

STUDY GUIDE

PHYSIOLOGY

SECOND YEAR MBBS

SESSION 2018-2023

SAHARA MEDICAL COLLEGE, Narowal

INTRODUCTION	Physiology is the study of normal function within living creatures. ... "[A] branch of biology that deals with the functions and activities of life or of living matter (such as organs, tissues, or cells) and of the physical and chemical phenomena involved."
TARGET STUDENTS	Second year MBBS
COURSES TO BE STUDIED IN SECOND YR MBBS	<ul style="list-style-type: none"> • Gastrointestinal physiology • Nervous system physiology • Motor system • Sensory system • Special senses • Renal physiology • Endocrine system physiology • Reproductive physiology
COURSE TITLE	1 GIT + ANS
DURATION	6 weeks
Specific Learning Objectives	<p>Autonomic Nervous system</p> <p>1. <u>General organization of autonomic nervous system</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Define autonomic nervous system • Enlist the various functions of ANS • Describe the physiological anatomy of sympathetic nervous system • Describe the physiological anatomy of parasympathetic nervous system • Describe the basic differences in the general organization of both divisions of ANS <p>2. <u>Basic characteristics of sympathetic & parasympathetic nervous system</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Mention the name of the fibers & neurotransmitters involved in the ANS • Discuss the mechanism of transmitter secretion and removal at postganglionic endings • Mention the various types of receptors present on effector organs <p>3. <u>Effect of sympathetic & parasympathetic stimulation on specific organs</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Discuss the various excitatory and inhibitory actions of sympathetic &

parasympathetic stimulation on specific organs

- Describe the value of adrenal medulla to the function of Sympathetic Nervous system

4. Sympathetic & Parasympathetic tone, Stress response & autonomic reflexes

At the end of the lecture, the student should be able to:

- Describe what sympathetic & parasympathetic tone is?
- Discuss stress response & its importance
- Describe various autonomic reflexes
- Describe drugs acting on ANS

Gastrointestinal system

1. Introduction - histology & Blood supply

At the end of the lecture, the student should be able to:

- Describe the physiological anatomy of gastro intestinal tract(GIT)
- Explain the histology of wall of GIT and its layers

2. Electric activity in smooth muscle

At the end of the lecture, the student should be able to:

- Describe the Electric activity in smooth muscle of GIT
- Draw graph of slow waves and spike potential in smooth muscle of GIT

3. Hormonal control of GIT & GIT reflexes

At the end of the lecture, the student should be able to:

- Describe the various reflexes in GIT
- Enlist hormones of GIT
- Describe the various functions of hormones and their site of secretion

4. ENS+Mastication , type of movements

At the end of the lecture, the student should be able to:

- Describe the enteric nervous system and its connection with ANS
- Explain the mastication reflex along with its center
- Enlist the various movements seen in GIT
- Explain various movements seen in GIT

5. Saliva & regulation. Diseases

At the end of the lecture, the student should be able to:

- Explain the saliva and various glands that secrete it
- Describe composition of saliva
- Describe the nervous regulation of saliva secretion
- Describe diseases in hypo salivation and hyper salivation

6. Swallowing

At the end of the lecture, the student should be able to:

- Explain the swallowing reflex along with its center
- Describe the stages of swallowing
- Describe physiological apnea in swallowing
- Describe disorders of swallowing

7. Stomach structure & function

At the end of the lecture, the student should be able to:

- describe the physiological anatomy of stomach

- Explain the functions performed by stomach

8. Movements of stomach+vomiting

At the end of the lecture, the student should be able to:

- Describe the various movements of stomach
- Explain the vomiting reflex its center and mechanism

9. Gastric juice secretion phases& composition

At the end of the lecture, the student should be able to:

- Describe the composition and functions of gastric juice
- Describe the various stages of gastric juice secretion

10. HCl formation & diseases

At the end of the lecture, the student should be able to:

- Draw diagram showing hcl production
- Describe how HCL is produced by stomach
- Describe how pepsinogen is produced by stomach
- Describe the diseases in stomach

11. Small intestine structure & movements

At the end of the lecture, the student should be able to:

- Describe the structure and function of small intestine
- Describe movements in small intestine

12. Small intestine Secretion

- explain the composition of small intestine juice
- Describe the mechanism of regulation of secretion
- Describe the structure and function of large intestine

13. Large intestine Movements and diseases

At the end of the lecture, the student should be able to:

- Describe the structure and function of large intestine
- Describe movements in large intestine
- Describe the various disorders of large intestine

14. Defecation reflex

At the end of the lecture, the student should be able to:

- Explain the defecation reflex along with its center
- Describe the mechanism of defecation

15. Feaces & flatus composition+ pancreas

At the end of the lecture, the student should be able to:

- Discuss the composition of normal feaces
- Describe the composition of flatus
- Describe the structure & function of pancreas

16. Pancreatic juice composition & stages

At the end of the lecture, the student should be able to:

- Describe the composition of pancreatic juice
- Discuss the various stages of juice secretion
- Describe the mechanism of bicarbonate secretion

17. Bile formation & functions

At the end of the lecture, the student should be able to:

- Discuss the composition of bile
- Describe the role of gall bladder in bile modification
- Describe the functions of bile

