

KRISHNA INSTITUTE OF MEDICAL SCIENCES UNIVERSITY, KARAD.



**KRISHNA
VISHWA
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(Deemed to be University)

Knowledge • Innovation • Excellence

KRISHNA INSTITUTE OF MEDICAL SCIENCES

KVV/KIMS/CURRICULUM/PHYSIOLOGY

UG/ NEUROPHYSIOLOGY TECHNOLOGY SYLLABUS



Programme name : - B.Sc.Neurophysiology Technology

Curriculum Syllabus

(2022-23)

COURSE OVER-VIEW

Course Description:

The three year B.Sc. Neurophysiology Technology course will empower the candidate to carry out Neurophysiological testing which is an important component to the clinical evaluation of neurological disorders in children and adults.

Important neurology investigations included in the programme are electroencephalography (EEG), nerve conduction studies (NCV), electromyography (EMG), Evoked potentials, autonomic function tests. etc.

Neurophysiology deals with physiology and neuroscience which directly connects with the course study of nervous system functionality. It is a three years C.B.C.S. full time program inclusive of six semesters.

PROGRAM OBJECTIVES

- ❖ To promote the acquisition of knowledge and provide experience in laboratory.
- ❖ To promote the development of investigative skills to better understand neurophysiologic processes.
- ❖ The graduates will get hands on experience in various aspects of neurophysiology technology Viz Electrophysiology equipments, medical program developers, software testing for EEG, EMG/NCV Machines.
- ❖ To gain experience and skill in interpreting emergency portable EMG/NCV, EEG in patient AndIntensive care setting.
- ❖ The program will help the graduates to take up responsibilities in testing Identifying and AnalyzeComplex epilepsy and neurological diseases.
- ❖ Promote effective communication and sharing of expertise with peers and colleagues.
- ❖ To promote research and paper publishing skills in the students

At the end of the Programme

- Student should know basic knowledge of Anatomy, Physiology, Biochemistry, Electronics, Neuropharmacology, Microbiology and statistics in relations with central nervous system disorders.
- Students should able to plan and record neurological investigations such as EEG, NCV, EMG, VEP, BAEP, SSEP in a given patient.
- Students should able to plan and conduct research and publish research material in the Indexed journals.

Semester -I

B.Sc.Neurophysiology Technology

Sr.Number	Content	No.Hours	Credits
A.CORESUBJECT			
a–Theory			
1)PaperI	(Lectures,Tutorials) Anatomy I	45	3
2)PaperII	(Lectures,Tutorials)Physiology I	45	3
3)PaperIII	(Lectures,Tutorials) Biochemistry I	45	3
4)PaperIV	(Lectures,Tutorials)Nursing and first aid &MedicalTerminology I	45	3
b–Practical			
1)PaperI	Anatomy I	60	2
2)PaperII	Physiology I	60	2
3)PaperIII	Biochemistry I	60	2
4)PaperIV	Nursing and first aid& Medical Terminology I	60	2
B.DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a–Theory			
1.		----	----
2.			
b–Practical			
1.		-----	-----
2.			
C.GENERIC ELECTIVE (ANY ONE)STRESSMANAGEMENT,PERSONALITY DEVELOPMENT			
a.-Theory			
1.		30	2
b–Practical			
1.		90	3
D			
Case studies		30	1
	Total	570	26

ANATOMY

ANATOMY THEORY (SEMESTER-I)

A) GENERALANATOMY

- 1) Introduction to anatomy, descriptive terms, anatomical planes, types of tissues.
- 2) Introduction to bones.
- 3) Introduction to joints.
- 4) Introduction to muscular system.
- 5) Introduction to cardiovascular system.
- 6) Introduction to nervous system.

B) REGIONALANATOMY

a) Upper extremity

- 1) Osteology: clavicle, scapula and humerus.
- 2) Pectoral region, axilla and back
- 3) Shoulder region, axilla including brachial plexus
- 4) Shoulder joint
- 5) Front of arm
- 6) Back of arm
- 7) Osteology: Radius, ulna, articulated hand
- 8) Front of forearm
- 9) Palm
- 10) Back of forearm
- 11) Dorsum of hand
- 12) Elbow joint, radioulnar joints
- 13) Wrist joint, joints of hand
- 14) Nerve injuries, types of grip and dermatomes of upper limb

b) Lowerextremity

- 1) Osteology: hip bone, femur, patella
- 2) Front of thigh
- 3) Medial side of thigh
- 4) Gluteal region
- 5) Back of thigh, popliteal fossa
- 6) Hip joint
- 7) Osteology: tibia, fibula, articulated foot

- 8) Front of leg, dorsum of foot
- 9) Back of leg
- 10) Sole of foot
- 11) Knee joint
- 12) Ankle joint and joints of foot

c) **Thorax**

- 1) Introduction to thorax, bony thorax, dorsal vertebrae, intercostal spaces
- 2) Joints of thorax and movements
- 3) Mediastinum: definition, boundaries, subdivisions and contents
- 4) Pleura, lungs
- 5) Heart: external and internal features, blood and nerve supply
- 6) Arch of aorta, superior vena cava, brachiocephalic vein, trachea and thymus
- 7) Esophagus, descending aorta, sympathetic trunk, azygos system
- 8) Diencephalon
- 9) Basal ganglia
- 10) Cranial nerve nuclei
- 11) Ventricles of brain, CSF circulation
- 12) Internal capsule, commissures of brain and visual pathway
- 13) Autonomic nervous system
- 14) Limbic system

