its specializations • Muscles of front and medial side of thigh • Femoral triangle, femoral sheath, boundaries, muscles and contents • The femoral canal • Adductor canal
Intended Learning outcomes	
<p><i>The student should be able to</i></p> <p>Deep fascia</p> <ul style="list-style-type: none"> • describe the arrangement of the deep fascia of the thigh and its functions • identify the saphenous opening, the iliotibial tract, the intermuscular septa • outline the function of the iliotibial tract • define the muscular compartments in the thigh and each groups of muscles with their own nerve supply • list the muscles in the anterior and medial compartments and describe their attachments actions and nerve supply 	

	<ul style="list-style-type: none"> describe the heads of origin of the quadriceps and its insertion and its action on knee joint describe the boundaries of the femoral triangle and its contents describe the course of the femoral artery through femoral triangle and adductor canal & locate where pulsations can be felt, where it can be compressed define the fascial layers of femoral sheath and contents of the sheath describe the location and boundaries of the femoral canal discuss the clinical significance describe the iliopsoas muscle, its attachments and its action on the hip joint outline the origin of the femoral and obturator nerve from the lumbar plexus its course into the thigh and muscular and cutaneous branches outline the cutaneous nerves of the thigh outline the anatomical basis Meralgia paresthetica
2.	Gluteal region, hip joint & back of thigh
	<ul style="list-style-type: none"> Bony framework of gluteal region, back of thigh, Sciatic foramina and branches of the sacral plexus the gluteal muscles the hip joint hamstring muscles and popliteal fossa the sciatic nerve its course and branches Knee joint
Intended Learning outcomes	
<i>The student should be able to</i>	
Gluteal muscles	
<ul style="list-style-type: none"> recall the features of the hip bone and the femur identify the origin of the gluteal muscles from the gluteal surface of the Ilium, their insertion to the region of the greater trochanter 	
Hip joint	
<ul style="list-style-type: none"> define the articular surfaces, attachment of capsule and ligaments of the hip joint What are the retinaculae identify the muscles in relation to the hip joint outline the blood supply to the head of the femur discuss the possible sites of fracture of the neck of the femur and the possible effects identify the nerves can be damaged in a posterior dislocation of the hip joint discuss the movements at the hip joint and the muscles involved outline the attachments of sacrospinous and sacrotuberous ligaments and boundaries and communication of the foramina list the important structures that pass through these foramina 	

Nerves in gluteal region

Sciatic nerve

- outline the origin and course of the sciatic nerve, pudendal nerve, gluteal nerve, posterior cutaneous nerve of thigh, its main branches and the structures supplied
- based on the knowledge of the course of the sciatic nerve outline the possible causes of pain along the back of the thigh (sciatica) and on the lateral side of the thigh
- list the small muscles at the back of the hip joint and give their nerve supply and action

Hamstrings and popliteal fossa

- outline the origins and insertion of the flexor muscles in back of thigh-hamstrings and to their arrangement in relation to the popliteal fossa
- outline the attachments, nerve supply and action of the adductor magnus muscle
- outline the boundaries, and in order superior to inferior the structure that form the floor and the contents of the popliteal fossa
- outline the course of the branches of the sciatic nerve from the fossa to the leg

The knee joints

- outline the functions of the knee joint
- demonstrate and describe the articular surfaces -the femoral condyles, upper end of tibia and patella
- describe the capsular attachment, the ligaments (extra and intracapsular), the menisci and outline their functional role
- outline the extent of the synovial cavity and the location of the bursae as sites of infection(bursitis)
- describe the mechanics of extension and flexion of joint and the muscles involved
- outline the role of the quadriceps femoris and ligamentum patella, the patella and popliteus muscle
- discuss the mechanism of locking and unlocking of the joint
- discuss the nerve supply to the hip and knee joint with reference to referred pain
- explain knee jerk (significance will be explained later)
- interpret X rays
- discuss the aetiology of Sports injuries – collateral, cartilages, cruciate 3 C's and their injuries
 - fracture of the patella
 - bursitis

3.	The leg and foot
	<ul style="list-style-type: none"> • Bones of the leg and foot • Muscle compartments in leg and fascial septa • muscles and the tendons as they cross the ankle to the foot • Branches of the sciatic nerves of leg, their course and branches, cutaneous and muscular supply • Ankle joint joints of the foot. muscles, ligaments and arches of foot • Arteries and veins of the lower limb
Intended Learning outcomes	
<i>The student should be able to identify surface prominences as listed in study guide</i>	
Muscular compartments	
<ul style="list-style-type: none"> • identify the structural and functional muscular compartments extensor, peroneal and flexor • list the muscles in each of these compartments, their attachments actions and their nerve supply • describe the origin and insertion of the gastrocnemius and Soleus and their insertion to the tendocalcaneus. what are the actions of theses muscles? • describe the location of the tendons of these groups of muscles in relation to the ankle joint 	
Nerves and arteries	
<ul style="list-style-type: none"> • describe the course of the common peroneal nerve and posterior tibial nerve from the popliteal fossa to the leg • locate sites where the nerve may be damaged and outline the possible effects • outline the course of the deep peroneal nerve in the leg and its continuation into the foot & identify the structures supplied in the foot • outline the course of the anterior tibial artery its continuation into foot as dorsal pedis artery • locate the site of palpation of arterial pulse 	
The foot	
<ul style="list-style-type: none"> • define the ligaments of the ankle joint, the spring ligament, the bifurcate ligament • describe the movements of inversion and eversion and the joints and muscles involved in this movement • describe the arrangement of muscles in the sole of the foot and give their nerve supply • describe the arches of the foot 	
Venous drainage	
<ul style="list-style-type: none"> • discuss the structural mechanisms that help to maintain these arches • describe the arrangement of veins in the lower limb and outline the mechanisms of venous drainage. • define varicose veins and the basis of the appearance of varicose veins 	

	HISTOLOGY
1	Cell
<p>Constituents <i>The student should be able to</i></p> <ul style="list-style-type: none"> • recall the structure and function of the cell • understand the concept of the cell being the basic structural constituent of the body • recall the chemical constituents of the cell • describe the structural and functional organization of the cell • describe the structure of unit cell membrane • explain what is meant by the fluid mosaic model • describe the form and function of the glycocalyx • explain the mechanisms of transport across cell membranes <p>The nucleus <i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the components of the nucleus • discuss the role of chromatin and in its appearance in indifferent cell activities • discuss the role of the nucleolus • recall the process of cell division <p>The cytoplasm <i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline the constituents of the cytoplasm • describe EM appearance and arrangement and functions of organelles in a typical cell • describe the light microscopic and ultrastructural features of a protein secreting cell • recall the process of protein synthesis and secretion and organelles involved • discuss the process of lipid synthesis and secretion and organelles involved • discuss the lysosomal activity in a cell • list the constituents of the cytoskeletal framework • outline the distribution and function of the cytoskeletal elements <p>Plasma membrane <i>The student should be able to</i></p>	

	<ul style="list-style-type: none"> • list the types of intercellular attachments between adjacent cells • outline their structure and functional significance • list the surface specialization
2	Epithelial tissue and Glandular tissue
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • define an epithelium • list the features of an epithelium • outline the basis of classification of epithelia • describe the types of epithelia and relate the structure to their functions giving examples • describe the structure basement membrane and its role in epithelial tissue • recall the types of intercellular attachments occluding, adherent and gap junctions • list the two basic components of exocrine glandular tissue • describe the form and arrangement of component parts • describe the nature of secretions of glandular tissue secretion • describe the mechanisms of secretion • list the features of endocrine tissue
3	Connective tissue
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline the basic organization of connective tissue • describe the types of cells and their function • cells types of cells and their functions –in storage, defence and immune functions • components of Intercellular matrix and supporting framework • describe the types of fibres • outline the synthesis of collagen • describe the structure of embryonic connective tissue • describe the structure of the basement membrane and the sites where they are present • discuss the functions of basement membranes at different sites
4	Skeletal tissue
	<p><i>The student should be able to</i></p>