18. Liver and its functions

At the end of the lecture, the student should be able to:

- Elaborate the structure and anatomy of liver

	<ul style="list-style-type: none"> • Discuss the non metabolic functions of liver • Describe the metabolic functions of liver <p>19. <u>Liver function test</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Enlist and describe the liver function tests • Discuss the importance of LFTs in diagnosis of liver diseases
COURSE TITLE	2 SENSORY physiology
DURATION	6 weeks
SPECIFIC LEARNING OBJECTIVES	<p>1. <u>General design of nervous system/ major level of central nervous system</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Describe the general design of the nervous system. • Explain the sensory & motor part of the nervous system. • Enlist the levels of CNS control. • What is higher mental function? • Compare nervous system to a Computer. <p>2. <u>CNS Synapses/ physiological anatomy of CNS</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Explain the central nervous system synapses. • What are the types of synapses? • Explain the physiological anatomy of the synapses. • Describe the mechanism by which an action potential causes transmitter release from presynaptic terminal. • Second messenger system, chemical substances, neuropeptides <p>3. <u>Second messenger system in post – synaptic neuron/Chemical Substances that function as synaptic transmitter</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Explain second messenger system in post – synaptic neuron. • Describe excitatory or inhibitory receptor in the postsynaptic membrane. • Discuss chemical substances that function as a synaptic transmitter • Describe the characteristics of a some important small molecule transmitter • Explain neuropeptides • What are electrical events during neuronal excitation <p>4. <u>Electrical events , presynaptic inhibition , summation</u> At the end of this lecture, the students should be able to:</p>

- What are pre synaptic inhibition in time course of presynaptic potential
- Describe the spatial summation in neuron
- Describe the temporal summation in neuron

5. Special characteristics of synaptic transmission

At the end of this lecture, the students should be able to:

- Describe the special characteristics of the synaptic transmitter

6.

Type of sensory Receptor, their sensitivity, labeled line

At the end of this lecture, the students should be able to:

- Classify sensory receptors
- How do two types of sensory receptor detect differential types of sensory stimuli.
- What is 'Labelled Line' Principle.

7. Receptor potential/ Adaptation of Receptor/ Classification of nerve fiber/ Spatial & temporal Summation

At the end of this lecture, the students should be able to:

- Describe the mechanism of receptor potential.
- Explain the receptor potential of the pacinian corpuscle
- Discuss relation between stimulus, intensity & receptor potential.
- Describe the adaptation of different types of receptor
- Discuss the mechanism by which receptor adapt & their importance
- Define nerve fiber & classify.
- How nerve fiber transmit in different types of signal.
- Discuss spatial & temporal summation

8. Transmission & processing of signals in Neuronal pools

At the end of this lecture, the students should be able to:

- Describe transmission & processing of signal in neuronal pools.
- Discuss organization of neurons for relaying signal.
- Enumerate threshold & sub threshold stimuli for excitation & facilitation.

9. Instability and stability of the neuronal circuit

At the end of this lecture, the students should be able to:

- Describe the inhibitory circuit for stabilizing the nervous system
- Explain the term synaptic fatigue
- Describe the up-regulation and down-regulation of synaptic receptor

10. Classification of the somatic senses

At the end of this lecture, the students should be able to:

- Describe the mechanoreceptor and thermoreceptor senses
- Explain the exteroceptive sensation , proprioception , visceral and deep sensation
- Describe the detection and transmission of the tactile sensation

11. Sensory pathway ; lateral and dorsal column

At the end of this lecture, the students should be able to:

- How somatic signal transmit into central nervous system
- Explain the transmission in the dorsal column medial lemniscal system
- Discuss spatial orientation of the nerve fiber in the column medial lamniscal system

12. Somatosensory center/ Vibratory senses

At the end of this lecture, the students should be able to:

- Explain the somatosensory area
- Describe the layers of the somatosensory cortex and their function
- Discuss the overall characteristics of signal tansmission
- Sefine the vibratory senses and interpretation of the sensory stimulus intensity
- Describe the dudjment of the stimulus intensity and power law

13. Position senses/ Some special aspects of the somatosensory function

At the end of this lecture, the students should be able to:

- Define postion senses and their subtypes
- Describe the transmission of the less critical sensory signal in the anterolateral system
- Explain the some characteristics of the transmission in the anterolateral pathway
- Give the detail function of the somatosensory

14. Types of pain, Receptor, pathways & neurotransmitters

At the end of this lecture, the students should be able to:

- Discuss the protective of pain & its type.(Fast & Slow pain) with their qualities.
- Describe the pain receptor & their classification.
- Explain the causes of pain in tissue ischemia & muscle spasm.