PHYSIOLOGY

PHYSIOLOGY THEORY (SEMESTER I)

- 1) **Cell:-**
 - a) Basic concepts of cell structure, components, functions and transport
- 2) **Skin:-**
 - a) Structure, functions, temperature regulation
- 3) **Blood:-**
 - a) Composition and function of blood
 - b) Red blood cells: morphology, formation, normal counts, functions
 - c) White blood cells: morphology, formation, normal counts, functions
 - d) Platelets: morphology, formation, normal counts, functions
 - e) Hemoglobin: basic chemistry, function and fate of hemoglobin
 - f) Blood clotting: definition, clotting factors, theories of clotting
 - g) Blood group: ABO system, Rh system

- h) Blood volume and regulation
 - i) Blood transfusion
- 4) **Cardiovascular:-**
- a) Structure and properties of cardiac muscle
 - b) Cardiac cycle, conductive system, ECG
 - c) Heart sounds
 - d) Heart rate and regulation
 - e) Cardiac output and regulation
 - f) Blood pressure and regulation
 - g) Regional circulation: cerebral, coronary, pulmonary, renal
 - h) Effect of exercise on cardiovascular system
- 5) **Respiration:-**
- a) Structure and functions of respiratory system
 - b) Mechanics of respiration: muscles, lungs and chest wall compliance, V/Qratio, surfactant
 - c) Transport of gases: O₂ and CO₂
 - d) Nervous and chemical regulation of respiration
 - e) Hypoxia, cyanosis, and dyspnea
 - f) Acid base balance
 - g) Principles of lung function tests
 - h) Artificial respiration
 - i) Effect of exercise on respiratory system
 - j) Defense mechanisms
- 6) **Digestion:-**
- a) Structure and function of gastrointestinal system
 - b) Mastication and deglutition
 - c) Saliva: composition, function, regulation
 - d) Gastric secretion: composition, phases of secretion, function
 - e) Pancreatic secretion: composition, function, regulation
 - f) Bile: composition and function
 - g) Movements of small and large intestine
 - h) Digestion in mouth, stomach, intestine
 - i) Defecation
- 7) **Excretion:-**
- a) Structure and function of kidney
 - b) Structure and function of nephron
 - c) Formation of urine: filtration, reabsorption, secretion
 - d) Micturition.

BIOCHEMISTRY

BIOCHEMISTRY THEORY (SEMESTER I)

1) Enzymes:-

- a) Definition–Nomenclature–Classification–Factors affecting enzyme activity–Active site–Coenzyme
- b) Enzyme Inhibition–Units of enzyme–Isoenzymes–Enzyme pattern in diseases

2) Carbohydrates:-

- a) Overview of glucose metabolism
- b) Overview of glycogen metabolism, diabetes mellitus- clinical features, investigations

3) Proteins:-

- a) Classification of proteins and functions

4) Lipids:-

- a) Classification of lipids and functions.
- b) Blood.

NURSING

BASIC NURSING THEORY (SEMESTER-I)

- 1) Introduction to Nursing, patient positioning and safety
- 2) Bandaging including practical work
- 3) Lifting and transporting patients
- 4) Providing for patients elimination
- 5) Methods of giving nourishment
- 6) Surgical dressing (aseptic technique) including demonstration
- 7) Parenteral administration of medicine
- 8) Vital signs including practical work
- 9) First aid for Burns and Scalds, degrees of burns

MEDICAL TERMINOLOGY-I

Introduction to Medical Terminology

- 1) Definition and Origin of Medical Terms.
- 2) Components of Medical Terms
- 3) Prefixes
- 4) Suffixes

ANATOMY PRACTICALS (SEMESTER-I)

- 1) **Demonstration- Superior extremity:** Bone, clavicle, scapula, humerus, radius, ulna, articulated hand, surface anatomy, Radiology.
- 2) **Demonstration- Inferior extremity:** Hip bone I and II, femur, patella, tibia, fibula, articulated foot, Radiology.
- 3) **Demonstration of Thorax:** Sternum, typical rib, thoracic vertebra, Radiology, surface anatomy.
- 4) **Dissection of superior extremity:** Introduction of pectoral region, axilla, shoulder, shoulder joints, arm, cubital fossa, fore arm and hand, deep muscles, palm, back and dorsum of hand.
- 5) **Dissection of thorax:** Introduction, wall and cavity of thorax, heart and its blood supply, superior mediastinum, posterior mediastinum.
- 6) **Lower limb:** Front of thigh, deep dissection of front thigh, femoral triangle, middle side of thigh, gluteal region, popliteal fossa, back thigh, hip joint, front of leg, dorsum of foot, lateral side of leg, back of leg with deep muscles, sole of the foot,

PHYSIOLOGY PRACTICALS (SEMESTER-I).

