

HUMAN PHYSIOLOGY

(I) GOAL

The broad goal of the teaching of undergraduate students in physiology aims in providing the student, a comprehensive knowledge of the normal functions of the organ systems of the body and their interactions to facilitate understanding of the physiological basis of health and changes in disease.

(II) LEARNING

OBJECTIVES A.

Knowledge

At the end, a medical student in Physiology should be able to explain:

- (a) Functions of organ systems in a normal subject.
- (b) Contribution of organ systems and their integration in maintenance of homeostasis
- (c) Altered physiology on exposure to stress, and during disease process
- (d) Compare the normal and abnormal data; interpret the same to assess health status
- (e) Physiological principles underlying pathogenesis and treatment of disease.
- (f) Reproductive physiology as relevant to National Family Welfare programme
- (g) Basic laboratory investigations relevant for a rural set up
- (h) Concept of professionalism
- (i) Approaches to the patient with humanity and compassion

B. Skills

At the end of the course the student shall be able to

- (a) Conduct experiments designed for study of physiological phenomena
- (b) Interpret experimental / investigative data
- (c) Distinguish between normal and abnormal data derived as a result of tests which he/she has performed and observed in the laboratory

C. Integration

At the end of the integrated teaching, the student shall acquire an integrated knowledge of organ structure and function and its regulatory mechanisms.

(III) DETAILED SYLLABUS

DETAILS OF THE COURSE

Duration of the course: 2 semesters

Total number of hours: 480

Lectures: 160

Practical: 120

Innovative session (Projects, seminars, structured discussion, integrated teaching, formative evaluation and revision: 200

DETAILS OF CLASSES IN PHYSIOLOGY

GENERAL PHYSIOLOGY

3 hrs

Introduction to Physiology, Principles of Homeostasis, Transport Mechanism, Intercellular communication. Body fluid compartments- divisions, composition, & determination (mention Fick's Principle) Blood volume-normal value, abnormalities- Hypervolemia & Hypovolemia.

HEMATOLOGY

21 hrs

Introduction

1hr

Blood - Functions, composition, Properties – specific gravity, viscosity – definition, normal values & variations

Plasma proteins:

1hr

Types, Quantity, Functions, AG ratio- Importance to be given for functions - Abnormal proteins to be dealt in biochemistry

Red Blood Cells

1hr

Morphology, composition and functions, normal RBC count and variations----- Properties – to be dealt in practical's

Haemoglobin

1hr

outline only normal basic structure, normal content, functions, types (Hb A, Hb A2 and Hb

F) abnormal Hbs (only two - Thalassemias & Haemoglobin S – mention only details in Biochemistry)

Erythropoiesis

1hr

Sites (intra and extra uterine) different stages, Factors influencing & regulating Erythropoiesis Life Span of RBC and its destruction (outline), jaundice (mention – details in Biochemistry).

Anaemias

1hr

definition, classifications (etiological, morphological), physiological basis of anaemias (briefly), iron deficiency anaemia, Pernicious anaemia, aplastic anaemia, Hemolytic anaemia (briefly), Polycythemia- primary and secondary

White Blood Cells:

4hrs

Classification, morphology (details in practical classes), lifespan Properties and functions – Neutrophil, Eosinophil, Basophil, Monocyte, Lymphocyte. Normal total and differential count (methods in practicals), variations Leucocytosis, Leucopenia, leukaemia (definition, mention difference from leucocytosis), agranulocytosis

Immunity

1hr

Definition, Types – innate and acquired, Humoral and cellular Mechanisms of immune response, plasma cell, immunoglobins, autoimmune disorders, AIDS (mention).

Reticulo endothelial system

½hrs

Platelets:

1 hr

Morphology, properties and functions, normal count, variations, thrombopoiesis, and factors influencing this

Haemostasis

4 hrs

Primary (vasospasm, platelet plug formation) and Secondary (extrinsic and intrinsic mechanisms of coagulation of blood) Clot retraction (mention)

Anticlotting mechanisms in vivo -factors that limit clot formation (Protein C, Protein S and antithrombin III) and fibrinolytic system (all in brief).

Anticoagulants – used in lab and in vivo. Bleeding disorders Purpura, Hemophilia, Vitamin K deficiency Tests for bleeding disorders – bleeding time, clotting time (in practicals).

Prothrombin time and PTT (principles only) Thrombosis and Embolism – mention

Blood volume - Normal volume, abnormalities, hypervolemia & hypovolemia (mention)

Blood groups

2 hrs

ABO and Rh systems, inheritance, differences, Bombay group, Landsteiner's laws I and II Mention about Bombay blood group, no need of other minor blood groups

Blood grouping and cross matching (importance), concept of universal donor and recipient

ABO and Rh incompatibility – important manifestations, erythroblastosis foetalis.