	<ul style="list-style-type: none"> • What are the sharp & slow chronic pathways & where they termination pain in CNS. Describe the neurotransmitter of pain fiber. <p>15. <u>Analgesia system</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Define analgesia • Enlist the components of analgesia system • Enumerate the various neurotransmitters involved in analgesia system • Discuss the brain opiates system. • Describe inhibition of pain transmission by simultaneous tactile sensory signals <p>16. <u>Referred pain/ visceral and parietal pain</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Discuss about referred pain • explain the mechanism of referred pain. • Describe the visceral pain & its causes. • Describe the parietal pain & its causes. <p>17. <u>Clinical abnormalities of pain</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Define hyperalgesia • Differentiate between primary & secondary hyperalgesia. • describe herpes zoster along with its cause? • Discuss Brown sequard syndrome. <p>18. <u>Headache</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Define headache & their origin. • Enlist the various types of headache • Differentiate the features of different types of headache. <p>19. <u>Thermal sensation</u> At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Describe the various gradations of thermal sensation • Describe the mechanism of excitation of thermal receptors • Describe the receptor of thermal sensation. • Describe the transmission of thermal signals in the nervous system
COURSE TITLE	3 MOTOR system physiology
DURATION	6 WEEKS
SPECIFIC LEARNING OBJECTIVES	<p>1. Organization of spinal cord for motor function</p> <ol style="list-style-type: none"> a) Describe basic organization of spinal cord. b) Enumerate different neurons involved in motor functions. c) Describe functions of α γ motor neurons & of intercessors.

d) Describe importance of reshaw cells in motor control

e) Describe the function of propriospinal jibres.

2. Muscle sensory receptors-muscle spindles and golgi tendon organs - & their roles in muscles control.

a) Enumerate the special sensory receptors sapling the muscle & Golgi tendon.

b) State the structure & motor innovation of muscle spindle.

c) Name the types of sensory endings involved acetic of muscle spindle.

d) Describe the difference b/w dynamic & static response.

e) Identify the situations when muscle discharge continuously.

3. Muscles stretch reflex/clinical application of stretch reflex.

a) Define muscle stretch reflex.

b) Describe difference between dynamic & static stretch reflex.

c) Explain the “Damping” function of stretch reflex & its role.

d) Describe the role of muscle spindle in voluntary motor activity

e) Apply importance of stretch reflex on clinical grounds.

f) Define clonus and its clinical significance.

4. Golgi Tendon Reflex

a) Define Golgi tendon reflex and its role in control of Muscle tension

b) Identify the situations when tendon reflex prevents excessive tension on muscle.

5. Flexor Reflex Withdrawal Reflex

a) Explain the Flexor reflex and its neuronal mechanisms

b) Describe the pattern of Withdrawal Reflex during flexor reflex

6. Crossed Extensor Reflex/Reciprocal Inhibition and Reciprocal interventions.

a) Define cross Extensor reflex and its neuronal mechanism.

b) Define Reciprocal inhibition and its Mechanism

7. Postural and Locomotive Reflexes of the Cord / Stepping and walking movements.

a) Enumerate the postural and Locomotive Reflexes of spinal cord.

b) Describe positive supporting reaction and Cord Righting Reflex

c) Describe the physiology of Rythmical Stepping movement and Reciprocal Stepping movement.

d) State the Mark-Time Reflex, Galloping Reflex and Scratch Reflex.

8. Spinal cord reflexes that cause muscle spasm / Autonomic Reflexes in spinal cord.

a) Name the spinal cord reflexes that can cause muscle spasm and

b) State thei clinical significance of spinal cord reflexes

c) Identify different Autonomic reflexes in the Spinal cord.

d) Define Mass Reflex and its significance.

9. ascending tract of spinal tract

A)enlist various ascending tract of spinal cord

b) Describe in detail the pathway of various ascending tracts of spinal cord

10. Descending tract of spinal tract

- a) enlist various descending tract of spinal cord
- b) discuss various descending tract of spinal cord
- c) which tract control the extensors and flexors of the body muscles
- d) discuss the difference between UMNL and LMNL

11. Spinal Cord transaction

- a) Define Spinal shock and
- b) enlist the different conditions leading to spinal shock.
- c) Explain the different effects of spinal cord transaction at different levels.
- d) Define Brown Sequard syndrome and its Pathophysiology

12. Diseases of spinal cord

- A) name the different diseases of the spinal cord
- b) discuss the sign and symptom of the poliomyelitis

Cortical and brain stem control of motor function

Motor cortex /specialized areas of motor control found in human motor cortex

- a) describe motor cortex and its different areas
- b) discuss different areas of motor cortex
- c) describe some specialized areas of motor control in motor cortex

Transmission of signal from motor cortex to the muscles (corticospinal tracts)

- a) describe the path of corticospinal tract
- b) discuss pyramidal and accessory pathway in detail

Extrapyramidal system

- a) enlist different extrapyramidal tract
- b) discuss various extrapyramidal tract

Control of motor functions by the brain stem (role of reticular nuclei and vestibular nuclei)

- a. Enlist the different function of brain stem
- b. Describe the role of reticular system
- c. Discuss the role of vestibular nuclei to excite the anti gravity muscles

Maintenance of equilibrium -Vestibular apparatus / function of utricle and saccule

- Discuss the vestibular apparatus
- Describe the role of macule
- Discuss the function of utricle and saccule

Hypothalamus

- Enlist the different nuclei of the hypothalamus
- Enlist different role of the hypothalamus
- Discuss the regulation of the various function of the hypothalamus

limbic system

- Describe the parts of limbic system
- Discuss the reward and punishment function of limbic system

Specific functions of others parts of limbic system (hippocampus, amygdala, limbic cortex)