	<ul style="list-style-type: none"> • list the functions of skeletal tissue • list the types of skeletal tissue <p><u>Cartilage</u> <i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the constituents of cartilage • list the types of cells • describe how cartilage is formed • list the types of cartilage • describe their histological differences, their function and distribution <p><u>Bone</u> <i>The student should be able to</i></p> <ul style="list-style-type: none"> • list the types of bone • draw and describe the macroscopic structure of a long bone • describe the types of lamellar bone and their features • list the cells of bone • describe the structure of an osteone • list the stages in bone formation • describe what is meant by ossification • list the types of ossification • explain the basic difference between intramembranous and endochondral ossification • define the following in relation to a growth of a long bone -- Primary ossific centre, Secondary (epiphyseal) centre, Epiphyseal plate, Diaphysis, Epiphyseal line, Growing end • describe the layers of the epiphyseal plate
5	Muscle
	<i>The student should be able to</i> <ul style="list-style-type: none"> • recognize the primary functions of muscle

	<ul style="list-style-type: none"> • comprehend the properties of muscle tissue • explain the adaptation for contraction and movement • list the types of muscle • apply the terminology relating to muscle in the description of muscle tissue • recognise the organisation of skeletal muscle • describe the arrangement of fascia in muscle • describe the microscopic structure of a muscle fibre and the arrangement of myofibrils and myofilaments • describe the tubular system and its role in contraction of muscle • define the structural unit of a muscle and the functional unit of a muscle • describe the innervation of muscle • describe the structure of the motor end plate and the muscle spindle • describe the structure of smooth muscle • describe the structure of cardiac muscle and its adaptation to its function
6	Nerve tissue
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • understand the basis of organization of the nervous system into central and peripheral nervous systems • recognize the neurone as the functional unit of nerve tissue • list the functions of neurone • describe the structure of a neurone both under light microscope and electron microscope • discuss how it is specialised to perform its function • list the types of neurons • list the other cells of nerve tissue found in the CNS and PNS and give their functions • describe the form and structure of a synapse • describe the structure of a nerve fibre both myelinated and non-myelinated • describe the formation of myelin in the peripheral nervous system and central nervous system • discuss the organisation of a peripheral and the fascial coverings • describe a ganglion
7	Lymphoid tissue
	<i>The student is expected to be able to.</i>

	<ul style="list-style-type: none"> Cells of the immune system. Describe the appearance of lymphocytes in peripheral blood. Lymphocyte subtypes - list the types and the functions of each sub-type. List T and B lymphocyte surface antigens / markers. Describe the functions and the importance of lymphocyte surface antigens in clinical practice Structure of lymphoid organs. Describe the microscopic anatomy of lymphoid organs using line diagrams. Lymph node Spleen Tonsils Mucosa associated lymphoid tissue (MALT) Thymus (childhood and adult) <p>Describe the differences of a primary lymphoid follicle and a secondary lymphoid follicle.</p> <p>Types of lymphocytes. Histological appearance with H&E stain. The functional differences.</p> <p>Compare and contrast the features of the red pulp and white pulp of the spleen Macroscopic appearance. Microscopic anatomy (histology) in H&E stained sections.</p> <p>List important clinical conditions (both reactive and malignant) affecting lymphoid tissue and the changes that occur in the gross anatomical structure of the organs involved.</p>
8	Blood
	<i>The student should be able to</i>

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| | <ul style="list-style-type: none"> • list the functions and constituents of blood • explain the embryonic development of blood • describe the process of blood cell formation • list the haemopoietic organs and the ages at which they function • identify the cells histologically • describe the structure, function and histological appearance of the different types of white blood cells • explain what is meant by a white blood count (WBC) and differential count (DC) • describe the structure of erythrocytes - red blood cells • list the stages of red cell formation (erythropoiesis) • describe the changes that takes place in the developing red blood cells in this process • describe the functions of red blood cells • describe the structure, and functions and formation of platelets • list the types of bone marrow. • list the organs in which they are distributed • list the functions of bone marrow |
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	EMBRYOLOGY
1	Formation of gametes
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • list the stages of gametogenesis and outline the chromosomal changes during this process • outline the time sequence of spermatogenesis and oogenesis • recall the organization of the male and female reproductive systems • describe the process of sperm formation in the seminiferous tubules • describe the ovarian follicle in various stages of development • describe the changes in the maturing oocyte • describe the process ovulation and the changes that take place in the follicle • describe the corpus luteum and outline its fate • outline the cyclical changes that take place in the ovary (ovarian cycle) and the endometrium of the uterus (uterine cycle). • describe the structural changes that take place in the endometrium in preparation for implantation
2	Gametes and fertilization
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the structure of a mature ovum and sperm. • outline the path taken by the germ cells to the site of fertilization • describe the process of fertilization and its results • state the site of fertilization and list the abnormal sites • list the changes in the fertilized ovum prior to implantation • define the blastocyst, inner cell mass and trophoblast • describe the process of implantation • list the abnormal sites of implantation and the possible clinical complications
3	Bilaminar embryo and early placenta
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the bilaminar embryo - the epiblast and hypoblast • outline the position of the amniotic cavity and yolk sac • describe changes in the trophoblast in the second week • describe the formation of the extraembryonic mesoderm, the extraembryonic coelom and the connecting stalk • define the chorion and the chorionic cavity • recognize the beginning of the chorionic villi and the formation of the early placenta

4	Trilaminar embryo – 3rd week <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the formation of the three germ layers – ectoderm, mesoderm and endoderm • outline the distribution of the mesoderm in various parts of the embryonic disc • define the cardiogenic area, the septum transversum, the lateral mesoderm, the prechordal plate, cloacal membrane • outline the process of formation of the notochord • outline the processes leading to the formation of the neural tube • describe the differentiation of the mesoderm into paraxial, intermediate and lateral plate mesoderm and the formation of the intraembryonic coelom • recognize the early differentiation of blood vessels and the establishment of a primitive circulation • describe the differentiation of the trophoblast and identify the stages in the formation of the chorionic villi • recognize the formation of the placenta • recognise the connecting stalk between the developing placenta and the embryo
5	Embryonic period <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline the significant changes that take place during this period • describe the process of folding of the embryo and the formation of the curved embryo • describe the changes that result from the head fold, tail folds and lateral folds • recognise the formation of the primitive umbilicus • recognise the formation of the primitive gut and the extraembryonic coelom • describe the differentiation of the somites • outline the somites and notochord and the formation of the axial skeleton • list the derivatives of the three germ layers • outline the extent of the foregut, midgut and hindgut • describe the neural tube and its main parts • list the derivatives of the neural crest cells • list the abnormalities associated with the development of the central nervous system

6	Placenta
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • recall the early changes in the trophoblast and the formation of chorionic villi • describe the formation of the placenta • describe the chorionic villi and the placental barrier • define intervillous space decidua, decidual septa, cotyledons, villus tree, stem villi • state the functions of the placenta • describe the circulation of blood in the placenta • describe the external appearance of the placenta • list the abnormalities of the placenta • list the foetal membranes • outline their development • describe their functions • explain the terms twinning, monozygotic twins, dizygotic twins • explain the term ‘congenital abnormalities’ • list the factors that may cause congenital abnormalities • be aware of the principles of the methods available for the detection of congenital anomalies

GENETICS	
	Cell Division
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> describe: a. Mitosis b. Meiosis list the special features of meiosis and state why they are important describe problems associated with cell division Non-disjunction/ Anaphase lag
	Structure and Function Chromosome
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> describe the organization of chromosomes. describe the following terms, with reference to the structure and organisation of a chromosome: <ul style="list-style-type: none"> a. Chromatids b. Short arm c. Long arm d. Centromere e. Satellite stalk f. Telomere g. Metacentric h. Submetacentric i. Acrocentric describe in outline the procedure involved in chromosome culture and karyotyping.
	Chromosomal Abnormalities
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> define and describe the clinical features and the karyotypes of abnormalities in chromosome number. <ul style="list-style-type: none"> a. Polyploidy b. Aneuploidy <ul style="list-style-type: none"> i. Monosomy ii. Trisomy iii. Mosaicism define non-disjunction and describe how it contributes to aneuploidies. define, and describe the clinical features and the karyotypes of abnormalities in chromosome structure: <ul style="list-style-type: none"> a. Translocations <ul style="list-style-type: none"> i. Balanced ii. Unbalanced iii. Robertsonian Translocation b. Inversions c. Deletions d. Duplications e. Ring chromosomes f. Isochromosomes