Management and preventive measures, Medicolegal and clinical importance (briefly)

Blood banking and transfusion

1 ½hrs

Blood transfusion – indications, precautions and complications

Blood Banking –anticoagulants used, storage, changes during storage – Lymph –1 hr

formation, circulation, functions

Tissue fluid – formation, circulation and functions Starling's hypothesis – edema formation **2 hrs**

Seminars/tutorials

INTEGRATED TEACHING

6 hrs

1.Pathology dept

Anaemia blood smear –Normal and abnormal -1hour

2. Transfusion medicine department

Transfusion of blood components – with special reference to recent advances, Modern trends in blood banking -1 hour

2. Microbiology department

Immune mechanisms -1hour

CARDIOVASCULAR SYSTEM

LECTURES 26 hrs

Functional anatomy of heart and blood vessels Chambers, valves, great vessels, Systemic

and pulmonary circulations Properties of cardiac muscle, Excitability, rhythmicity, conductivity, contractility, to review only as it is dealt in NMP

1hr

Conducting system of heart, parts of conducting system, origin and spread of cardiac

1hr

impulse, abnormal pacemakers, conduction defects

Cardiac cycle:

5hrs

Definition, phases, events of cardiac cycle Pressure changes – Atria, Jugular vein (mention clinical significance). Ventricles – right and left, Aorta and Pulmonary artery, Volume changes – in different chambers. Heart sounds – causes, character, murmur (definition, physiological basis)

Arterial Pulse - genesis and characters of normal pulse

Common abnormalities– to be dealt in practical classes

Venous blood flow-Venous tone, valves

ECG
2hrs

Definition, Principles of recording of ECG (details in practical) Leads – unipolar and bipolar, commonly used 12 Leads, Normal tracing in Lead II – normal waves, intervals and segments, how HR is determined, correlation with action potential and phases of cardiac cycle,

Correlation between different events of cardiac cycle – (diagrammatic representation)

Clinical uses of ECG – (mention).

(Abnormal ECG pattern in myocardial infarction, cardiac arrhythmias . Effect of changes in ECF K⁺, Ca⁺⁺ and Na⁺ conduction defects to be dealt in practical)

Cardiac output:
5 hrs

Definition, normal values, variations Fick's principle – mention (Methods & other methods of measurement details not required) . Regulation of cardiac output – heart rate - Regulation of heart rate, stroke volume – determinants, regulation

Hemodynamics:
2hrs

General principles including physical laws governing flow of blood in heart and blood vessels not in detail)-Pressure – resistance - flow relationship, Poiseuille-Hagen formulae, law of Laplace Laminar flow, turbulent flow, Reynold's number, critical closing volume Importance of peripheral resistance, venous circulation, venous tone to be dealt with blood pressure. Regulation of blood flow

Structure & function of different segments of blood vessels. Correlate with function, local regulation including autoregulation of blood flow, vasoconstrictors and vasodilators, substances secreted by endothelium.

Arterial Blood pressure:
3hrs

Systolic and diastolic pressures– definition, normal values, variations Define end pressure and lateral pressure, Bernoulli's principle (mention) Pulse pressure, Mean arterial pressure

- definition, normal values Determinants of Systolic and diastolic pressures Measurement– details in practical class

Regulation - neural and humoral.(short term, intermediate and long term)

Cardiovascular reflexes, Local regulation including auto regulation of blood flow, vasoconstrictors and vasodilators, substances secreted by endothelium (important ones)

Effects of gravity, Posture and Exercise on B.P Hypertension & hypotension in practicals

Regional circulation:
3hrs

Coronary, cerebral, capillary, cutaneous, splanchnic circulation

Fetal, pulmonary, renal to be taught in respective system

Circulatory shock **1hr**

Types pathophysiology, stages, compensatory mechanisms

Cardio-vascular & Respiratory adjustments in **1hr**

health –effect of gravity (+ve and –ve),

weightlessness (brief)

Effect of exercise **2hrs**

To be dealt after both Respiratory & CVS is over -Refer Respiratory system

Seminar/Tutorials **2hrs**

Integrated teaching **2hrs**

ECHO, Abnormal ECG and Cardiac catheterization

RESPIRATORY SYSTEM **LECTURES 16hrs**

Introduction **1hr**

Define respiration ,Organisation and functional anatomy of respiratory system
 Tracheobronchial tree, Respiratory unit, Alveoli (structure and functions), Pleura, pleural fluid Functions of different parts of respiratory system including non-respiratory functions