- 1) Estimation of Hemoglobin.
- 2) W.B.C Count.
- 3) R.B.C Count.
- 4) Determination of Blood Groups.
- 5) Differential W.B.C Count.
- 6) Determination of BT&CT.
- 7) Platelets Counts.
- 8) Reticulocyte Counts.
- 9) Determination of ESR & PCV.

BIOCHEMISTRY PRACTICALS (SEMESTER-I).

Demonstrations / Practicals.

- 1) Glassware and Reagents
- 2) Determination of Serum Inorganic Phosphorous
- 3) Liver Function Tests- A. (Serum Bilirubin)
- 4) Liver Function Tests - B. (Serum AST and ALT)
- 5) Colorimetry and Spectrophotometry

NURSING PRACTICALS (SEMESTER-I)

- 1) Cardiopulmonary Resuscitation (CPR)
- 2) Bandaging
- 3) Poisoning
- 4) First aid treatment

Semester - II

B.Sc.Neurophysiology Technology
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Sr.Number	Content	No.H ours	Credits
A.CORESUBJECT			
a.THEORY			
1)PaperI	(Lectures,Tutorials) Anatomy II	45	3
2)PaperII	(Lectures,Tutorials) Physiology II	45	3
3)PaperIII	(Lectures,Tutorials) Biochemistry II	45	3
4)PaperIV	(Lectures,Tutorials) Nursing & First Aid and Medical Terminology	45	3
b.Practical			
1)PaperI	Anatomy II.	60	2
2)PaperII	PhysiologyII.	60	2
3)PaperIII	Biochemistry II .	60	2
4)PaperIV	Nursing & First Aid and Medical Terminology .II	60	2
B.DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a–Theory			
1.	Advanced Electronics,Recent advances	60	4
2.	Use of Computers & Soft wares for analysis		
b–Practical			
1.	Advanced Electronics,Recent advances	90	3
2.	Use of Computers & Soft wares for analysis		
C.GENERICELECTIVE.(ANYONE)			
A–Theory			
1.		----	----
b–Practice			
1.		----	----
D. Case studies		-----	---
	Total	570	27
ANATOMY			

A) Abdomen, pelvis and perineum:-

- 1) Osteology: hip bone, lumbar vertebrae, sacrum
- 2) Anterior abdominal wall, inguinal canal, male external genitalia

B) Muscles of posterior abdominal wall, peritoneal cavity:-

- 1) Stomach and spleen
- 2) Duodenum and pancreas
- 3) Liver and extrahepatic biliary apparatus
- 4) Small and large intestines, portal vein
- 5) Kidney and suprarenal glands
- 6) Aorta, inferior vena cava, lumbar plexus
- 7) Diaphragm
- 8) Bony pelvis, joints and walls of pelvis
- 9) Rectum and anal canal
- 10) Male pelvis: urinary bladder, prostate, seminal vesicles
- 11) Female pelvis: vessels and nerves of pelvis, uterus, Fallopian tubes, ovary
- 12) Perineum

C) Head and neck

- 1) Osteology: external features of skull, cervical vertebra
- 2) Face and scalp
- 3) Posterior triangle
- 4) Main vessels of head and neck
- 5) Main nerves of head and neck
- 6) Parotid region and infratemporal fossa
- 7) Cranium and meninges
- 8) Cranial nerves
- 9) Orbit and eye
- 10) Ear
- 11) Mouth and pharynx
- 12) Palate, nose, larynx

D) Neuro anatomy

- 1) Spinal cord: gross anatomy
- 2) Spinal cord: tracts
- 3) Brainstem
- 4) Cerebellum
- 5) Cerebral hemispheres

A) Endocrine

- 1) General organization of endocrine glands
- 2) General metabolism: carbohydrate, fat, protein
- 3) Physiological actions, regulation and disorder of hormones: adrenal, pancreatic, parathyroid, thyroid

B) Reproduction

- 1) Male reproductive system
- 2) Female reproductive system
- 3) Pregnancy, function of placenta, parturition, lactation, contraception
- 4) Puberty and menopause
- 5) Spermatogenesis and oogenesis
- 6) Menstrual cycle

C) Nervous system

- 1) General organization of nervous system
- 2) Structure, type and function of neuron
- 3) Properties of neurons
- 4) Synapse and synaptic transmission
- 5) Neurotransmitters
- 6) Reflex: properties and types
- 7) Sensory: receptors, sensory pathway, pain pathway, referred pain, modulation of pain
- 8) Motor: basal ganglia, cerebellum, cortex – functions and effects of lesions
- 9) Ascending and descending pathways
- 10) Posture and equilibrium
- 11) Muscle tone
- 12) Autonomic nervous system: organization and functions of sympathetic and parasympathetic nervous systems
- 13) Cerebrospinal fluid: composition, formation, circulation and function
- 14) Lower motor neuron and upper motor neuron lesion

D) Special senses

- 1) Vision: rods and cones, retina and its function, visual pathway
- 2) Hearing: organ of Corti, auditory pathway
- 3) Olfaction
- 4) Taste: taste buds.

E) Muscle

- 1) Structure of muscle: macroscopic and microscopic
- 2) Properties of skeletal muscle
- 3) Cardiac and smooth muscle
- 4) Chemical processes involved in muscle contraction
- 5) Motor unit and electromyography
- 6) Effect of exercise of muscular system, exercise metabolism, O_2 debt, respiratory quotient.