	Patterns of inheritance
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • define and explain the terms: <ul style="list-style-type: none"> a. Polymorphism b. Mutation c. Genotype d. Phenotype e. Homozygous f. Heterozygous g. Dominant Trait h. Recessive Trait i. Intermediate Trait • familiar with pedigree drawing symbols and should be able to draw a pedigree using those symbols. • define and describe the clinical features and give examples of: <ul style="list-style-type: none"> a. Autosomal dominant inheritance <p>i. Incomplete penetrance</p> <p>ii. Variable Expressivity</p> <p>iii. Gonadal Mosaicism</p> <ul style="list-style-type: none"> a. Autosomal recessive inheritance b. X-Linked dominant inheritance c. X- Linked recessive inheritance d. Y-Linked inheritance e. Mitochondrial inheritance f. Triplet Repeat Expansions g. Anticipation h. Imprinting <p>i. Contiguous Gene Syndrome</p> <ul style="list-style-type: none"> j. Uni-parental Disomy k. Multifactorial or Polygenic Inheritance

	Genes
	<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the structure of DNA • describe the organization of genes and define the terms: <ul style="list-style-type: none"> a. Intron b. Exon • define and describe transcription and translation • define and describe the following terms with regard to genetic changes at DNA level: <ul style="list-style-type: none"> a. Polymorphisms b. Mutations c. Substitutions <ul style="list-style-type: none"> i. Synonymous substitutions ii. Nonsynonymous substitutions d. Insertion e. Deletion f. Duplications g. Single Nucleotide Polymorphisms (SNPs) h. Deletions/Insertion Polymorphisms (DIPs) i. Missense Mutations <ul style="list-style-type: none"> j. Nonsense Mutations k. Frameshift Mutations l. Dynamic Mutations (Triple Repeats) m. Copy Number Variants (CNV) • describe the structure and function of mitochondrial DNA.

SEMESTER 2

SPLANCHNOLOGY

- Study of the anatomy of the internal organs and system, their organization, development and how they function
- Body cavities - location of pleural pericardial and peritoneal cavities
- Development of coelomic cavity and body cavities
- Arrangement of viscera in peritoneal cavity

1.	Cardiovascular system
	<p>Heart and pericardial cavity</p> <ul style="list-style-type: none"> • Position and surfaces and chambers of heart • Pericardium • Surface marking borders and heart sounds • Major blood vessels • Coronary arteries their origin and area of supply • Conducting system • Microscopic structure of cardiac muscle and its functional specialization • Microscopic structure of arteries, veins and capillaries • Development of Cardiovascular system – • Congenital anomalies and their embryological basis <p>About blood vessels</p> <ul style="list-style-type: none"> • Collateral circulation, anastomoses, end arteries • Arrangement in the thorax and abdomen and plan of blood supply • to viscera, In upper and lower extremities, in head and neck • venous systems - systemic, azygos and portal • Foetal and placental circulation and changes at birth
Intended learning outcomes	
<p>The heart and pericardium <i>The student should able to</i></p> <p>Pericardium</p> <ul style="list-style-type: none"> • describe fibrous and serous pericardium and its nerve supply and basis of referred pain • outline the basis of retrosternal pain referred to neck, arm, epigastrium • outline the lines of continuity of parietal and serous pericardium • describe the position of the transverse sinus and oblique sinus and major blood vessels in relation to them • locate the site for a pericardial tap in a pericardial effusion 	

Heart

- define the position of borders, surfaces and chambers of the heart
- locate the site of palpation of apex beat
- define the position of valves and site of auscultation of heart sounds
- outline the direction of enlargement of chambers
- describe the origin course and branches of the coronary arteries and areas supplied
- effects of occlusion of coronary arteries and areas damaged (case report)
- interpret normal x-rays of the heart

Embryology of heart

- describe the folding of the embryonic heart tube and the establishment of external form and positioning of chambers
- explain the formation of chambers and separations of atrium, ventricle and tunics
- explain the significance of these changes in relation to the circulation of blood in the foetus

Major blood vessels

- outline the plan of the circulatory system
- describe types of arteries
- describe types of veins and capillaries and their arrangement
- define collateral circulation, anastomoses, end arteries and their significance with examples
- outline the parts of the aorta and the regions (mediastinum) in which they are located

The aorta

Arch of aorta-

- state the levels at which it begins and ends and its direction of curvatures and outline its important relations
- list the branches that arise from the arch
- outline the relation of the phrenic and vagus nerve and recurrent laryngeal nerve to the arch
- define the Ligamentum arteriosum
- outline the function of the ductus arteriosus in the foetus
- describe the pharyngeal arch arteries and their derivatives
- outline the embryological basis of PDA, coarctation of aorta, retro-oesophageal right subclavian artery

2.	Respiratory system
	<ul style="list-style-type: none"> • Organization and development • External nose, nasal cavity, paranasal sinuses • Larynx – cartilages, membranes, muscles and vocal cord • Trachea and bronchi and bronchial tree • Lungs and pleura – topography, Segments, lobules. • Functional unit • Surface projection of pleura and lungs • Mediastinum • X - ray of respiratory organs
Intended Learning outcomes	
<p><i>The student should able to</i></p> <ul style="list-style-type: none"> • describe the plan and organization of the organs of respiration • describe the development of the respiratory system <p>Nasal cavity</p> <ul style="list-style-type: none"> • structure of the external nose, nasal cavity, paranasal sinuses and their adaptation to their functions • describe the bony walls and structures related • describe the appearance of the lateral wall and the openings of the paranasal sinuses • define the olfactory region • describe the features of the respiratory epithelium and its relation to function <p>Larynx-</p> <ul style="list-style-type: none"> • describe the cartilages of the larynx, the membranes, muscles, Rima glottis and its function in respiration and phonation <p>Pleural cavity</p> <ul style="list-style-type: none"> • outline the extent of pleural cavity and lines of pleural reflection and the surface projection of pleura and lungs • describe the pleural recesses • describe the relations of the pleural cavity to lungs, diaphragm, heart and pericardium and major blood vessels, liver, kidney and spleen, stomach. • outline the nerve supply of parietal and visceral pleura and state the sites of referred pain • describe the X-ray appearance of a normal lung and pleural cavity • explain the radiological appearance in a pleural effusion, pneumothorax and haemothorax • outline the anatomical basis for choice of a site for pleural tap 	

	<p>Trachea and bronchi</p> <ul style="list-style-type: none"> • describe trachea in neck and thorax • state the level of bifurcation and direction and length of bronchi • outline the plan of the bronchial tree and the structural and related functional changes in the wall • explain into which lobe of the lung is a foreign body most likely to enter <p>Lungs</p> <ul style="list-style-type: none"> • describe external features of the lungs, the fissures and the lobes. • outline the location of the lobes in pleural cavity on the basis which to choose the site of auscultation of breath sounds of each lobe • outline the structures related to each lung • define a bronchopulmonary segment and discuss its significance in postural drainage resection of lung and diagnostic procedures • describe the microscopic structure of the conducting and respiratory parts • outline the structure of an alveolus and the layers of the alveolar membrane • review the movements of the thoracic cage in respiration • analyze an x - ray of the chest • outline the embryological basis of tracheoesophageal fistulae • outline the arrangement of lymph nodes • outline development of pleural cavity and lung • outline the functional differentiation of lung <p><i>case report – pleural effusion</i></p>
3.	Digestive system
	<ul style="list-style-type: none"> • Organization of organs of digestive system • Oral cavity, salivary glands, tongue, pharynx and oesophagus • The peritoneal cavity • Development of body cavities • Arrangement of viscera in peritoneal cavity • Arrangement of autonomic nerves • Peritoneum - visceral and parietal, mesenteries, lomenta, spaces • The gastrointestinal tract – its components, their location, morphology, peritoneal relations, blood supply and lymphatic drainage • Rectum and anal canal in pelvis and perineum • Microscopic structure - basic pattern -features of mucous membrane and epithelial lining, arrangement of muscle and nerves • Adaptation of macroscopic and microscopic structure to their function • Liver and pancreas and biliary system • X - rays • Embryology of the digestive system to understand their topography and as a basis of congenital anomalies

Intended Learning outcomes

- describe the organisation of the digestive tract
- recall the development of digestive tract -
- derivatives of the fore, mid and hind gut
- the embryological basis of the blood supply
- the sequence of changes in the midgut – herniation, rotation, return and fixation of
- changes in the hindgut
- cloaca and its division into bladder/ urethra and rectum/anal canal
- growth of the liver and pancreas
- **Oral cavity and pharynx**
 - define its parts
 - describe the structure of lips and cheeks and the muscle within them discuss
 - identify the alveolar margin and recall dentition
- **Palate**
- Identify the bones of the hard palate
- describe the muscles of the soft palate
- discuss the development and basis of cleft palates
- identify that foramina that communicate with pterygopalatine fossa and the structures that they transmit
- recall the course and branches of the maxillary nerve