Mechanics of respiration: **2hrs**

Inspiration and expiration, muscles of inspiration and expiration and their actions, Pump handle and bucket handle movements, expansion of thorax and lungs, Types of breathing Pressure changes during normal respiratory cycle – intra (alveolar) pulmonary and intra thoracic (alveolar) pressure changes, development of negative intra thoracic pressure

Surfactant – functions (surface tension, alveolar stability, alveoli kept dry, interdependence of alveoli), hyaline membrane disease, ARDS Law of laplace – application

Measurement of pulmonary ventilation **2hrs**

Spirometry in practicals

Lung volumes (mention) static & dynamic lung volumes TV, IRV, ERV, RV, VC TLC, FEV, FRC

– Residual volume (measurement not needed) RMV, MVV, breathing reserve, closing volume (mention) to be dealt with practicals Ventilation – pulmonary and alveolar Dead space – Anatomical & Physiological- definition, normal values, variations (1-2 eg) (Measurement not needed)

Pressure – volume relationship -
1 hr

Elastic behaviour of lungs, total and lung compliance – normal values Airway resistance, work of breathing (brief outline –it is to overcome elastic, nonelastic and airway resistance), factors affecting bronchial tone, 1-2 conditions where work of breathing is increased

Pulmonary blood flow: -
1 hr

Volume, pressure, factors influencing – nervous and chemical factors, unique features. Variations in regional pulmonary blood flow, ventilation – perfusion ratio and its importance

Pulmonary exchange of gas & Mechanism -
2hrs

Composition of inspired air, expired air, partial pressures gas composition of Arterial & venous blood,. Structure of blood gas barrier, factors affecting diffusion across respiratory Membrane diffusion capacity for O₂ & CO₂, O₂ transport in blood, oxygenation of Hb, O₂ carrying capacity, O₂ content, % saturation, coefficient of O₂ utilization, Properties of Hb that facilitates O₂ transport O₂ dissociation curve, factors shifting curve to right and left, P50 foetal Hb, Myoglobin, carboxy Hb–

CO₂ transport in blood
1 hr

Different forms of transport, chemical reactions involved, changes occurring in lungs Haldane and Bohr effect -

Regulation of respiration:
3 hrs

Neural control – neural centers, genesis of respiratory rhythmicity, ramp signal (experimental evidence not required), Voluntary control, Reflex control Breath holding and braking point. Chemical control – stimuli, chemoreceptors (peripheral and central), ventilatory response to hypercapnea, hypoxia and change in H⁺ ion concentration.

Hypoxia:
- 1hr

Definition, types, clinical features, Oxygen therapy - Cyanosis, asphyxia and dyspnea, Definition, CO poisoning (mention), Periodic breathing Cheyne – stokes and biots breathing, voluntary hyperventilation

Environmental Physiology:
1hr

High altitude, rapid ascent, Mountain sickness, Acclimatization Effects of UV rays, Dysbarism

Effects of increased barometric pressure
1hr
Seminar/Tutorials
4hrs

Nitrogen narcosis, High pressure nervous syndrome, Oxygen toxicity
 Decompression sickness (Caissons disease) Cardiovascular & Respiratory changes
 during exercise - Space physiology ,effect of "G" forces on respiratory system

INTEGRATED TEACHING
4hrs

Artificial respiration(delete Holger Neilson method) CPR with Mannequien
 Pulmonary function tests to be dealt in practicals & include in record .

GASTROINTESTINAL SYSTEM
LECTURES -12
Introduction to G.I. Physiology :
1 hr

General organization of G.I. tract Neural control of G.I function Enteric nervous system, Autonomic control Mechanism of enzyme secretion by glands in general.

Salivary Gland:-Saliva composition, function, control of secretion.

1 hr

Conditioned and unconditioned reflexes disturbances in salivary secretion-in anxiety and dehydration

Gastric Secretion:- Gastric juice: Composition, functions. gastric HCL secretion-mechanism and regulation of secretion. Gastric juice-functions, phases of secretion and regulation. Gastrin-functions and regulation of secretion. Mucosal barrier, pathophysiology of peptic ulcer in brief

3 hrs
Pancreas , Liver and gall bladder
2 hrs

Exocrine Pancreas; Pancreatic juice: Composition, function, and regulation of secretion (neural and humoral – CCK and secretin)-applied importance (mention steatorrhoea)

. - Functions of Liver, Composition and functions of bile, control of secretion Functions of gall bladder, filling and emptying of gall bladder Enterohepatic circulation, Jaundice – prehepatic, hepatic and post hepatic in brief

Small intestine.
1hr

Composition, regulation of secretion, and functions of intestinal juice Small intestine Functions-

Large intestine
1 hr

Functions – secretory, motor, absorptive, synthesis of short chain fatty acids.