- Describe the function of the hippocampus
- Discuss the role of hippocampus in learning
- Enlist the different function of the amygdala
- Discuss the stimulating the inhibiting amygdala
- Discuss briefly function of the limbic cortex

Cerebellum 1

- Give brief discussion on parts of cerebellum
- Differentiate between superior and inferior vermin
- Describe the division of cerebellum
- Discuss the division of cerebellum on the basis of function
- Explain the layers of cerebral cortex
- Brief discussion on interneuronal activity of cerebellum
- Describe the afferent fiber of the cerebellar cortex

Cerebellum 2 + cerebellar dysfunction

- Describe the deep cerebellar nuclei and efferent pathways
- Explain the excitatory and inhibitory deep cerebellar nuclei
- Describe the function of cerebellum in overall motor cortex
- What are role of vestibulo cerebellum with the brain stem and spinal cord to control the equilibrium and posture movement
- Discuss the functions of spinocerebellum & cerebrocerebellum
- describe the following terms related to cerebellar lesion :dysmetria ataxia, dysdiadochokinesia, dysarthria, intention tremor ,cerebellar nystagmus ,hypotonia

Basal ganglia and its function 1

- Describe basic components of basal ganglia.
- Discuss the functions & different components of basal ganglia.
- Describe the putamen & caudate circuit
- Explain the phenomenon of disinhibition.
- Discuss the direct and indirect pathway of the basal ganglia.

Basal ganglia and its function 2+ diseases related to basal ganglia

- Enlist the different disorders related to basal ganglia.
- Define Parkinson disease.
- Discuss patho physiology of Parkinson disease.
- Enlist sign, symptoms of Parkinson disease.
- State the treatment options of Parkinsons disease
- Define Huntington's disease.
- Discuss patho physiology of Huntington's disease.
- Enlist signs symptoms disease.
- Describe treatment of Huntington's disease.

	<p>Thalamus and its function</p> <ul style="list-style-type: none"> • Describe the functional anatomy of the thalamus i.e . thalamic nuclei • Discuss the regulation of each function of the thalamus • Enlist various functions of thalamus
COURSE TITLE	SPECIAL SENSES
DURATION	4 WEEKS
SPECIFIC LEARNING OBJECTIVES	<p>1. <u>Physiological anatomy of eye</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe the three coats of eye along with their basic functions <p>2. <u>Physical principles of optics</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • State what is refraction • Define refractive index • Describe the Application of Refractive Principles to Lenses • Describe what is focal length • Discuss how the Refractive Power of a Lens is measured—“Diopter” <p>3. <u>Optics of eye & Accommodation</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Discuss the concept of a reduced eye • Define accommodation • Mention the adjustments in eyeball during accommodation • Describe the pathway for accommodation reflex <p>4. <u>Errors of refraction</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe emmetropia • Describe myopia • Describe hyperopia • Differentiate myopia & hyperopia • State how to correct/ rectify these errors of refractions <p>5. <u>Depth perception</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe how the eye determines the distance of an object from it <p>6. <u>Intraocular fluid system of the eye</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe the mechanism of formation of intra-ocular fluid • Describe the circulation and drainage of aqueous humor • Mention the normal value of intra-ocular pressure • Define glaucoma and discuss its effects on the eye <p>7. <u>Anatomy & function of retina</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Enumerate the different layers of retina • Describe the photoreceptors and their structure • State the blood supply of retina

8. Visual cycle

At the end of the lecture, the student should be able to:

- Describe the various steps involved in the rhodopsin-retinal visual cycle
- Discuss night blindness
- Discuss the rod-receptor potential

9. Colour vision/ light & dark adaptation

At the end of the lecture, the student should be able to:

- Describe the mechanism of dark & light adaptation
- Discuss the photochemistry of colour vision
- Describe colour-blindness & its types

10. Neural function of Retina

At the end of the lecture, the student should be able to:

- Describe the neural circuitry of retina
- Enlist the various neurotransmitters of retina
- Describe electrotonic conduction
- Enlist various types of ganglion cells & their respective fields
- Describe the function of various types of ganglion cells

11. Visual pathway & lesions

At the end of the lecture, the student should be able to:

- Describe the outline of the visual pathway
- State the effect of different lesions of visual pathway

12. Visual cortex & major pathways for analysis of visual information

At the end of the lecture, the student should be able to:

- Describe the organization and function of visual cortex
- Describe the major pathways responsible for analysis of visual information
- Describe the effects of removal of visual cortex

13. Eye movement & their control

At the end of the lecture, the student should be able to:

- Describe the muscular control of eye movements
- Describe the neural pathways for control of eye movements
- Describe the various fixation movements of the eye

14. Tympanic membrane and ossicular system /Functional anatomy of cochlea

At the end of this lecture, the students should be able to:

- Describe the conduction pathway of sound from tympanic membrane to cochlea
- Explain the functional anatomy of the cochlea
- Discuss the transmission of sound waves in the cochlea

15. Function of organ of cortii

At the end of this lecture, the students should be able to:

- Describe organ of cortii
- Describe the mechanism of excitation of the hair cell
- Describe how auditory signals are transmitted mainly by the inner