Floor of the mouth and tongue

- outline the appearance of the floor of the mouth
- outline the parts of the tongue
- describe the appearance of the dorsum of the tongue
- recall the distribution and the histological features of the papillae
- describe the muscles and the movements
- describe the innervations of the mucous membrane and muscles
- review the pathway for taste

Salivary glands

Parotid, Submandibular, sublingual and minor gland

- describe location form fascial relations and topography
- outline the duct stem and the sites of opening
- describe the microscopic structure of a secretory unit and relate it to the type of secretion
- outline the secretomotor partway

Pharynx

- identify the divisions of the pharynx and their position and their communications
- list the layers of the wall of the pharynx
- describe the constrictors and fascia
- list the other muscles of pharynx

- describe the sites of the lymphatic collections in the wall of the pharynx
- recall the epithelial lining
- outline the blood supply, nerve supply and lymphatic drainage
- discuss the mechanism of deglutition

Oesophagus

- define its level of commencement and its length
- describe its course and relations
 - in the neck,
 - in superior and posterior mediastinum
 - as it passes through the diaphragm
 - in the abdomen
- list the sites of constrictions
- recognize the sphincteric mechanisms at its upper and lower ends
- describe the oesophageal plexus and gastric nerves
- describe the blood supply
- explain the basis of oesophageal varices
- review its microscopic structure

Peritoneal cavity and abdominal viscera

- outline and name the division of the abdomen into its nine regions
- describe the layout of the viscera
- define the parietal and visceral peritoneum
- note the peritoneal folds in relation to some visceral structures
- recognise the viscera that are retroperitoneal
- identify the peritoneal spaces and recesses and their significance

Stomach

- describe the location of the stomach
- describe its morphological features
- describe the lesser and greater omenta and their attachments
- describe the posterior relations of the stomach
- describe the extent of the lesser sac
- describe its blood supply and lymph drainage and
- outline the nerve supply
- recall the microscopic structure
- recall the development of the stomach and the fate of the dorsal and ventral mesogastrium

Liver and biliary apparatus

- outline the parts of the biliary system
- outline its development
- describe the position, morphology, lobes, and surfaces of the liver
- describe the structures in relation to the surfaces

- describe structures in the porta hepatis
- describe peritoneal attachments of the liver, the bare area and peritoneal spaces
- recognise the vascular segments and their significance
- surface mark the liver
- recall the microscopic structure of the liver and its relation to its functions
- describe the location of the gall bladder and its parts
- surface mark its fundus
- describe the arrangement of the duct system and the arterial pattern
- recognise variations in this pattern and its significance
- describe the course, relations and termination of the bile duct
- explain the site of pain in a biliary infection
- describe the radiological appearance of the gall bladder and duct

Pancreas

- describe its position, parts, blood supply and relations
- describe the course and termination of its ducts
- recall the development

Spleen

- describe its position and surfaces, peritoneal relations and blood supply
- describe its structure and functions
- recognize a splenic enlargement

Small intestine

- outline the parts of small intestine and its length

Duodenum

- describe its parts of the duodenum, peritoneal relations, blood supply and structures related
- describe the appearance of its inner wall at the openings of pancreatic and bile ducts
- recall its development

Jejunum, ileum and mesentery

- locate its position in the peritoneal cavity and state its length
- identify its mesentery and its attachment to the posterior abdominal wall
- describe the superior mesenteric artery and its branches to the jejunum and ileum
- describe the superior mesenteric vein and its tributaries. course and termination
- recognize the distinguishing features of the walls of the jejunum and ileum, its peritoneum and arrangement of blood vessels.
- recall the stages of rotation of the gut and possible anomalies
- recall the microscopic structure of the different parts and their adaptation to function

Large intestine

Caecum, appendix, ascending transverse, descending, sigmoid colon

- outline its parts
- describe the external features and the peritoneal relations of the different parts
- describe the attachments of the transverse and sigmoid mesocolon
- recall the superior mesenteric artery and its branches
- describe the inferior mesenteric artery and its branches
- outline the nerve supply and the nerve plexuses in its walls
- describe the normal position of the appendix and other likely locations
- describe the attachment of the mesoappendix and course of the appendicular artery
- explain the anatomical basis of pain in appendicitis.

Rectum and anal canal

- describe the position, curvatures and peritoneal relations of the rectum
- describe the position of the anorectal junction
- recall the levator ani and the ischiorectal fossa
- describe the length and direction of the anal canal
- describe the arrangement of the sphincters in the anal canal
- describe the blood supply of the rectum and anal canal
- describe the internal appearance of the anal canal
- recall the structure of the lining of the anal canal
- recall the development of the anal canal and the possible anomalies that may occur
- identify the anal valves, anal columns

4.	Urinary system
	<ul style="list-style-type: none"> • Kidney and ureters - position/location gross anatomy, Topography • Functional unit nephron - arrangement in kidney • Fascial relations • Ureter and urinary bladder • Urethra- male and female <p>Development of Urinary system</p>

Intended Learning outcomes

The student should be able to

Kidney

- indicate its position and location
- surface mark the kidney
- describe the gross anatomy
- understand the arrangement of renal fascia and its significance in the extent of spread of perinephric abscesses
- describe the topography
- describe the structures at the hilum
- describe the renal artery and arrangement of branches at the hilum and within the kidney
- understand the significance of vascular segments
- describe the pelvis of the kidney and the calyces
- describe appearance of sagittal section of kidney visualize the internal architecture
- describe the structure of the functional unit and its arrangement in the kidney
- relate the nerve supply to pain in renal disease (localized and referred)
- comprehend the basis of palpation of kidney
- review the development of the kidney and discuss the embryological basis of congenital anomalies
- demonstrate the pattern of renal pelvis and calyces in an IVP and retrograde pyelogram

Ureter

- describe its course and relations in the abdomen and pelvis
- indicate the sites of constriction as sites of possible calculi formation
- indicate features that help identification at surgery
- outline its blood supply
- outline its nerve supply and sites of ureteric pain
- identify line of ureter in an x-ray and demonstrate pattern of renal pelvis
- discuss the embryological basis of congenital anomalies

Urinary bladder

- describe its position, form and topography
- describe the bladder in a child
- describe the peritoneal in an empty and distended bladder
- describe the internal appearance and identify the ureteric and urethral orifices
- outline its blood supply
- recall its development
- describe its innervations relating it to the physiology of micturition
- Recall its microscopic structure

Urethra

Urethra – refer reproductive system

Recall the development of Urogenital system and the basis of anomalies

5. Male reproductive system

- Topography of system
- Scrotum and testes
- Spermatic cord and inguinal canal
- Descent of testes
- Gland of male genital system
- Male urethra

Intended Learning Outcomes

The student should be able to

- outline the parts of the male reproductive system and the location of its parts

Scrotum and testes

- describe walls of the scrotum and recall its continuity with the anterior abdominal wall
- describe the gross anatomy of the testes, its blood supply and lymphatic drainage
- review structure of seminiferous tubule and process of spermatogenesis
- review the ducts in the testes
- recall the anatomy of the inguinal canal- its location, position of the deep and superficial inguinal rings, its walls and contents
- describe the spermatic cord and its contents
- recall descent of testes
- describe the parts of the epididymis and its microscopic structure
- describe the course of the ductus deferens
- describe gross anatomy of the prostate
- describe the capsule
- draw and describe a sagittal and transverse section through the prostatic urethra
- outline the lobes of the prostate and the arrangement of the glandular tissue
- relate the venous drainage to spread of malignancy
- recall the microscopic structure of the ductus deferens, seminal vesicle and prostate gland

Urethra

- Describe the commencement and termination of the urethra
- Describe the parts of the urethra and the location of these parts