Movements of G.I. tract. -
1hr

Movements to be taught in respective segments of GIT

Electrophysiology of smooth muscle in the GIT (revise) – BER, MMC. Peristalsis – definition, basis, functions. Mastication – definition, muscles involved, functions

Deglutition – definition, muscles involved, stages functions & abnormalities **1hr**

Gastric motility – types, regulation, abnormal movements Gastric emptying –duration, factors affecting vomiting. **1hr**

Movements of small intestine& Large intestine- Types with reference to BER mixing, pendular, movements of villi and peristalsis.

Defecation reflex, Diarrhoea, Role of dietary fibre, bacterial flora

1hr

Seminar/tutorials	4hrs
Gastro intestinal hormones	
Assignment	4hrs
(Gastrin, CCK-PZ, Secretin, Villikinin, VIP, GIP)	
INTEGRATED TEACHING	2hrs
Liver and biliary system (depts of physiology, anatomy, biochemistry and internal medicine)	
RENAL SYSTEM	LECTURES 10 hrs
Introduction-	1hr
Functions of kidney – homeostasis, as an endocrine organ Functional anatomy of Kidney Nephron-structure, parts, function, types (in detail)	
Renal circulation - Normal flow, regulation, peculiarities, and principle of measurement – Juxtaglomerular apparatus. Site, structure, function.	
Glomerular filtration:	2hrs
Definition, rate, filtration membrane, forces governing filtration and permeability of the membrane, measurement of GFR Clearance values – definition, values for glucose, insulin, and urea	
Tubular functions:	1 hr
Tubular reabsorption – define Sodium, glucose, water, urea, electrolytes - sites, mechanisms involved Tubular maximum, Glomerulo tubular feedback, and Renal threshold ,Water - reabsorption in different segments – obligatory and facultative Tubular secretion – H ⁺ (acidification), K ⁺ Filtered load, -	
Acidification of urine & Role of kidney in acid base balance	1hr
Mechanisms and sites of H ⁺ secretion, pH changes along renal tubules, fate of H ⁺ in the renal tubule (buffer systems), non-ionic diffusion. –	
Concentration of urine	2hrs
Counter current system – multiplier, exchanger Cortico medullary gradient – factors maintaining (ADH, permeability characteristics of renal tubule, role of urea and vasa recta) Osmotic gradient along renal tubules Diuresis – definition, osmotic and pressure diuresis	
Micturition:	2 hrs

Functional anatomy of bladder -muscles and sphincters and innervation of bladder, Filling and emptying of bladder, Cystometrogram Micturition reflex and its higher control, voluntary control Abnormalities of micturition – deafferented, decentralised and automatic bladder –

Urine –Normal volume, constituents abnormal --dealt in biochemistry

Mention polyuria,oliguria,anuria

1hr

Basic principles of haemo & peritoneal dialysis –Artificial kidney

RFT dealt in biochemistry

Seminar /Tutorials

6hrs

SKIN AND TEMPERATURE REGULATION

2 hrs

Functions of skin, Methods of heat conservation and loss in human body

Regulation of body temperature – role of skin, hypothalamus Hyperthermia, Fever, hypothermia

NERVE MUSCLE PHYSIOLOGY

11hrs

Excitable tissue

1hr

Definition, properties. Neuron. Structure of a typical neuron, types, properties, functions. Stimulus. Definition, types – threshold, subthreshold, suprathreshold -

Nerve fibers Types, classification, and functions

Resting membrane potential.

1hr

Definition, ionic basis and genesis -

Nerve action potential. -

Definition, ionic basis and properties, Monophasic action potential

1hr

Transmission of nerve impulses. -

1hr

Types (myelinated and unmyelinated), differences in impulse transmission. Velocity of conduction and factors affecting it

Peripheral nerve injury.

1hr

Wallerian degeneration, regeneration, denervation hypersensitivity

Neuromuscular junction.

1hr

Functional anatomy, transmission of impulses across neuromuscular junction, EPP.

Neuromuscular blocking drugs (important ones with clinical correlation).