BIOCHEMISTRY

BIOCHEMISTRY THEORY (SEMESTER II)

1) Vitamins

- a) Fat soluble vitamins (A,D,E,K)
- b) Water soluble vitamins – B-complex vitamins, vitamin C

2) Minerals:-

- a) Major elements Calcium, Phosphorus,
- b) Trace elements, Magnesium, Sodium, Potassium, Chlorine and sulphur

3) Nutrition:-

- a) Calorific value of foods – Basal metabolic rate(BMR) – respiratory quotient(RQ) Specific dynamic action (SDA) – Balanced diet
- b) Marasmus – Kwashiorkor, obesity, diet in DM, CVD, Kidney disease

4) Acids and bases

- a) Definition, pH, Henderson – Hasselbalch equation, Buffers, Indicators, Normality, Molarity, Molality
- b) Acid base balance in the body

5) Body fluids, hormones

- a) Chemistry of the body fluids in health and diseases (Urine-normal and abnormal, blood/serum, CSF)
- b) Hormones,

6) Clotting mechanisms of the blood

BASIC NURSING AND FIRST AID THEORY (SEMESTER II)

- 1) Poisoning: Irritants, acids, alkali, narcotics
- 2) Trauma due to foreign body: eye, ear, nose, throat, stomach and lung
- 3) Bites: insects, dog and snake
- 4) Skeletal injuries
- 5) Respiratory emergencies: Ventilators, monitors including demonstration

MEDICAL TERMINOLOGY (Semester II).

- 1) Roots and Combining forms.
- 2) External Anatomy and Internal Anatomy
- 3) Additional Lists and the intercombining form groups are:
 - Verbs
 - Adjectives
 - Body Fluids
 - Body Substances
 - Chemicals
 - Colours

Phobias

ANATOMY PRACTICALS (SEMESTER II)

- 1) **Abdomen demonstration:** Lumbar vertebra, Sacrum, Bony Pelvis, liver, small intestine, surface anatomy, Radiology,
- 2) **Abdomen dissection:** Introduction, anterior abdominal wall, male ext. genitalia, abdominal cavity, spleen, stomach, appendix, liver, gall bladder, kidney, pelvis, anal region, ovaries, uterine tube, urinary bladder, prostate, uterus, rectum, canal.
- 3) **Demonstration- Brain:** Spinal cord, medulla, pons, cerebellum, mid brain, cerebral hemispheres, section of brain.
- 4) **Demonstration- H. N. F.:** Norma basalis, interior, foetal skull, adult skull, mandible, cervical vertebra, hyoid bone, radiology.
- 5) **Dissection of brain:** Introduction, blood supply, hind brain, midbrain, cerebrum, white matter, lateral ventricle, thalamic optic tract, deep nuclei.
- 6) **H. N. F. dissection:** Anterior triangle of neck, back, cranial cavity, deep dissection neck, orbit and middle ear, parotid gland, temporal and infratemporal region, Pharynx and mouth, nose cavity and larynx.

PHYSIOLOGY PRACTICALS (SEMESTER II)

- 1) Examination of Sensory System.
- 2) Examination of higher functions
- 3) Examination of cranial nerves
- 4) Examination of Motor system I.
- 5) Examination of Motor system II.
- 6) Examination of Eyes & Visual Reflexes.
- 7) Tests for Hearing.
- 8) Tests for smell & Taste.
- 9) Electrocardiography (ECG)
- 10) Perimetry.
- 11) Spirometry.

BIOCHEMISTRY PRACTICALS (SEMESTER II).

Demonstrations :

- 1) Determination of pH
- 2) Determination of Electrolytes
- 3) Chromatography
- 4) Electrophoresis
- 5) Blood Gas analysis.

NURSING PRACTICALS (SEMESTER- II)

- 1) Emergency management
- 2) Personal hygienic care
- 3) Assessment of Glasgow coma Scale

Semester - III

B.Sc.Neurophysiology Technology			
Sr.Number	Content	No.Hours	Credits
A.CORESUBJECT			

a.Theory			
1)PaperI	(Lectures,Tutorials)Electroencephalography I	30	2
2)PaperII	(Lectures,Tutorials) Electronics I	30	2
3)PaperIII	(Lectures,Tutorials) Evoked Potential I	30	2
4)PaperIV	(Lectures,Tutorials) Clinical Neurology I	30	2
b.Practical			
1)PaperI	Electroencephalography I	60	2
2)PaperII	Electronics I	60	2
3)PaperIII	Evoked Potential I	60	2
4)PaperIV	Clinical Neurology I	60	2
B. DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a–Theory			
1.		--	--
2.			
b–Practical			
1.		--	--
2.			
C.GENERICELECTIVE (ANYONE)			
a–Theory			
1.		----	----
b–Practice			
1.		----	----
D.			
Case studies		180	6
	Total	540	22

PHYSIOLOGY

PHYSIOLOGY THEORY (SEMESTER III)