	<ul style="list-style-type: none"> • Appreciate the sinuous course and varying dilatations and constrictions • Describe the sphincters • Outline the blood supply • recall the development of the male genital ducts and external genitalia • recall the factors that influence the development of these structures • recall the congenital anomalies of the urethra
6.	Female reproductive system
	<ul style="list-style-type: none"> • Topography of system • Ovary – development of ovum and ovulation • Anatomy of uterus, uterine tubes and vagina • Peritoneal folds and fossa • Fertilization and implantation • Supports of the uterus <p>Mammary gland</p>
Intended Learning Outcomes	
Pelvic viscera and peritoneum <ul style="list-style-type: none"> • outline the plan of the system and its arrangement in the pelvis • describe the pelvic viscera and the arrangement of the peritoneum • describe the broad ligament, the rectouterine and uterovesical reflections • Recall the development of the female genital system • Review the female reproductive system (early embryology) 	
Ovary <ul style="list-style-type: none"> • describe its position in the pelvic cavity its gross structure, its relations • outline the blood supply and describe the course of the main arteries • recall development of ovum and changes at ovulation • recall the ovarian cycle and its influence on the uterus 	
Uterus and uterine tubes <ul style="list-style-type: none"> • describe the anatomy of uterus and its position in the pelvic cavity • define anteversion and anteflexion • discuss the supports of the uterus • define the internal os and external os • define the fornices in relation to the cervix • describe its blood supply • discuss the uterine cycle and describe the endometrial changes • describe the parts of the uterine tube • outline its functions • recall the process of fertilization and implantation 	

Vagina <ul style="list-style-type: none"> • describe the anatomy of the vagina • state its direction • define the fornices and state their important relations • outline the blood supply • recall the microscopic structure the breast <ul style="list-style-type: none"> • describe the location of the breast • state the components of the breast • outline its fascial relations • describe the mammary gland and the arrangement of the ducts • describe its blood supply • describe the lymphatic drainage Recall the changes in the breast during pregnancy and lactation	
7.	Lymphatic and immune system <ul style="list-style-type: none"> • Plan of lymphatic circulation • Lymph nodes - regional distribution • Lymph drainage of mammary gland, stomach, intestine, uterus, lungs, pharynx • Tongue, head and neck • Thymus & Spleen - topography, structure and function • Mucosa associated lymphatic tissue- Tonsils • Lymphatic follicles in small intestine – Peyer's patch, Appendix
Intended Learning Outcomes	
<i>The student should be able to</i> <ul style="list-style-type: none"> • List the other lymphatic organs • Describe the topography, structure and functions of the thymus and spleen • List the sites of submucosal collections of lymphatic tissue (MALT) Recall the tonsil, Peyer's patch and the appendix	
8.	Endocrine system <ul style="list-style-type: none"> • Classification and features of endocrine organs • Hypophysis cerebri • Topography, development, structure and function • Control of secretion • Hypothalamo hypophyseal portal circulation • Thyroid, parathyroid, suprarenal-Topography, development, structure and function • Endocrine pancreas • Endocrine tissue in testes and ovaries

Learning outcomes

The student should be able to

- classify the endocrine organs
- describe the features of endocrine tissue

Hypophysis cerebri

- describe the location its components and its
- Outline the structural, functional and embryological differences between the anterior and posterior pituitary
- list the hormones secreted
- describe the neuronal connections with the hypothalamus
- describe the mechanisms for control of secretion
- describe the hypothalamo-hypophyseal portal circulation

Thyroid

- describe its basic structure - lobes and isthmus
- recall histological appearance
- describe the blood supply, lymph drainage and nerve supply
- recall the functions of thyroid gland
- recall the development of thyroid gland
- discuss its important relations

Parathyroid

- describe its form and location
- outline its functions
- describe its blood supply and lymph drainage
- recall its development

Suprarenal gland

- describe its form and location
- describe its topography ‘
- recognize its parts
- recall its development
- recall its histological features
- list its secretions
- outline its functions

	HISTOLOGY
1	Circulatory system <i>The student should be able to</i> <ul style="list-style-type: none"> • outline the plan of the circulatory system • describe the structural organization of the heart • describe the features of the endocardium • describe the features of cardiac muscle and their arrangement in myocardium • recall the parts of the conducting system and their location • describe the histological features of the Purkinje fibres • describe the basic organisation of tissue components of a blood vessel • discuss the basis of differentiation of arteries into elastic and muscular and arterioles • describe the microscopic features of the different types of arteries • describe the special features of an arteriole and relate them to its function • describe the capillary circulation • discuss the basis on which capillaries are classified into three types • describe the structural features of the different types of capillaries • list the sites at which these capillaries are found and give their functions • describe the microscopic structure of the different types of vein • compare this structure to that of the corresponding arteries • discuss the significance of arterial anastomoses, end arteries, arteriovenous anastomoses
2	Respiratory system <i>The student should be able to</i> <ul style="list-style-type: none"> • outline the plan of the respiratory system • describe the principal structural features • recognise the features of the respiratory epithelium • recognise the structural framework • discuss the mechanism for conditioning of inspired air • describe the wall of the trachea • describe the structure from the main bronchus to terminal bronchiole and its adaptation to function • describe the structure of an alveolus and the features of the alveolar epithelium • identify the components of the alveolar membrane • discuss the structural adaptation of the cells to its function • what is the Respiratory distress syndrome? • capillary endothelial cells

3	Digestive system
	<p style="text-align: center;"><u>Oral cavity</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline parts of the oral cavity • describe the features of the hard palate and gingiva and their adaptation to masticatory function • list the component tissues of the tongue and the variations in the anterior and posterior parts of the tongue • describe the epithelium covering the dorsum of the tongue • identify the different types of papillae • describe the structure of taste buds and its distribution • describe the features of salivary glands regarding their nature of secretion and mode of secretion • describe the features of the duct system • describe the wall of the pharynx • describe the location of lymphoid tissue in the wall of the pharynx • describe the features of the palatine tonsil <p style="text-align: center;"><u>Oesophagus and stomach</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline the general plan and arrangements of tissues in the wall of the gastrointestinal system • outline the distribution of the nerve plexuses in the wall • describes the walls of the oesophagus • discuss how the structure of the oesophagus and stomach vary from the basic plan and its adaptation to its function • describe the location of the glands of the oesophagus • describe the epithelial lining of the stomach and the arrangement of the glands in the different parts of the stomach • describe the features of the different types of secretory cells found in the glands and relate it to their functions • describe the transition from stomach to small intestine as seen at the gastroduodenal junction

	<p><u>Intestines</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • discuss how the structure of the small intestine and large intestine vary from the basic plan • discuss how the structural features of the small intestine are adapted to its function • describe the structure of a villus and a crypt • list the different types of cells in the walls of the villi and crypts and their function • describe the location of endocrine cells in the lining of the small intestine • describe the distribution of lymphatic tissue in the different parts of the intestine and their role
4	Urinary system
	<p><i>The student should be able to</i></p> <p>outline the functions of the urinary system recall the gross anatomy of the components of the urinary system</p> <p><u>Kidney</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the parts of the kidney • define the functioning unit of the kidney • outline the parts of the nephron and its arrangement in the different parts of the kidney • describe the arrangement of blood vessels in the kidney and in relation to the parts of the nephron • describe the microscopic structure of a renal corpuscle and its relation to function • describe the ultrastructural features of the filtration membrane • describe the structure of the juxtaglomerular apparatus and its function • describe the microscopic structure of the proximal convoluted tubules, loops of Henle, distal convoluted tubules and collecting tubules • discuss the structure of the above components of the nephron are relation to their function

	<p style="text-align: center;"><u>Ureter, Bladder and Urethra</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • recall the microscopic structure of transitional epithelium • discuss the how the epithelium is adapted to its function • describe the arrangement of the muscle in the wall of the ureter and bladder • outline the parts of the urethra • describe the lining and walls of the different parts • outline the location of the sphincters
5	<p>Male reproductive system</p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • outline the parts of the male genital system • recall its gross anatomy • recall the walls of the scrotum <p style="text-align: center;"><u>Testes</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • define the tunica albuginea and the intermuscular septa and lobules • describe the seminiferous tubules • list the cells lining the tubules, the rete testis and the vasa efferentia • outline the process of spermatogenesis and list the cells of the spermatogenic series • describe the morphological features of the cells of this series • define spermiogenesis • discuss the changes that occur in the formation of a sperm from a spermatid • describe the structure of a mature sperm • describe the features of a Sertoli cells and discuss their function • Discuss the blood testes barrier • Describe the location of the interstitial cells of the testes and discuss their functions
6	<p>Female reproductive system</p>