Pathophysiology of Myasthenia Gravis

Muscles:
2hrs

Classification. Skeletal muscle Structure including molecular details, properties. Action potential - Definition, ionic basis and properties, Comparison with nerve action potential Molecular basis of muscle contraction - Excitation – contraction coupling. Types of muscle contraction – isotonic and isometric with examples. Muscle types – fast and slow, differences. Fasciculation, fibrillation (briefly) --

Cardiac muscle:
2hrs

Structure, properties. Action potential- Definition, ionic basis and properties, Comparison with nerve and muscle action potential. Pacemaker potential - molecular basis, properties -

Smooth muscle:
1 hr

Types, Structure, innervation and neuromuscular junction. Plasticity (cystometrogram to explain). –

Seminar/tutorials
Comparison of structure & function of three types of muscle
INTEGRATED TEACHING in Practicals
1hr
EMG
NERVOUS SYSTEM
LECTURES -38 hrs
Organization of nervous system:
2hrs

General organization Functional anatomy of brain and spinal cord, Coverings, white and grey mater – review briefly. Brain – lobes, functions, Brodmann's areas –important ones with functions Neuron, neuroglia – functions Spinal cord – Functional anatomy -coverings, structure, white and grey mater Cross section with location of sensory, motor and autonomic neurons and tracts.

CSF:
2hrs

Formation, circulation, composition and functions –Lumbar puncture. Blood brain barrier

Synapse:
3hrs

Types. Functional anatomy of typical chemical synapse and synaptic transmission. Synaptic potentials – EPSP, IPSP –ionic basis and comparison with action potential. Properties of synapses (one way conduction, synaptic delay, synaptic inhibition, convergence, divergence, summation, fatigue, after discharge and synaptic plasticity).

Synaptic inhibition –types, mechanisms. Neurotransmitters – facilitatory and inhibitory with 2-3 eg and clinical applications Factors affecting signal transmission -

1hr

Reflex action.& Sensory receptors

Definition, reflex arc - components Classification with examples -Mono and polysynaptic, Somatic and visceral, Superficial and deep with mention of examples (details of reflexes in motor system)

Sensory receptors. Classification (recent view), types (phasic and tonic), properties - adaptation Receptor potential, comparison with action potential.

Sensory tracts -

3hrs

Organisation of sensory pathways. Name all ascending pathways of spinal cord. Tracing of pathways from body and face. Medial lemniscal system – dorsal column sensations. Spino thalamic system. Sensation of touch and pressure. Sensation of pain and temperature. Synthetic sensation. Other ascending tracts – salient features- spinoreticular, spinocerebellar

Pain –

1hr

Different types of pain. Slow and fast pain – types of fibres, tracts and terminations. Modulation of pain - Spinal level, supra spinal level. Visceral pain, referred pain, radiating pain, - clinical correlates. Altered pain sensations Thalamus: connections in relation to function only, Functions of thalamus Thalamic syndrome –

Pain pathway – across the DRGanglion, ST Tracts, Thalamus, PAGrey Matter, Cortex, etc. Links with emotional centre. Pain appraisal – primary and secondary, subjectivity of pain experience.

3hrs

Sensory Cortex, Motor cortex & Cerebral Cortex

(not to be asked in exam)

1hr

Location – primary area, secondary area, association areas. Salient histological features. Body representation -sensory homunculus. Functions of primary, secondary and association areas. : Brodmann's areas- Lesions -

Motor system –

2hrs

Introduction, levels of motor control, review cross section of spinal cord.

Review cross section of spinal cord – various ascending and descending Pathways Stretch reflex – details and function Inverse stretch reflex, Reciprocal innervation, Other poly synaptic reflexes Pathological – Babinski sign

Descending tracts.

3hrs

Muscle spindle Structure -function-regulation

General organisation, Pyramidal and extra pyramidal tracts, their functions. Mention as medial and lateral systems, Upper motor neurons and lower motor neurons. Upper motor neuron and lower motor neuron lesions – differences Effects of lesions at various levels - hemiplegia, paraplegia, monoplegia

Cross section of spinal cord & Injuries of spinal cord **2hrs**

- complete transection, incomplete transection, hemisection, section of anterior and posterior roots, injury to motor nerve

Basal ganglia – **2hrs**

Organisation. Neuronal masses & Connections (brief). Functions. Disorders – Parkinsonism with explanation of the Physiological basis of the signs and symptoms. Wilson's disease – mention

Cerebellum- **2hrs**

Evolutional divisions & functions. Deep cerebellar nuclei, connections in relation to functions, Neuronal circuit (mention). Cerebellar lesion – features and their physiological basis -

Reticular formation: **1hr**

ARAS, descending reticular system –explain control of muscle tone

EEG and sleep.- **1hr**

Define EEG, principle of recording, Normal waves (α, β, γ and δ), alpha block, Clinical uses

Sleep-Genesis, types,& stages of sleep-Differences between REM & NREM sleep

Limbic system & Prefrontal lobe **1hr**

Organisation, connections (mention important ones) and functions -1hr

Vestibular apparatus: **2hrs**

Functional anatomy - gross structure, receptors, receptor potential Functions & abnormalities-