ELECTROENCEPHALOGRAPHY- I

- 1) Historical aspects of EEG
- 2) Neurophysiologic basis of EEG and DC potentials
- 3) Analog signal recording principles
- 4) Digital EEG
- 5) Polarity and field determination – electrode placement, montages, ten-twenty system
- 6) Normal EEG and sleep in preterm and term neonates
- 7) Normal EEG and sleep from infancy to adolescents
- 8) Normal EEG and sleep in adults and elderly
- 9) Activation methods
- 10) Artefacts of recording
- 11) Epileptiform and non-epileptiform paroxysmal EEG abnormalities
- 12) Clinical EEG in seizures and epilepsies in the preterm and term neonate
- 13) Clinical EEG in seizures and epilepsy in infants to adolescents

ELECTRONICS -I

I Basic Electronics

Conductors, Insulators, Semiconductors, Energy band diagram of semiconductors, Ohm's Law, Kirchhoff's voltage and current law, Resistors, Capacitors, Inductors, Resistors in serial and parallel combination, transformer.

P-N junction diode, forward and reverse bias characteristics, PNP and NPN transistors, Half wave rectifier, Full wave rectifier, filters, voltage regulator.

II Neurology Equipments

Bio potentials electrodes, Transducers, Differential amplifiers, Filters (Hi-pass, low-pass, band-pass), Analog to digital converter, recording devices – CRO, PMMC. Computers in neurology equipments, calibration.

EEG machine – Block diagram

EMG machine – Block diagram.

EVOKED POTENTIALS -I

- 1) Event-related potentials (ERP): general aspects and quantification
- 2) Visual evoked potential (VEP)
 - a) Anatomical basis of VEP
 - b) Method of recording VEP
 - c) Normal VEP and waveforms
 - d) Variables influencing VEP
 - e) Clinical applications of VEP

CLINICAL NEUROLOGY

CLINICAL NEUROLOGY-I

1) Introduction to Neurology

- a) Neurological diseases – a basic approach
- b) Clinical examination basics
- c) Episodic impairment of consciousness
- d) Delirium and altered sensorium
- e) Stupor and Coma
- f) Memory Impairment
- g) Child with developmental delay
- h) Behavioral disorders
- i) Apraxia, agnosia and aphasia
- j) Disorders of vision
- k) Hearing impairment and vertigo
- l) Cranial and facial pain
- m) Brainstem syndromes
- n) Ataxic disorders
- o) Movement disorders
- p) Gait disorders
- q) Hemiplegia and monoplegia
- r) Paraplegia
- s) Proximal and distal weakness
- t) Floppy infant
- u) Sensory abnormalities of face, trunk and limbs
- v) Neurological causes of bladder, bowel and sexual dysfunction
- w) The Epilepsies

2) Neuropathology

- a) General pathology
- b) Disorders of muscle
- c) Disorders of nerve
- d) Disorders of brain.

PHYSIOLOGY PRACTICALS (SEMESTER III)

Paper – I EEG-I

- 1) Study and arrangement of various montages.
- 2) Recording of normal EEG.
- 3) Activation procedures- photic stimulation & Hyperventilation.

Paper-II Electronics-I

- 1) Study of various neurophysiology instruments, electrodes, electronic components,

connections.

Paper-III Evoked Potentials-I

- 1) Study of electrode placements & recording procedure of study of VEP in subjects and patients. Study of normal VEP identifications of various waves and abnormal VEP finding.

Paper-IV Clinical Neurology-I

- 1) Visit to OPD & wards for observing & studying various patients of CNS disorders for indications of EEG & VEP.

Semester - IV

B.Sc.Neurophysiology Technology			
Sr.Number	Content	No.H ours	Credits
A.CORESUBJECT			
a.Theory			
1)PaperI	(Lectures,Tutorials) Electroencephalography II	30	2

2)PaperII	(Lectures,Tutorials)Electronics II	30	2
3)PaperIII	(Lectures,Tutorials) Evoked Potential II	30	2
4)PaperIV	(Lectures,Tutorials)Clinical neurology II	30	2
b.Practical			
1)PaperI	Electroencephalography II	60	2
2)PaperII	Electronics II	60	2
3)PaperIII	Evoked Potential	60	2
4)PaperIV	Clinical neurology II	60	2
B.DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a.-Theory			
1.	Recent advances in Evoked Potential	60	4
	Use of Computers &softwares for EMG analysis		
b.-Practical			
1.	Recent advances in Evoked Potential	90	3
2.	Use of Computers &softwares for EMG analysis		
C.GENERICELECTIVE (ANYONE)			
a–Theory			
1.		-----	-----
b–Practice			
1.		-----	-----
D. Case studies		60	2
	Total	570	25

PHYSIOLOGY

PHYSIOLOGY THEORY (SEMESTER IV)

ELECTROENCEPHALOGRAPHY- II

- 1) Clinical EEG in epilepsy in adults and the elderly
- 2) EEG in status epilepticus and nonconvulsive status epilepticus
- 3) Special techniques in recording – depth electrodes, intracranial monitoring, electrocorticography
- 4) Techniques for Long term EEG recording – video EEG, ambulatory EEG, ICU recordings
- 5) Polysomnography
- 6) Magnetoencephalography
- 7) EEG in brain tumors and strokes
- 8) EEG in Central nervous system infections and infestations
- 9) EEG in dementia and degenerative diseases
- 10) EEG in metabolic disorders
- 11) EEG in coma and brain death
- 12) EEG in psychiatric diseases
- 13) Role of EEG in presurgical evaluation of epilepsy