	<p><i>The student should be able to</i></p> <p>outline the parts of this system recall its gross anatomy</p> <p><u>Ovary</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the microscopic structure of the ovary • describe the follicles in various stages of maturation • recall the process of oogenesis and the changes that take place in the oocyte • recall the process of ovulation • describe the microscopic structure of the corpus luteum <p><u>Uterus and Vagina</u></p> <p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • recall the ovarian and uterine cycle • describe the microscopic structure of the uterine tube • relate this structure to its function • describe the histological features of the walls of the uterus • describe the features of the endometrium at stages of the ovarian/uterine cycle • discuss the significance of these changes in relation to implantation of the fertilized ovum • describe the microscopic structure of the cervix • describe the microscopic features of the vaginal wall
7	Endocrine system
	<p><i>The student should be able to</i></p> <p>describe the features of endocrine tissue explain the mechanisms for control of endocrine secretion</p> <p><u>Pituitary gland (Hypophysis cerebri)</u></p> <p><i>The student should be able to</i></p>

- recall the gross anatomy of the hypophysis including its blood supply
- recall the development of the hypophysis cerebri

Anterior pituitary/ Adenohypophysis/Pars distalis

The student should be able to

- list the types of cells in anterior pituitary
- list the hormones secreted by the acidophils and basophils
- describe the basic functions of these hormones
- describe mechanisms that control the secretion of hormones by the anterior pituitary
- describe the arrangement of blood vessels in the hypothalamohypophyseal portal circulation
- explain its mechanism of control

Posterior Pituitary /Neurohypophysis /pars posterior

The student should be able to

- describe the microscopic appearance of the posterior pituitary
- name the predominant cell type in the neurohypophysis
- explain the hypothalamohypophyseal tract
- list hormones are secreted by the posterior pituitary
- name the cells that secrete these hormones and where they are located
- what are Herring bodies
- describe the features of neurosecretory cells

Thyroid

The student should be able to

- recall the gross anatomy of the thyroid gland
- describe the structural unit of the thyroid gland
- describe the functions of the follicular cells
- discuss how the cells of the follicle function in the synthesis, storage and secretion of thyroid hormone
- discuss how the appearance of the follicle varies with activity
- discuss the mechanisms that control the secretions of the thyroid gland
- describe the parafollicular cells their location and secretions

Parathyroid

The student should be able to

- describe the location of the parathyroid gland, the main types of cells in the gland, their secretions and functions

Adrenal /Suprarenal

The student should be able to

- recall the gross anatomy and the embryology of the gland
- recall the features of a steroid secreting cell
- list the layers of the adrenal cortex
- describe arrangement and structure of cells in these layers
- understand the functions of the cells in each of these layers
- describe the arrangement of blood vessels in the cortex and medulla
- list the cells of the adrenal medulla
- describe the features of these cells
- list the sites of extra adrenal chromaffin cells
- discuss why the adrenal medullary cells are comparable to preganglionic sympathetic neurones
- discuss the significance of the **diffuse endocrine system** (APUD) and the distribution of these cells

Islets of Langerhans

The student should be able to

- describe the islets of Langerhans and how they differ from the exocrine cells of the pancreas
- list the types of cells and the hormones secreted

Pineal body

The student should be able to

- describe the location, structure, secretion and functions of the pineal body

SEMESTER 3

HEAD AND NECK AND NEUROANATOMY	
1.	Bones of the face and vault of skull
	Surface anatomy
	Bony prominences and landmarks External features of face <ul style="list-style-type: none"> • Skull as a whole and major individual bone • Facial skeleton Skull of the new born, features related to age and sex
	Scalp and face
	<ul style="list-style-type: none"> • Muscles of the face and scalp • Facial nerve • Cutaneous supply of face and scalp parotid gland
	Parotid region
	<ul style="list-style-type: none"> • Structures in relation to the parotid gland • Parotid duct • Branches of facial nerve • Retromandibular vein • Facial artery and vein
Intended Learning outcomes	
the skull as a whole <ul style="list-style-type: none"> • name the bones of the vault, base, lateral aspect of the skull • recall the development of cranium neurocranium and viscerocranium and pharyngeal arches • recognize features of the skull of newborn, and changes of skull with age and sex • describe the bones of the face 	
Scalp and face <ul style="list-style-type: none"> • list the layers of the scalp, • why injuries of the scalp bleed profusely, gape and heal easily? • discuss the extent of spread of infections, haemorrhage into the subaponeurotic and subperiosteal layers of scalp • name the nerves that supply the skin of the face and scalp and relate it to its embryological origin • describe the nerve supply of the muscles of the face and scalp and relate it to its embryological origin • discuss what is special about facial muscles and outline the attachments and action of the buccinators, orbicularis oculi, and occipitofrontal is. • indicate the areas of skin face and scalp supplied by branches of trigeminal nerve and cervical nerve 	

	<ul style="list-style-type: none"> • outline the veins in the face and scalp their communications with intracranial venous sinuses- emissary veins • outline the course of arteries and sites where arterial pulsations • state the sites of anastomosis between branches of internal and external carotid arteries • describe the development of face and palate and the embryological basis of congenital defects in the face • outline the differences between the skin of the face and of the scalp
	The neck
	<ul style="list-style-type: none"> • Cervical region of the vertebral column • general arrangement of structures • Cervical fascia & fascial planes • triangles of the neck and contents of triangles • surface landmarks superficial structures <p>the posterior triangle its boundaries and contents</p>
	Intended learning outcomes
	<ul style="list-style-type: none"> • outline the arrangement and extent of cervical fascia and the fascial planes • describe the external jugular vein, its formation, course, surface marking, relation to deep cervical fascia • outline the triangles of the neck and their contents • describe the Sternomastoid and trapezius muscle –its origin, insertion, actions, nerve supply and its relations • State the location of the infrahyoid muscles and the prevertebral muscles • describe the common carotid artery and its bifurcation • outline the branches of the external carotid artery’ and their course • hypoglossal nerve and accessory nerves • the development of the pharyngeal region. arches pouches and clefts • structures encountered when approaching the trachea for a tracheotomy <p>the thyroid gland</p>
	Deep structures in the face
	Temporal and infratemporal fossae Temporomandibular joint
	<ul style="list-style-type: none"> • Bones -Lateral and base of skull <ul style="list-style-type: none"> ○ Temporal and sphenoid bones • Mandible • Locate infratemporal fossa • Walls, fissures foramina and communications • Contents

Learning outcomes	
Infratemporal fossa and temporomandibular joint describe its walls and communications <ul style="list-style-type: none"> • describe the pterygoid muscles and muscles of mastication • outline the course and branches of the mandibular division of trigeminal and its branches • describe the chorda tympani and outline the fibres that are carried in this nerve outline the communications with facial nerve • the otic ganglion and its communications • course of the maxillary artery • pterygoid plexus of veins, its communication with veins of the face and dural venous sinuses Describe the temporomandibular joint its articular surfaces, intraarticular disc, capsular attachments, ligaments, Outline the movements that take place in the joint during mastication What is meant by a bicondylar joint? Outline the anatomy of dislocation	
	Cranial fossae
	The cranial fossae, dura mater and dural venous sinuses
	<ul style="list-style-type: none"> • outline the parts of the brain in relation to the cranial cavity • describe the arrangement of the dura mater and the dural venous sinuses • List the veins that would typically drain into dural sinuses • outline the position, important relations and the veins that communicate with the cavernous sinus • outline the walls of the orbit and nasal cavity • identify the sites of exit of the cranial nerves from the brain stem and their exit from the cranial cavity • identify the foramina and the nerves that are transmitted
	Deep structures in the neck
	<ul style="list-style-type: none"> • The base of skull in region of posterior cranial fossa • The jugular foramen, foramen magnum • Deep structures in neck cranial nerves 9-12 • Internal jugular vein internal carotid artery • Cervical nerves
	Learning outcomes
	<ul style="list-style-type: none"> • outline the course and distribution of the 9-12cranial nerves • outline the course of the internal carotid artery and internal jugular vein, • the arrangement of lymph nodes in the neck deep structures in the neck