Muscle tone, posture, equilibrium. **1hr**

Basis of maintenance – stretch reflex, higher control, Postural reflexes – mention with levels of integration (details not required). Regulation of muscle tone and posture (righting reflexes not included) -

Hypothalamus **1hr**

Functional anatomy, Nuclei & functions

Higher functions of the brain: **2hrs**

Conditioned reflex ,Learning - Memory – types& basis
 Speech – Types, Mechanisms of speech, Aphasia – types –

Autonomic nervous system:

2hrs

Organization and functions

SEMINAR / TUTORIAL -

8hrs

Autonomic nervous system, hypothalamus, Limbic system, cross section of Spinal cord, CSF

SPECIAL SENSES

LECTURES – 16 ½ hrs

Olfaction

1hr

Receptor, pathway, lesions – anosmia, parosmia -

Taste:

1hr

Taste buds, receptor, primary taste sensations, pathway -

Vision:

10 ½hrs

Introduction. Functional anatomy of eye –

Review. Chambers of the eye, intraocular fluids - aqueous humor, vitreous humor.

Lens - characteristics, changes with age, aphakia, cataract. Retina – Histology to be reviewed, Macula lutea, fovea centralis – Explain - 1½ hr

Basic optics. -2hrs

Optical system of the eye. Refractive media of eye -Refracting surfaces & refractive indices. Concepts of reduced eye, Image formation on retina. Emmetropic eye. Far and near points Errors of refraction – chromatic and spherical aberrations, hypermetropia, myopia, and Astigmatism presbyopia, – causes (brief) features and corrective lenses. Contact lenses (mention)

Visual receptors, adaptation, Muscles of eye - 3hrs

(cones and rods). Structure in detail. Visual pigments, role of vitamin A.

Phototransduction.(only neural signaling) Adaptations of visual receptors -Dark adaptation and light adaptation. Electrophysiology of receptors, receptor potential, lateral inhibition. Electroretinogram (mention) Duplicity theory of vision, photopic and scotopic vision – Muscles of eye- Names, nerve supply and movements of eyeball

Corresponding points, double vision and squint (mention)Color vision

Primary, secondary and complementary colors (mention). Hue, brightness and saturation (mention).Trichromatic and Opponent Process Theories. Color blobs – location and function. Color blindness. Afterimages, contrasts -

Visual Pathways. 2hrs

Monoocular and binocular vision. Visual signals -Processing in the Retina. Effects of lesion at different levels. Macular sparing (recent views) Visual cortex – all areas and functions

Visual reflexes. Pupillary light reflex (direct and indirect) - pathway, lesion, Miosis & mydriasis (mention).

Accommodation and accommodation reflex (Near response) –3 components - Pupillary constriction, convergence of eye balls, and increased anterior curvature of lens.. –

Accommodation reflex – pathways, lesions. -

2hrs

Tests of Vision -Field of vision, Visual acuity, Color vision – definition, details of tests in practicals

AUDITION

4hrs

Acoustics – frequency, amplitude of sound, pitch, intensity, and quality of sound.

Functional anatomy of the ear. Functions of external, middle and inner ear - **1hr**

Cochlea – structure, Organ of corti. Hair cell physiology- receptor potential. Mechano-electrical transduction by hair cells. Endocochlear potential. Discrimination of pitch (travelling wave theory) and intensity of sound -

2hr

Auditory pathway. Sound localization, pitch discrimination, masking of sounds. Deafness (conduction and nerve deafness) –

1hr

Audiometry (details in practicals) -

1hr

LECTURES -20 hrs

ENDOCRINOLOGY

General endocrinology& Hypothalamus

-3hrs

Names and organisation of Endocrine glands in human body Hormone – definition, and classification – on chemical nature. General hormones and local hormones – autocrine, paracrine and endocrine.hormones. Mechanism of action of hormones. Hormone receptors – cell membrane and intracellular, Mechanism of action via the different receptors – basics with 2 examples, Second messenger system –brief. Control of secretion of hormones in general – the + ve and –ve feed back with 2 examples. Abnormalities of hormone function – decrease, increase, receptor dysfunction, abnormal hormones or antibodies to be dealt with individual glands

Hypothalamus Functional anatomy, Hormones (Releasing and inhibiting), their physiological actions Interrelationship between hypothalamus and pituitary glands – Infundibulum -hypothalamo –pituitary tract and portal system.