ELECTRONICS –II

Overview of all Medical Electronic Equipment

- 1) Types of medical equipment – Diagnostic, Therapeutic, Analytical
- 2) Hazards and safety measures in medical equipments
- 3) Classification of equipment based on electrical safety
- 4) International standards and certification of medical equipment
- 5) Various symbols, color coding, controls and their meaning pertaining to medical equipment
- 6) Dos and don'ts for users of medical equipment.
- 7) Calibration - for different medical equipment and their importance

EVOKED POTENTIALS -II

- 1) **Brainstem auditory evoked potentials (BAEP)**
 - a) Anatomical basis of BAEP
 - b) Method of recording BAEP
 - c) Variables influencing BAEP
 - d) Normal BAEP, potential field distribution, waveforms
 - e) Clinical applications of BAEP
- 2) **Somatosensory evoked potentials (SEP)**

- a) Anatomical basis of SEP
- b) Stimulation and recording procedures
- c) Median somatosensory evoked potential
- d) Tibial somatosensory evoked potential
- e) Clinical applications of SEP

CLINICAL NEUROLOGY-II

3) Neuropharmacology

- a) General pharmacology: definitions, routes of drug administration, pharmacokinetics, pharmacodynamics
- b) Drugs acting on the autonomic nervous system
- c) General and local anesthetics, skeletal muscle relaxants
- d) Sedative hypnotics, ethyl alcohol
- e) Antiepileptic drugs
- f) Antiparkinsonian drugs
- g) Drugs used in mental illness
- h) CNS stimulants and cerebroactive drugs
- i) Drugs affecting coagulation, bleeding and thrombosis
- j) Antiseptics, disinfectants

4) Microbiology (including sterilization)

- a) Morphology and physiology of bacteria
- b) Sterilization and disinfection
- c) Infection and immunity
- d) Important bacteria, viruses, and parasites
- e) Normal microbial flora of body, bacteriology of water and air, hospital infection

PHYSIOLOGY PRACTICALS (SEMESTER III)

Paper – I EEG-II

- Study of normal EEG records (Identification of various waves and artifacts)
- Study of various waves in different montages
- Abnormal EEG findings in various disorder.

Paper-II Electronics-II

- Study of various neurophysiology instruments, electrodes, electronic components, connections.

Paper-III Evoked Potentials-II

- Study of normal BAEP & SEP record, identification of various waves, abnormal BAEP & SEP findings in various disorders.

Paper-IV Clinical Neurology-II

- Visit to OPD & wards for observing & studying various patients of CNS disorders for indications of BAEP & SEP.

Semester - V

B.Sc.Neurophysiology Technology SEMESTER V			
Sr.Number	Content	No.Hours	Credits
A.CORE SUBJECT			
a.Theory			
1)Paper I	(Lectures,Tutorials)Nerve conduction studies and Electromyography I	30	2

2)PaperII	(Lectures,Tutorials)Application of Neurophysiology & Assessment I	30	2
3)PaperIII	(Lectures,Tutorials) Computers I	30	2
4)PaperIV	(Lectures,Tutorials)Biostatistics I	30	2
b.Practical			
1)PaperI	Nerve conduction studies and Electromyography I	60	2
2)PaperII	Application of Neurophysiology & Assessment I	60	2
3)PaperIII	Computers I	60	2
4)PaperIV	Biostatistics I	60	2
B.DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a–Theory			
1.			
2.			
b–Practical			
1.			
2.			
C.GENERICELECTIVE(ANYONE)			
a–Theory			
1.		----	----
b–Practice			
1.		----	----
D			
Case studies		150	5
	Total	510	21

PHYSIOLOGY

NERVE CONDUCTION AND ELECTROMYOGRAPHY THEORY (SEMESTERV)

NERVE CONDUCTION AND ELECTROMYOGRAPHY-I

- 1) History of nerve conduction studies
- 2) Electro diagnostic signals and their measurements

- a) Principles of motor nerve conduction
 - b) Principles of sensory nerve conduction
- 3) Basic components of electromyography instruments
- 4) Nerve conduction techniques
- 5) Anatomical guide and normative data for common nerve conduction studies
 - a) Brachial plexus and branches
 - b) Lumbar plexus and branches
 - c) Sacral plexus and branches
- 6) Required tests for specific problems like carpal tunnel syndrome
- 7) Pediatric nerve conduction study
- 8) Artifacts in NCS

APPLICATION OF CLINICAL NEUROPHYSIOLOGY AND ASSESSMENT-I

Clinical Neurology

- 1) Neurological complications of systemic disease
- 2) Trauma and the nervous system
- 3) Vascular diseases of the nervous system
- 4) Cancer and the nervous system
- 5) Infections of the nervous system
- 6) Multiple sclerosis and other white matter diseases
- 7) Hypoxic, toxic and metabolic encephalopathies
- 8) Nutritional diseases of the nervous system
- 9) Disorders of cerebrospinal fluid circulation and brain edema
- 10) Inborn errors of metabolism, mitochondrial disorders, channelopathies
- 11) The Dementias
- 12) Sleep and its disorders

COMPUTERS

COMPUTERS - I

Introduction to computers – Key board usage

Hardware:

- 1) Knowledge of the following terminology -Micro processor(CPU), Memory, Monitor,Keyboard ,Storage device, hard discs, printers, Microcomputers.
- 2) Switching on and switching off the computer and printer
- 3) Accessory Management: Explorer and Outlook Express.