	<p>hair cells</p> <ul style="list-style-type: none"> • Explain endocochlear potential <p>16. <u>Determinant of sound frequency the ‘place ‘ principle / central auditory mechanism / hearing abnormalities</u></p> <p>At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Describe the determinants of sound frequency • Describe the determinants of loudness and decibel unit • Describe the threshold for hearing of different frequency and frequency range of hearing • Describe the auditory nervous pathway • Discuss the types of deafness and audiogram <p>17. <u>Sense Of Taste/ Taste buds and its function/ Receptor potential/ Taste pathways / taste preferences and abnormalities</u></p> <p>At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Enlist various primary sensations of the taste • Enumerate relative index of different taste substances • Describe taste buds and its function • Explain the mechanism of stimulation of taste buds • Explain the receptor potential and generation of nerve impulse by the taste buds • Describe the transmission of taste signal into the central nervous system • Explain the taste preferences and control of diet • Enlist clinical abnormalities of taste sensation <p>18. <u>Sense of smell Olfactory membrane / Pathways / Primary sensation of the smell</u></p> <p>At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Describe olfactory membrane and olfactory bulb and their connection to olfactory tract • Enlist & describe various olfactory cells • Describe the mechanism of excitation of the olfactory cells • Explain the membrane potential and action potential in the olfactory cell • Discuss rapid adaptation of olfactory sensation • Classify the sensation on the basis of psychological studies • Explain the affective nature of smell • Describe the transmission of smell signal into central nervous system. • Enlist various disorders of smell
COURSE TITLE	Renal physiology
DURATION	6 weeks
SPECIFIC LEARNING OBJECTIVES	<p>19. <u>Body fluid compartment (BFC)</u></p> <p>At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe fluid intake and output requirement • Describe various body fluid compartments (BFC)

- Describe the normal composition of extracellular fluid

20. Determination of BFC/ hypo& hyper- natremia

At the end of the lecture, the student should be able to:

- Describe the methods of measurements of body fluid compartment
- Describe the concept of concentration of body fluid compartment
- Describe hypo/ hyper-natremia and dehydration

21. Blood volume, Osmosis and osmolarity

At the end of the lecture, the student should be able to:

- Define and explain osmosis & osmolarity
- Define and describe blood volume and its measurement

22. Edema types & safety factors

At the end of the lecture, the student should be able to:

- Define edema
- Describe the various types and causes of edema
- Describe the safety factors to prevent edema

23. Introduction & Functions of kidney

At the end of the lecture, the student should be able to:

- Describe functional anatomy of kidney
- Enlist the various functions of kidney
- Describe hormones secreted by kidney

24. Nephron & Blood supply

At the end of the lecture, the student should be able to:

- Describe the structure and types of nephron
- Explain functions of nephron
- Describe blood flow of kidney, its determinants and regulation

25. Micturition

At the end of the lecture, the student should be able to:

- Explain physiological anatomy of bladder
- Describe Micturition reflex along with its center and nervous control
- Describe the abnormalities in micturition
- Describe renal blood flow and its regulation

26. Abnormalities in micturition

At the end of the lecture, the student should be able to:

- Describe the abnormalities in micturition
- Differentiate the abnormalities in micturition

27. GFR & determinants

At the end of the lecture, the student should be able to:

- Define and explain glomerular filtration rate and its normal value
- Describe determinants of GFR

28. Regulation of GFR +Plasma Clearance

At the end of the lecture, the student should be able to:

- Describe the Auto regulation of GFR
- Describe the humoral regulation of GFR
- Describe the nervous regulation of GFR
- Describe the tubule glomerular feedback of GFR
- Describe the plasma clearance of various substances

29. Tubular reabsorption determinants

At the end of the lecture, the student should be able to:

- Describe the tubular reabsorption
- Describe the mechanism and route of reabsorption
- Describe the determinants of tubular reabsorption

30. Regulation Tubular reabsorption+ test

At the end of the lecture, the student should be able to:

- Explain the mechanism of regulation of tubular reabsorption
- Calculate reabsorption rate by formula

31. Reabsorption of glucose

At the end of the lecture, the student should be able to:

- Describe the glucose reabsorption in various parts of nephron
- Define & describe the concept of transport maximum
- Describe the transporters for reabsorption of glucose

32. Reabsorption of sodium/ Features of nephron segments regarding reabsorption

At the end of the lecture, the student should be able to:

- Describe the sodium reabsorption in various parts of nephron
- Describe the transporters for reabsorption of sodium
- Describe the co and counter transport mechanism
- Enlist the various transporters in nephron segments

33. Reabsorption in various segments of nephron-1

At the end of the lecture, the student should be able to:

- Describe the water and sodium reabsorption in proximal tubule
- Describe the water and sodium reabsorption in loop of Henle

34. Reabsorption in various segments of nephron-2

At the end of the lecture, the student should be able to:

- Describe the water and sodium reabsorption in distal tubule and collecting duct
- Describe the role of ADH in water reabsorption

35. Pressure Natriuresis & Diuresis/ Secretion of substances

At the end of the lecture, the student should be able to:

- Enlist various substances excreted by secretion
- Describe the role of transporters involved in secretion of substances
- Describe pressure Natriuresis
- Describe pressure Diuresis

36. kidney function test

At the end of the lecture, the student should be able to:

- Enlist and describe the kidney function tests
- Calculate the kidney function tests