Pituitary gland
4 hrs

Hormones of anterior and posterior pituitary. Growth hormone - physiological actions and regulation of secretion in detail. Hyper and hypofunction – Acromegaly, Gigantism and Dwarfism. Other hormones to be dealt with the target glands, Mention intermediate lobe hormones - pro opiomelanocortin and MSH -

Thyroid gland:
4hrs

Hormones- names, biosynthesis (details in biochemistry), transport, physiological actions and regulation of secretion (H-P-T axis). Thyroid function tests (details in biochemistry). Hyper and hypofunction in children and adults – Cretinism, Myxedema, Hyperthyroidism -

Pancreas – Endocrine.
2hrs

Hormones- physiological actions and regulation of secretion. Insulin - receptors and insulin resistance (mention) Physiological actions Regulation of secretion Hyper and hypofunction

– diabetes mellitus and hypoglycemia. Glucagon – physiologic actions on carbohydrate, proteins and fat metabolism, on heart. Regulation of secretion. Somatostatin – site of production, actions, stimuli for secretion, paracrine regulations. Pancreatic polypeptide – site of secretion, factors which increase secretion, action

Adrenal gland:
4hrs

Adrenal Cortex: 3hrs

3 layers (briefly) Biosynthesis of adrenal cortical hormones (details in biochemistry). Hormones of adrenal cortex – glucocorticoids, mineralocorticoids, sex steroids. Transport, physiological actions and regulation of secretion glucocorticoids - metabolic, permissive, anti inflammatory, anti allergic and in stress. Regulation of secretion – H-P-A axis mineralocorticoids – role in salt and water balance, stress. Regulation of secretion – effects of K⁺, Na⁺, ACTH Hyper and hypofunction – Cushing's syndrome. Primary and secondary hyperaldosteronism, Addison's disease –

Adrenal medulla: Hormones (catecholamine), regulation of secretion, Pheochromocytoma -1hr

Calcium homeostasis
-2hrs

Normal calcium metabolism (outline). Parathyroid hormone, calcitonin and vitamin D - target organs and physiological actions. Hypocalcemia and tetany -

Other endocrine glands & Local Hormones-
1hr

Physiological actions and regulation of secretion – Kidney, Pineal body (retino

hypothalamic tract – very brief). Thymus, Heart, Local hormones, Histamine, Sub P, bradykinin, serotonin, prostaglandins, Sources and physiological actions -

SEMINARS / TUTORIALS -

Physiology of growth and development. Correlation of actions of different hormones from childhood, puberty and adulthood (briefly) -**1hr**

PHYSIOLOGY OF REPRODUCTION

LECTURES -11hrs

Introduction

1hr

Briefly on hormonal factors influencing development of genitalia. Developmental abnormalities-(adrenogenital, hermaphroditism). Puberty – normal, precocious and delayed puberty -

Male reproductive system.

2hrs

Functions of testis – endocrine -testosterone (functions and regulation of secretion) - Factors influencing Spermatogenesis and regulating it. Abnormalities of testicular function

- cryptorchidism, male hypogonadism (mention) Erection, ejaculation, composition of semen, sterility -

Female reproductive system:

2hrs

Ovarian hormones- estrogens, progesterone, relaxin. Control of ovarian functions by H- P-Gonadal axis. Pituitary gonadotropins (FSH, LH), Prolactin – physiologic actions, regulation of secretion

Menstrual cycle:

2hrs

Menstrual, proliferative and secretory phases. Ovarian, uterine and vaginal changes during menstrual cycle. Hormonal regulation. Abnormalities of ovarian function - anovulatory cycle, infertility. Menarche, menopause. Castration before and after puberty -

Pregnancy & Lactation –

3hrs

Corpus luteum of pregnancy. Placenta – functions, Placental hormones. Foetoplacental unit. Parturition – physiology of labour. Lactation Mention Neuroendocrine reflex in Parturition & Lactation Pregnancy tests – immunological (currently done). Hormones influencing and their actions -

Contraception:

1hr

Temporary and permanent methods in males and females, and their physiological basis -

INTEGRATED TEACHING -

1hr

Induction of ovulation, in vitro fertilization, Infertility (with O &G dept)

DETAILS OF PRACTICALS**Human Physiology****-76hr**

1. Use and care of microscope and microscopic examination of blood
2. PCV, ESR, osmotic fragility
3. Haemoglobin estimation and blood indices
4. RBC count
5. WBC count
6. Examination of peripheral blood smear
7. Differential WBC count – normal, abnormal, anaemias
8. ABO grouping, Rh typing
9. Bleeding time, clotting time
10. Recording of BP – effects of posture and exercise
11. Recording of arterial pulse only
12. Respiratory movements demonstration
13. General examination
14. Examination of Respiratory system
15. Examination of CVS
16. Examination of higher functions and sensory system
17. Examination of Motor system
18. Examination reflexes
19. Examination of cranial nerves 1-6
20. Examination of cranial nerves 7-12
21. Revisions as required

Experimental physiology(Demonstration through e-modules /recorded graphs **-28hr**