- 4) Printers, Modem, CD.
- 5) Simple trouble shooting.
- 6) Simple Preventive Maintenance techniques (dust, Mouse pad maintenance, gentle use of keys)

BIOSTATISTICS

BIOSTATISTICS-

- Introduction: Concepts, Types, significance, and scope of statistics, Meaning data, sample, parameter, type and level of data and their measurement organization and presentation of data – Tabulation of data, Frequency distribution Graphical and tabular presentation.
- Measures of central tendency: Mean, Median, Mode
- Measures of variability: Range, Percentiles, Average deviation, Quartile deviation, Standard deviation.
- Normal distribution: Probability, characteristics and application of normal probability curve, sampling error.
- Measures of relationship: Correlation- need and meaning rank order correlation, Scatter diagram method, Product moment correlation, simple linear regression analysis and prediction.
- Significance of statistic and significance between two statics (Testing hypothesis)
- Non-parametric test- chi-sqaure test, sign, median test, Mann Whitney test.
- Parametric test -‘t’ test, ANOVA, MANOVA, ANCOVA and reliability tests

PHYSIOLOGY PRACTICALS (SEMESTER V)

Paper – I Nerve Conduction Study & Electromyography I

- 1) Methodology procedure for application of electrodes for NCV.
- 2) Methodology of sensory nerve conclusion studies
- 3) Methodology of motors nerve conclusion studies.
- 4) Methodology of H-reflex.
- 5) Methodology of F-wave.
- 6) Methodology of repetitive nerve stimulation.

Paper-II Application of neurophysiology & Assessments I

- 1) Clinical Examination of CNS (Sensory & Motor System)
- 2) General Examination of patient.

- 3) Planning of nerve conduction studies in given patient as per the clinical Examination.
 - How many extremities are to be tested?
 - How many nerves (sensory/ motor) to be tested?

Paper-III Computers-I

- 1) Study of various parts and components of computer & printer and its uses.

Paper-IV Biostatistics I

- 1) Preparation & Presentation of data.
- 2) Tabulation of data.
- 3) Presentation of data, frequency distribution.
- 4) Calculations of mean, median & mode & standard deviation of given data.

Semester - VI

B.Sc.Neurophysiology Technology SEMESTER VI			
Sr.Number	Content	No.Hours	Credits
A.CORESUBJECT			
a.Theory			
1)PaperI	(Lectures,Tutorials)Nerve conduction studies and Electromyography II	45	3
2)PaperII	(Lectures,Tutorials) Application of Neurophysiology & Assessment II	45	3
3)PaperIII	(Lectures,Tutorials) Computers II	45	3

4)PaperIV	(Lectures,Tutorials) Biostatistics II	45	3
b.Practical			
1)PaperI	Nerve conduction studies and Electromyography II	30	1
2)PaperII	Application of Neurophysiology & Assessment II	30	1
3)PaperIII	Computers II	30	1
4)PaperIV	Biostatistics II	30	1
B.DISCIPLINE SPESIFIC ELECTIVE(ANYONE)			
a–Theory			
1.	Recent advances in Nerve conduction and F wave	60	4
2.	Use of Computers &softwaresfor Nerve conduction.		
b.-Practical Use of Computers &softwares for EMG analysis			
1.	Recent advances in Nerve conduction and F wave	120	4
2.	Use of Computers &softwaresfor Nerve conduction.		
C.GENERICELECTIVE(ANYONE)			
a–Theory			
1.		-----	-----
b–Practice			
1.		-----	-----
D. Case studies		60	2
	Total	540	26

PHYSIOLOGY

NERVE CONDUCTION AND ELECTROMYOGRAPHY THEORY (SEMESTERVI)

- 1) History of nerve conduction studies
- 2) Electro diagnostic signals and their measurements
 - a) Principles of motor nerve conduction
 - b) Principles of sensory nerve conduction
- 3) Basic components of electromyography instruments

- 4) Nerve conduction techniques
- 5) Anatomical guide and normative data for common nerve conduction studies
 - a) Brachial plexus and branches
 - b) Lumbar plexus and branches
 - c) Sacral plexus and branches
- 6) Required tests for specific problems like carpal tunnel syndrome
- 7) Pediatric nerve conduction study
- 8) Artefacts in NCS
- 9) Nerve conduction of non limb nerves – techniques and normal values
- 10) Physiological and non physiological factors affecting NCS.
- 11) Anomalous innervations of extremities.
- 12) Late responses
- 13) Autonomic nervous system testing
- 14) Introduction to EMG
- 15) Technique of EMG
- 16) Clinical applications of EMG and NCV in neurological disorders
- 17) Repetitive nerve stimulation Single fiber and macro Electromyography.