37. Formation of dilute urine

At the end of the lecture, the student should be able to:

- Describe the mechanism of formation of dilute urine
- Discuss the role of ADH in formation of dilute urine

20. Formation of concentrated urine-I

At the end of the lecture, the student should be able to:

- Describe the mechanism of formation of concentrated urine
- Discuss the role of ADH in formation of concentrated urine
- Describe the mechanism of hyperosmolar medullary interstitium

21. Formation of concentrated urine-II

At the end of the lecture, the student should be able to:

- Discuss the countercurrent exchangers & multipliers
- Describe disorders of urinary concentrating ability

22. Control of ECF osmolarity

At the end of the lecture, the student should be able to:

- Estimate the plasma osmolarity from plasma sodium concentration

23. Osmoreceptor-ADH Feedback system

At the end of the lecture, the student should be able to:

- Describe the ADH synthesis & secretion
- Describe the factors stimulating & inhibiting ADH secretion

24. Renal regulation of Potassium ions

At the end of the lecture, the student should be able to:

- Describe the distribution of K in ECF & ICF
- Discuss the role of Aldosterone in regulating K ion level

25. Renal regulation of Calcium ions

At the end of the lecture, the student should be able to:

- Describe the control of calcium excretion by the kidney
- Describe the role of PTH in calcium regulation
- Enumerate the factors that alter renal Ca excretion
- Describe the control of Magnesium excretion by the kidney

26. Acid-Base Balance (introduction to basic terms)

At the end of the lecture, the student should be able to:

- Define acid, base, pH, buffers
- Discuss the Henderson-Hasselbalch equation
- Differentiate between acidic & basic pH

	<p><u>27. Acid-Base Balance(Buffer system)</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe the various buffer systems of the body • Describe the role of protein as a buffer <p><u>28. Acid-Base Balance (Respiratory & renal regulation)</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe the role of lungs in regulating acid-base balance • Describe the role of kidneys in regulating acid-base balance <p><u>29. Acid-Base Balance (Quantifying renal acid-base secretion & disorders)</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe how net acid excretion can be assessed • Describe regulation of renal tubular H ion secretion • Enumerate the various factors that affect H ion secretion and bicarbonate ion reabsorption by renal tubules • Describe the types of acidosis & alkalosis • Discuss causes of acidosis & alkalosis <p><u>30. Diuretics & their mechanism</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Enlist the different types of diuretics • Describe the mechanism of action of different types of diuretics <p><u>31. Kidney diseases</u> At the end of the lecture, the student should be able to:</p> <ul style="list-style-type: none"> • Describe nephrotic syndrome • Describe different types of acute renal failure • Discuss glomerulonephritis & acute tubular necrosis • Mention different causes of CRF • State the effects of Chronic renal failure on the body • Describe what is hemodialysis & artificial kidney
COURSE TITLE	ENDOcrine physiology
DURATION	5 weeks
SPECIFIC LEARNING OBJECTIVES	<p>1. Introduction to endocrinology/ chemical structure & synthesis of hormones At the end of this lecture, the students should be able to:</p> <ul style="list-style-type: none"> • Define hormone and • classify hormones • enlist various endocrine glands and the hormones produced • describe the basic mechanism of synthesis of various types of

hormones

2. Hormone secretion, transport & clearance

At the end of this lecture, the students should be able to:

- Enlist the differences between water-soluble & lipid-soluble hormones as regards their mode of secretion, transport in the blood & clearance
- Describe the concept of metabolic clearance rate

3. Mechanism of action of hormones

At the end of this lecture, the students should be able to:

- Describe three types of membrane receptors
- Enlist the location of receptors & hormones that bind with them
- Describe what Regulation of receptors means
- Enlist the various second messenger systems
- Enlist the hormones that act on the genetic machinery of the cell

4. Measurement of hormones in the blood

At the end of this lecture, the students should be able to:

- Enlist the various methods used for measuring hormones in blood
- Briefly describe the various methods used for measuring hormones in blood

5. Pituitary gland & its relation to the hypothalamus

At the end of this lecture, the students should be able to:

- Enlist the hormones produced by Anterior Pituitary and Posterior Pituitary
- Enlist the types of cells of anterior pituitary
- Describe the Control of Pituitary by the Hypothalamus
- Enlist the Hypothalamic releasing & inhibiting factors for anterior pituitary hormones
- Describe the Hypothalamic-hypophysial portal system.

6. Physiological functions of growth hormone

At the end of this lecture, the students should be able to:

- Describe the effects of GH on metabolism (CHO, Fat & Pr)
- Describe the effect of GH on bone growth
- Discuss the factors regulating GH secretion

7. Regulation of growth hormone secretion & abnormalities of growth hormone secretion

At the end of this lecture, the students should be able to:

- Enlist the various factors that stimulate & inhibit the secretion of growth hormone
- Describe the role of hypothalamus in controlling growth hormone secretion
- Discuss the various abnormalities of growth hormone secretion
- Differentiate between Levi-Lorain dwarf & cretin dwarf

8. Posterior pituitary gland & its relation to the hypothalamus

At the end of this lecture, the students should be able to:

- Mention site of synthesis of post. Pituitary hormones
- Mention the chemical nature of posterior pituitary hormones