1. Appliances in experimental physiology Laboratory including physiograph
2. Pithing, muscle nerve preparation, mounting, effects of different types of stimuli
3. Simple muscle twitch
4. Two successive stimuli, repetitive stimuli and fatigue
5. Genesis of tetanus and Starling's law of muscle
6. Effect of load and after load on muscle contraction
7. Effects of variations of temperature on muscle contraction
8. Velocity of nerve impulse
9. Normal cardiogram of frog's heart and effects of heat and cold.
10. Effect of temperature on frog's heart
11. Refractory period of frog's heart
12. Stannius ligatures. Properties of cardiac muscle – all or none law, treppe, summation of subminimal stimuli
13. Effect of vagal stimulation on frog's heart
14. Perfusion of frog's heart – action of ions, action of drugs

Demonstration Only

Electro encephalogram (EEG), Electro miogram (EMG),
Electro Cardio Gram (ECG), Audiometry, Perimetry,
Spirometry

Recommended Text Books

1. Text book of Physiology by Arthur C Guyton-13th edition
2. Review of Medical Physiology by Ganong.-24th edition
3. Text book of Physiology by G.K.Pal
4. Text book of Physiology by A.K.Jain (2volumes)

Reference Books

1. Text book of Human Physiology. Madhavan Kutty, Sarada Subramaniam, HD Sing, S. Chand and Company
2. Wintrobe's Hematology
3. Williams text book of Endocrinology
4. Snell's neuroanatomy
5. Samson Wright's applied physiology
6. Best and Taylor's Physiological Basis of Medical Practice
7. Understanding Medical Physicology. R.I. Bajalani Jaypee Publishers
8. Best and Taylor's basis of Medical Practice by J B West-William and Walkins

EVALUATION

M.C.I. Guidelines

1. Problem solving exercises

2. OSPE (Objective Structured Practical Examination)
3. Viva Voce – with practicals

Pattern of questions in Theory paper

Paper 1: Blood, CVS, Respiration, Renal , Environmental Physiology, Digestion, Regulation of Temperature,

Paper II: General Physiology, CNS, Special senses, Muscle and Nerve, Endocrinology, Reproduction, Growth and development,

- Structured Essay (preferably case scenario) - I no.(10 marks)
- Short questions- 2 nos. (5marks x 2 =10 marks)
- Write briefly on-5 nos. (3 marks x 5 = 15 marks)
- Draw labelled diagrams-2 nos. (2 ½ marks x 2 =5)
- Physiological basis/Give reasons- 5 nos. (2 marks x 5 =10)

Physiology Practical Exam

- Max marks - 40(university) +20 (Internal)= 60 marks
 - Practical - I (20 marks)
 - Spotters -10 marks
 - Amphibian graph – 5 marks
 - Short hematology – 5 marks
 - Practical -II (20 marks)
 - Clinical Exam -10 marks
 - Long hematology (any one of the following - RBC count / WBC count / Peripheral Smear) -10 marks

Mark distribution

- Theory : (Total-140 marks)
 - Theory Paper I + II = (50 + 50) =100 marks(University)
 - Viva- 20 marks
 - Internal asessment- 20 marks

Practicals : (Total-60 marks)

- Practicals I & II-(20+20) =40 marks(University)
- Internal assessment - 20 marks
- Aggregate : 200 marks
- Internal Assessment

Based on day to day performance assessed by daily evaluation, short examinations, tutorials, seminars, sessional examinations etc.

Theory – Pattern of Question paper - Two papers of three hours duration (50 marks each)

OBJECTIVE STRUCTURED PRACTICAL EXAMINATION (OSPE)

SPOTTERS : 10 Numbers-Based on calculations, ,instruments,charts, microscopic slides of blood cells, graphs,(including graphs from systems,amphibian expts-skeletal muscle/cardiac muscle) clinical history,clinical skill)

Seminars :

Guide lines:

- Allot 8 topics for a day.
- Assign a single topic per student for presentation that lasts 10 minutes
- All the students should learn all the 8 topics to participate in the post test session (10 questions) after the presentation session
- Marks: 10 marks for presentation & 10 marks for post test
Consider 10 % of this mark for internal assessment

List of Assignment topics and Seminar topics can be prepared by the department.
Records should be maintained with marks assigned during internal assessment

FORENSIC MEDICINE AND TOXICOLOGY

GOAL

The broad goal of the teaching of undergraduate students in Forensic medicine is to produce a physician who is well informed about medico legal responsibilities in practice of medicine. He/she acquire knowledge of law in relation to medical practice, medical negligence and respect for codes of medical ethics.

Learning objectives-

1. Be conversant with medical ethics, etiquette, duties rights and legal