	Neurology
	<p>This course includes</p> <ul style="list-style-type: none"> • The normal development of the nervous system • The organization • Control of movement • Integration of sensory modalities • Special sensations • Higher cerebral functions
	Introduction
	<ul style="list-style-type: none"> • The organization of the nervous system • Development of nervous system • Development of the pharyngeal arches • Basic tissues of the nervous system <p>Osteology of skull and vertebral column (review)</p>
	Central nervous system
	Spinal cord
	<ul style="list-style-type: none"> • External, grooves elevations upper and lower limits • upper limit and lower limit • Arrangement of grey matter and nuclear columns • White matter - ascending and descending tracts • roots of spinal nerves dorsal root ganglia spinal nerves
	Learning outcomes
	<p><i>The student should be able to,</i></p> <ul style="list-style-type: none"> • state the vertebral level that marks the lower limit of the spinal cord • list precisely the structures that lie in the canal below this level • state the levels to which the dura mater, arachnoid mater and pia mater extend • define the extent of the coverings and the spaces • state reasons for varying proportions of grey matter and white matter in the different regions • List the types of neurons in the anterior horn and state where the axons of these neurones terminate • Outline the arrangement of the nuclear columns and neurons in the posterior horn • List the main ascending and descending and outline the fibres in them • List the 3 neurones in a sensory pathway and state their location 1st order neurone (dorsal root ganglion, 2nd order neurones in the spinal cord (3rd order neurone in the thalamus is in the thalamus)

- Describe the formation of a spinal nerve
- the cauda equina and the contents of the lower lumbar and sacral vertebral canal
- the boundaries of an intervertebral foramen
- results of prolapse of IV disc
- outline the basis for the selection of the site for a lumbar puncture
- outline the blood supply of the spinal cord and
- demonstrate grooves and elevations that demarcate important areas
- describe the arrangement of grey matter and the nuclear columns
- describe the arrangement of white matter and list the major ascending and descending tracts
- recognise that the cells of the dorsal root ganglia are the 1st order neurone in the sensory pathway
- recognise that the cells of the posterior horn of the grey matter are the 2nd order neurones in the sensory pathway of normal sensation
- describe the cauda equina and the contents of the lower lumbar and sacral vertebral canal

Hemi section of the spinal cord

Syringomyelia

Thrombosis of anterior spinal artery

Brain stem

Medulla, Pons and midbrain

- the external features of medulla, pons and midbrain,
- The external connections with the other parts of the brain- cerebellar peduncles
- points of emergence of cranial nerves in each part
- Internal architecture as seen in transverse sections of the brainstem at different levels
 - Medulla at level of motor decussation and sensory decussation fibres involved
 - Pons
 - Mid brain at level of inferior colliculus and superior colliculus
- Grey matter - Cranial nerve nuclei and relate to point of exit from brain stem their intracranial course and exit from cranium
- other neurons
- White matter - them motor decussation and sensory decussation fibres involved
Lemnisci, fibres contained in them

4th ventricle

Learning outcomes

The student should be able to,

- relate the grooves and elevations on anterior posterior and lateral surfaces important underlying internal structures
- outline the connections with the other parts of the brain

- Internal structures as seen in transverse sections of the brainstem at different levels
- Identify in the relevant regions
 - nuclear columns (cranial nuclei 3-12, and the location of their functional components (motor sensory, somatic, visceral)
 - their intracerebral course and site of emergence of the cranial nerves (review the intra cranial, extracranial course, the branches and structures supplied (motor and sensory) of cranial nerves 3-12)
 - the arrangement of sensory and motor tracts in the white matter
 - their continuity with the spinal cord and cerebrum
 - the medial lemniscus the fibres involved and its significance
 - other collections of neurones - reticular formation, red nucleus and their communications
 - describe the cerebellar peduncles and the fibres contained in them cerebellar connections
 - outline the ventricular system -central canal, 4th ventricle, aqueduct and its continuity with the 3rd ventricle and cerebral hemispheres
 - describe the 4th ventricle its location, its closed part and open part, the boundaries and structures in the floor of the ventricle
 - describe the formation and circulation of cerebrospinal fluid in the brain
 - explain the blood brain barrier

Cerebellum

Cerebellum

- Parts, lobes, fissures
- Cerebellar peduncles
- Arrangement of grey matter and white matter
- Intracerebellar nuclei
- Functions

Distribution of neurons and fibres and their connections (histology)

The student should be able to

- describe the external features, the lobes and internal structure of cerebellum
- list the intracerebellar nuclei
- describe peduncles of cerebellum and fibres contained in them
- understand the functions of the cerebellum and that they exert them control on the same side (ipsilateral)
- list the types of neurons, and outline their distribution and the afferent and efferent pathways

recall the histological structure of the cerebellum

	Cerebrum
	Diencephalon <ul style="list-style-type: none"> • Thalamus, Hypothalamus, Epithalamus • Topography, connections • 3rd ventricle Cerebral hemispheres <ul style="list-style-type: none"> • Sulci and gyri • Grey matter- basal nuclei, lateral ventricle, cerebral cortex • White matter – corona radiata, internal capsule, pathways • Functional areas in cortex • Association fibres Commissural fibres
Intended learning outcomes	
<p><i>The student should be able to</i></p> <p>Recall the anatomy of the cranium – its vault and cranial fossae</p> <p>Describe the location of Hypothalamus</p> <ul style="list-style-type: none"> • the parts of the cerebrum in the cranial cavity • Recognise the two main parts –diencephalon and cerebral hemisphere • Describe the anatomy of cerebral hemispheres - surfaces, borders, major sulci, lobes, sulci • Locate theses sulci and gyri on the brain <p>Diencephalon</p> <ul style="list-style-type: none"> • Describe the topography of the diencephalon, extent, its components, connections • Draw a sagittal section of brain to illustrate the limits • Identify the following in relation to the diencephalon <ul style="list-style-type: none"> - Optic chiasma and optic tract - Pineal body - Structure in interpeduncular fossa - Telachoroidea of the 3rd ventricle - Internal capsule - Thalamus and hypothalamus - Third ventricle <p>Thalamus</p> <ul style="list-style-type: none"> • Recognise the thalamus as the main cell station (3rd order neurone) of the sensory system • Recognise several sensory nuclei it contains for all sensations and that it is divided into several parts • Describe the anatomy and relations of the thalamus • Describe the medial and lateral geniculate bodies • Recognise the functions of these two bodies (visual and auditory) and their connections • Identify the regions of the epithalamus - and the pineal body 	

- Identify the region of the hypothalamus and its important relations
- Recognise the relationship of the hypothalamus to the hypophysis cerebri structurally and functionally
- Discuss the functions of the hypothalamus
- Describe the third ventricle

Cerebral hemispheres–

- describe the main fissures, lobes and functional areas
- outline the two main sites of distribution of the grey matter - basal ganglia and cerebral cortex
- List the nuclei in the basal ganglia, describe their arrangement and important relations and list their main functions
- Outline the functional areas in the cortex
- Describe the neuronal layers in the different functional parts and their connections (review microscopic structure of cerebral cortex)
- Describe the patterns of arrangement of the white matter
- Describe the location of the internal capsule and the distribution of the fibres
- Describe the corona radiata and the fibres contained in them
- Describe the optic radiation
- Define commissural fibres and association fibres
- List the commissures
- Describe the corpus callosum and fornix
- Describe the anatomy of cerebral hemispheres - surfaces, borders, major sulci, lobes, sulci
Locate these sulci and gyri on the brain
Recognise
 - the distribution of grey matter in cerebral cortex and basal ganglia
 - the distribution white matter in corona radiata, internal capsule, commissures
 - the cavity – the lateral ventricle
 - grey matter
- Describe the location of the main functional areas in the cerebral cortex
- Describe the neuronal layers in the different functional parts and their connections (review microscopic structure of cerebral cortex)
- Name the basal ganglia and discuss their function and their important relations

White fibres

- Describe the corona radiata and the fibres contained in them
- Describe internal capsule and the fibres contained in its parts
- Describe the optic radiation

Commissures

- Define commissural fibres and association fibres
- List the commissures
- Describe the corpus callosum
- Describe the fornix and its communications
- Describe the lateral ventricle, its parts, its relations, its communication with the third ventricle

Blood supply

- Name the blood vessels that supply the brain
- Describe the Circle of Willis
- Describe the branches of the arteries that supply the cerebrum and brain stem
- Demonstrate the area of cerebrum supplied by each of these arteries of the brain

Ascending pathways

- Three neurone pathways
- Neurones
 - 1st order neurone - dorsal root ganglion spinal nerves
- sensory ganglia in cranial nerves
 - 2nd order neurons in spinal cord /CNS
 - 3rd order neurone - thalamus