- Describe the physiological effects of post pituitary hormones

9. Thyroid hormones- structure, biosynthesis & secretion

At the end of this lecture, the students should be able to:

- Describe the physiologic anatomy of thyroid gland
- Outline the steps of synthesis of thyroid hormones

10. Thyroid hormones-release, transport, regulation & catabolism

At the end of this lecture, the students should be able to:

- Discuss how the thyroid hormones are transported in blood to the tissues.
- State the differences between the T3 & T4 as regards their transport, onset & duration of action, daily rate of secretion & potency

11. Functions of thyroid hormones

At the end of this lecture, you should be able to:

- Describe the various effects of thyroid hormone on body functions
- Enlist the non-genomic actions of thyroid hormones

12. Regulation of thyroid hormone secretion

At the end of this lecture, you should be able to:

- Describe the various factors that affect the regulation of thyroid hormone secretion
- List the factors that inhibit the iodide-trapping mechanism
- Discuss the mechanism of action of propylthiouracil (anti-thyroid drug)

13. Diseases of thyroid gland

At the end of this lecture, the students should be able to:

- Enumerate the causes of hypo & hyperthyroidism
- Describe the various symptoms of hypothyroidism
- Enlist the various symptoms of hyperthyroidism
- Name the diagnostic tests used for hypo & hyperthyroidism

14. Synthesis & secretion of adrenocortical hormones

At the end of this lecture, the students should be able to:

- Enlist the layers of adrenal cortex along with its major secretions
- Outline the steps of synthesis of adrenal steroids
- Enumerate the mineralocorticoids & glucocorticoids
- Mention the fate of adrenocortical hormones

15. Functions of mineralocorticoids

At the end of this lecture, the students should be able to:

- Describe the renal & circulatory effects of aldosterone
- Describe the effects produced by mineralocorticoid deficiency
- Describe the effects produced by mineralocorticoid excess
- Describe apparent mineralocorticoid excess syndrome.
- Discuss the cellular mechanism of aldosterone action.

16. Functions of glucocorticoids-1

At the end of this lecture, the students should be able to:

- Describe the effects of glucocorticoids on carbohydrate metabolism
- Describe the effects of glucocorticoids on fat metabolism
- Describe the effects of glucocorticoids on protein metabolism

17. Functions of glucocorticoids-2

At the end of this lecture, you should be able to:

- Describe the effects of glucocorticoids on metabolism (CHO, Fat & Pr)
- Describe the effect of glucocorticoids on bone growth
- Discuss the factors regulating glucocorticoids secretion

18. Regulation of cortisol secretion

At the end of this lecture, you should be able to:

- Describe the various factors that affect the regulation of cortisol hormone secretion
- Discuss the feedback control of cortisol secretion
- Briefly describe the circadian rhythm of cortisol secretion

19. Abnormalities of adrenocortical secretion

At the end of this lecture, the students should be able to:

- Describe the pathophysiology of cushing syndrome
- Differentiate between cushing syndrome & cushing's disease
- Describe the pathophysiology & sign/symptoms of rickets & osteomalacia

20. Insulin & its metabolic effects

At the end of this lecture, the students should be able to:

- Enlist the hormones produced by the pancreas
- Describe the chemistry of insulin
- Outline the steps involved in the synthesis of insulin
- Describe the cellular effects produced by activation of target cell receptors

21. Effects of insulin on metabolism

At the end of this lecture, the students should be able to:

- Describe the effects of insulin on carbohydrate metabolism
- Describe the effects of insulin on fat metabolism
- Describe the effects of insulin on protein metabolism & growth

22. Regulation of insulin secretion

At the end of this lecture, the students should be able to:

- Describe the basic cellular mechanisms for insulin secretion
- Enlist the factors and conditions that affect insulin secretion
- Discuss the role of insulin in switching between carbohydrate & lipid metabolism

23. Glucagon & its secretion

At the end of this lecture, you should be able to:

- Describe the effects of glucagon on glucose metabolism
- Enumerate the factors that affect glucagon secretion

24. Diabetes Mellitus & its types

At the end of this lecture, the students should be able to:

- Describe the types of diabetes mellitus
- Tabulate the differences between DM type 1 & 2
- Describe the pathophysiology of DM type 1 & 2
- Enumerate the various sign & symptoms of DM
- Briefly discuss the management options

25. Regulation of Calcium & phosphate in ECF & plasma

At the end of this lecture, the students should be able to:

- Discuss the various forms of calcium found in the plasma
- Describe the distribution of Ca and phosphates in the body
- Describe the physiological effects of altered Ca and phosphate concentrations in the body fluids
- Discuss the calcium exchange between different tissue compartments

26. Bone & its relation to ECF Ca & PO₄

At the end of this lecture, the students should be able to:

- Briefly describe the composition of bone matrix & bone salts
- Briefly describe the difference between compressional & tensile strength of the bone
- Briefly describe the mechanism of bone calcification
- Briefly describe remodeling of bone

27. Vitamin D & its actions

At the end of this lecture, the students should be able to:

- Outline the various steps of formation of vitamin D
- Discuss the role of vitamin D in intestinal absorption of calcium & phosphate
- Discuss the role of vitamin D in renal excretion of calcium & phosphate

28. Parathyroid hormone its effects

At the end of this lecture, the students should be able to:

- Describe the physiologic anatomy of parathyroid gland
- Enlist the various hormones produced by parathyroid gland
- Describe the effect of PTH on Calcium and phosphate concentration in ECF
- Describe the control of parathyroid secretion by the calcium ion concentration

29. Pathophysiology of parathyroid gland

At the end of this lecture, the students should be able to:

- Describe the pathophysiology of hyper & hypoparathyroidism
- Describe the pathophysiology & sign/symptoms of rickets & osteomalacia
- Describe the causes & pathophysiology of osteoporosis

30. Calcitonin & its effects

At the end of this lecture, the students should be able to:

- Describe the effects of calcitonin on regulation of calcium ion concentration

COURSE TITLE	REPROductive physiology
DURATION	3 weeks
SPECIFIC LEARNING OBJECTIVES	<ol style="list-style-type: none"> 1. <u>Physiological anatomy of male reproductive system</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Enlist the organs of the human male reproductive tract • Discuss the functions of the various organs of the human male reproductive tract • Describe the follicular development in the ovaries 2. <u>Spermatogenesis & its control</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Define spermatogenesis • Outline the various steps involved in spermatogenesis • Discuss the cell divisions involved during Spermatogenesis • Enumerate the hormonal factors that stimulate spermatogenesis 3. <u>Capacitation & acrosomal reaction</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Define capacitation • Describe the various changes that occur during the process of capacitation • Discuss the significance of capacitation • Explain what is acrosomal reaction • Discuss the significance of acrosomal reaction 4. <u>Abnormalities of spermatogenesis & male fertility</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Discuss the effect of temperature on spermatogenesis • Define cryptorchidism • State the hormonal factors that affect the descent of testis • State the consequences of non descent of fetal testis 5. <u>Testosterone & its functions</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Enumerate the various effects of testosterone on development of primary & secondary male sexual characteristics • Describe the various effects of testosterone on development of primary & secondary male sexual characteristics • State the functions of testosterone during fetal development • Discuss the role of testosterone in descent of the testes 6. <u>Control of male sexual functions by hormones</u> At the end of the lecture, the student should be able to: <ul style="list-style-type: none"> • Describe the feedback regulation of the hypothalamic-pituitary-ovarian axis in males • Discuss the regulation of spermatogenesis by FSH & testosterone • Discuss the role of inhibin in negative feedback control of seminiferous tubule activity 7. <u>Abnormalities of male sexual function</u> At the end of the lecture, the student should be able to:

- Enlist abnormalities of prostate gland
- State the effect of abnormalities of prostate gland
- Describe the effects of loss of testes before puberty & an adult
- Enlist the causes of erectile dysfunction

8. Physiological anatomy of female reproductive system & Female hormonal system

At the end of the lecture, the student should be able to:

- Enlist the organs of the human female reproductive tract
- Discuss the functions of the various organs of the human female reproductive tract
- Describe the follicular development in the ovaries

9. ovarian cycle & ovulation

At the end of the lecture, the student should be able to:

- Enlist the various phases of ovarian cycle
- Discuss the various phases of ovarian cycle
- Discuss the mechanism of ovulation

10. Functions of ovarian hormones- estrogens & progesterone

At the end of the lecture, the student should be able to:

- Enumerate the various effects produced by estrogens & progesterone on primary & secondary female sex characteristics
- Describe the various effects produced by estrogens & progesterone on primary & secondary female sex characteristics

11. Endometrial cycle

At the end of the lecture, the student should be able to:

- Enlist the various phases of endometrial cycle
- Discuss the various phases of endometrial cycle

12. Regulation of female monthly rhythm & female fertility

At the end of the lecture, the student should be able to:

- Describe the feedback regulation of the hypothalamic-pituitary-ovarian axis in females
- Discuss the feedback oscillation of the hypothalamic-pituitary-ovarian system

13. Maturation & fertilization of ovum

At the end of the lecture, the student should be able to:

- Define fertilization
- State the part of fallopian tube in which fertilization takes place
- Discuss the factor that determines the sex of the fetus
- State the reasons for the delay of fertilized ovum in the fallopian tube
- Discuss about the early nutrition of an embryo

14. Functions of placenta & Hormonal factors in pregnancy

At the end of the lecture, the student should be able to:

- Enlist the various hormones produced by the placenta.
- Describe the functions of various placental hormones
- Describe the reaction of various nonsexual endocrine gland of the

mother to pregnancy

15. Response of mothers body to pregnancy

At the end of the lecture, the student should be able to:

- Enlist the effects of pregnancy on mother's body
- Discuss the changes in maternal major organ systems (circulatory system, respiration & kidney)
- Mention the extra nutritional requirements of mother during pregnancy

16. Parturition

At the end of the lecture, the student should be able to:

- Enlist & describe the hormonal factors that increase uterine contractility
- Describe the mechanical factors that increase uterine contractility
- Discuss the mechanism for initiation of labour
- Discuss the mechanics of parturition

17. Lactation

At the end of the lecture, the student should be able to:

- Describe the role of estrogen & progesterone in the development of breast.
- Discuss the role of prolactin in the promotion of lactation
- Describe the milk-let down process in milk secretion
- Enumerate the various constituents of human milk.