Intended learning outcomes

The student should be able to,

- list the sensory receptors for the different sensory modalities and give their location
- outline the peripheral afferent pathway for different sensory information
 - sensation of touch and proprioception
 - sensation of pain, temperature and touch
- outline the pathways in CNS thro spinal cord, brain stem. thalamus to primary sensory cortex in cerebrum for the above sensation. State the tracts involved
- State the locations of the neurons in these pathways
- outline the sites of sensory decussation
- list the lemnisci and the fibres contained in them- medial, spinal and lateral Lemnisci
- review the segmental innervations of the skin

Descending pathways

- control somatic motor function
- two neurone pathway -Upper motor (UMN)and Lower motor neurone (LMN)
- location of UMN Functional organization of primary motor cortex
- location and Types of L:MN alpha and gamma motor neurons in spinal cord
- innervations of facial muscles UMN control of face
- signs and symptoms of UMN and LMN lesions
- modulation of movement by basal ganglia and cerebellum

Intended learning outcomes

The student should be able to

- define an upper and lower motor neurone
- list and outline the pathway from upper motor neuron in cerebral cortex to the lower motor neurons in brain stem and spinal cord, that control movements in different regions
- state the sites of decussation of these fibres and the outcome of the decussations
- state the location of the lower motor neurons and the types of lower motor neuron
- draw a diagram to illustrate origin course and termination of the fibres of corticospinal/ pyramidal tracts
- differentiate between an UMN lesion and LMN lesion clinically

Peripheral pathway and nerve endings

- trace peripheral nerve pathway via cranial nerves and spinal nerves to relevant muscles/ groups of muscles
- describe structure of the nerve endings in striated muscle - motor end plate
- describe structure of sensory endings in muscle (muscle spindle)
- reflexes - reflex arc. stretch reflexes
- outline role of basal ganglia in muscle contraction
- outline role of cerebellum in modulation and coordination
- list the extrapyramidal tract
- *Effects of lesions*
 - *Hemi section of spinal cord*
 - *Lateral medullary syndrome*
 - *Obstruction to anterior spinal artery*

Cerebral haemorrhage

Meninges

Intended learning outcomes

The student should be able to,

- list the coverings of the brain
- describe the arrangement of dura mater in relation to brain and spinal cord
- recall arrangement of dura mater and its functions and venous sinuses in the cranial cavity
- define epidural, subdural, subarachnoid spaces
- describe the subarachnoid space and its contents

define the Telachoroidea and choroid plexus

Ventricles and cerebrospinal fluid

Limbic system and reticular formation

- Outline the ventricular system
- Describe the formation and circulation of cerebrospinal fluid in the brain
- Explain the blood brain barrier

Explain functions of the limbic system and reticular formation

Autonomic nervous system

	<ul style="list-style-type: none"> • Organization & Basic plan
Intended learning outcomes	
<i>The student should be able to</i> <ul style="list-style-type: none"> • describe the organization of autonomic nervous system • describe the basic plan of autonomic nervous system- preganglionic neurone and the postganglionic neurone and how it differs from the somatic nervous system • define the two components sympathetic and parasympathetic • discuss the basic differences in the location of the preganglionic neurons, postganglionic neurons and the neurotransmitters • discuss the functions of the two systems 	
	Sympathetic nervous system
	<ul style="list-style-type: none"> • Organization of sympathetic nervous system • Pre-ganglionic neurons and spinal cord and preganglionic outflow • Sympathetic trunk, prevertebral and paravertebral ganglia • Branches • Nerve plexuses in: Head and neck – carotid plexuses Thorax – cardiac, pulmonary, oesophageal plexuses Abdomen and pelvis – aortic, celiac, superior mesenteric, hepatic suprarenal
Intended learning outcomes	
<i>The student should be able to</i> <ul style="list-style-type: none"> • outline the centers in spinal cord • describe the arrangement of the sympathetic nerve trunk and the ganglia • discuss the possible modes of distribution to the ganglia • describe the paravertebral ganglia and their connections. • describe the splanchnic nerves and the prevertebral (subsidiary) ganglia and plexuses • discuss the distribution to the effector organs • identify and describe <ul style="list-style-type: none"> ▪ The sympathetic trunk and ganglia in the neck and internal carotid plexus ▪ Thorax - cardiac, pulmonary, oesophageal plexuses ▪ Abdomen–celiac, aortic, superior mesenteric, hepatic, suprarenal ▪ Pelvis – superior hypogastric and inferior hypogastric plexuses 	
	Parasympathetic nervous system
	<ul style="list-style-type: none"> • Organization, Cranial and sacral parasympathetic outflow • Nuclei of 3rd, 7th, 9th, 10th cranial nerves • Sacral 2nd, 3rd, 4th segments • Parasympathetic ganglia their location and connections • Innervations of viscera
Intended learning outcomes	

The student should be able to

- recognize the anatomical components of parasympathetic nervous system
- identify the centre (preganglionic neurons) in relation to nuclei of 3rd, 7th, 9th, 10th cranial nerves and 2nd, 3rd, 4th sacral spinal segments
- describe the parasympathetic ganglia in relation to branches of the above cranial nerves
 - Ciliary- 3rd nerve
 - Pterygopalatine- 7th nerve
 - Submandibular- 7th nerve
 - Optic - 9th nerve
 - Several ganglia in viscera - 10th nerve
- describe the communications of the ganglions. their branches and structures Innervated

Peripheral nervous system

Cranial nerves

- *Review skull and foramina*
- *Review development of brain stem and nuclear columns*
- Functional components of cranial nerves
- Cranial nerves 3 to 12, Central nuclei and connections
- Intracerebral course and site of exit from brain
- Intracranial course
- Extracranial course, branches and structures supplied
- Distribution motor, sensory, parasympathetic
- How to test for cranial nerve function

Intended Learning outcomes

The student should be able to

- recall skull and foramina
- recall development of brain stem and nuclear columns
- describe functional components of cranial nerves 3-12
- describe central nuclei and connections
- describe the Intracerebral course and site of exit from brain and intracranial course
- describe the extra cranial course, branches and structures supplied
- describe distribution -motor, sensory, parasympathetic nerves
- describe how to test for cranial nerve function

Spinal nerves

	<ul style="list-style-type: none"> • Typical spinal nerve as in the thoracic region – course of a typical intercostal nerve • Innervations of intercostals muscles and anterior abdominal wall • Dermatomes • Myotomes • Structural and functional organisation of nerve plexuses • Cervical, brachial, lumbar, sacral and coccygeal plexuses • Branches arising from plexuses • Course, branches and distribution of large peripheral nerves • Radial, ulnar, median, sciatic, obturator, femoral nerves • Analysis of nerve lesions
Intended learning outcomes	
<p><i>The student should be able to</i></p> <ul style="list-style-type: none"> • describe the typical spinal nerve as in the thoracic region –course of a typical intercostal nerve • define the term dermatome and Myotomes • describe the structural and functional organization of nerve plexuses • describe the cervical, brachial, lumbar, sacral and coccygeal plexuses and the branches arising from these plexuses • draw the plan of the brachial plexus • describe the course branches and distribution of the peripheral nerves that arise from the plexus – axillary nerve, musculocutaneous, radial, ulnar and median nerves • draw a plan of the lumbar and sacral plexus • describe the course, branches and distribution of the femoral, obturator and sciatic nerve • discuss how this knowledge can be used to analyse effects of lesions of these nerves 	
	Sensory organs

	Hearing and balance <ul style="list-style-type: none"> • Parts of ear • Pinna, external ear, tympanic membrane • Middle ear- walls, auditory tube, mastoid antrum and air cells • Internal ear-bony and membranous labyrinth • Organ of Corti • Semicircular canals • Course of facial nerve
	Vision <ul style="list-style-type: none"> • Revise bony orbit • Eyelids and conjunctiva, lacrimal apparatus • Extra ocular muscles • coats of eyeball • Structure of the cornea and sclera • Choroid and ciliary body • Flow of aqueous humour • Chambers, Refractive media • Intraocular muscles • Retina, optic disc, optic nerve <ul style="list-style-type: none"> ▪ Visual pathway ▪ Visual reflexes ▪ Corneal reflex
	Taste <ul style="list-style-type: none"> • Tongue, papillae, taste buds • Nervous pathway for taste – peripheral and central
	Smell <ul style="list-style-type: none"> • Olfactory nerves, and olfactory pathway
	Skin <ul style="list-style-type: none"> • Structure of skin • Types of skin, • Derivatives of skin, Appendages of skin • Receptors