APPLICATION OF CLINICAL NEUROPHYSIOLOGY AND ASSESSMENT-II

- 1) Headache and other cranio-facial pain
- 2) Cranial neuropathies
- 3) Parkinsonism and related movement disorders
- 4) Disorders of cerebellum and tracts
- 5) Disorders of bones, joints, ligaments, and meninges
- 6) Disorders of upper and lower motor neurons
- 7) Disorders of nerve roots and plexuses
- 8) Disorders of peripheral nerves
- 9) Disorders of autonomic nervous system
- 10) Disorders of neuromuscular transmission
- 11) Disorders of skeletal muscle
- 12) Neurological problems of the newborn

COMPUTERS

COMPUTERS – II

Software :

- **Operating Systems:** E.g. Windows, Linux, DOS. The student should know how to use

any one.

- **Word processing Software:** E.g. MS Word, Star Office, Word Perfect .The students should be able to use any one
- **Spread sheet software:** E.g. MS Excel, Star Office, Lotus. The student should be able to use any one
- **Application Software:** Power Point, Graphics
- **Browser/ Mail:** Netscape Communication, Internet
- **Internet:** searching Medline and related research –Key terms, Privacy issues and ethics.

BIOSTATISTICS

BIOSTATISTICS-II

- Research Methodology
 - 1) Stages of research process
 - 2) Developing ideas and defining a research question
 - 3) Literature review
 - 4) Errors in measurement and their control,
 - 5) Reliability and validity
 - 6) Epidemiological measures of disease frequency
 - 7) Research design:
 - A) Quantitative (epidemiological)
 - a) Experiment (clinical, field, community)
 - b) Observational
 - c) Cohort
 - d) Case control
 - e) . Cross sectional study
 - f) Ecological study
 - B) Qualitative Research Method (Sociological)
 - a) Developing instruments (Delphi technique)
 - b) Focus groups
 - c) In depth interview
 - d) Key informant interview.
 - 8) Ethical issues
 - 9) Critical Appraisal of a research report.

PHYSIOLOGY PRACTICALS (SEMESTER VI)

Paper – I Nerve Conduction Studies & Electromyography II

- 1) Study of surface electrodes and needle electrode for EMG studies.
- 2) Recording of normal surface EMG in given patient.

- 3) Recording of needle EMG in given patient
- 4) Study of inserstional activity, spontaneous activity, MUPS & interference pattern.
- 5) EMG Analysis.

Paper-II Application of neurophysiology & Assessments II

- 1) Study of upper extremity muscles for actions, power etc.
- 2) Activation procedure of various muscles testing.
- 3) Study of lower extremity muscles for actions, power etc.
- 4) Planning of EMG study (which muscles to be tasted upper and lower extremity)

Paper-III Computers-II

- 1) Study of use of computers to load a patients store, edit and print the data.
- 2) Use of computers for data analysis.

Paper-IV Biostatistics I

- 1) Application of various statistical test for data analysis and level of significance.
- 2) Non-parametric test-chi-square test, sign, median test, Mann Whitney test.
- 3) Parametric test- “t” test, ANOVA, MANOVA, ANCOVA and reliability tests.

EXAMINATION PATTERN

Internal assessment examination will be converted to of 20 marks theory and 20 marks practical and will be added in End semester examination.

End semester examination:

Question Paper Pattern:

Theory:80 Marks

Answer all the questions.

- I. Multiple Choice Question (MCQ) = $20 \times 20 = 20$
- II. Essay question : $20 \times 1 = 20$
- III. Long Answers(Answer 2 out of 3) = $2 \times 10 = 20$
- IV. Short Answers (Answers 4 out of 6) = $4 \times 5 = 20$

Total = 80 Marks

Practical:

Oral Examination: 30 Marks

Practical Examination 50 Marks

Total Marks : 80.

Total exam marks for end semester are 100 marks theory and 100 marks practical.

1) Promotion and award of grades

A student shall be declared PASS and eligible for getting he/she secures at least 50% marks in that particular course including internal assessment..

2) Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified ,then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

3) Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

Grading of performances**Letter grades and grade points allocations:**

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in table I

Table –I Letter grades and grade points equivalent to
Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of

AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

The Semester grade point average(SGPA)

The performance of a student in a semester is indicated by a number called ‘Semester Grade Point Average’ (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses(Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student’s grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students’ SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO} + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

Cumulative Grade Point Average(CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

where C₁, C₂, C₃,... is the total number of credits for semester I,II,III,... and S₁,S₂, S₃,... is the SGPA of semester I,II,III,....

Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction= CGPA of. 7.50 and above

First Class= CGPA of 6.00 to 7.49

Second Class= CGPA of 5.00 to 5.99

Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA.

Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

Final Mark list of University Examination

Sr. No.	Semester	Internal Assessment		End Semester Examination		Total	
		Theory 20 marks	Practical 20 marks	Theory 80 marks	Practical 80 marks	Theory 100 marks	Practical 100 marks
1	Semester I						
2	Semester II						
3	Semester III						
4	Semester IV						
5	Semester V						
6	Semester VI						

B.Sc. Neuro Physiology Technology - Microbiology Syllabus

1) Microbiology (including sterilization)

- a) Morphology and physiology of bacteria
- b) Sterilization and disinfection
- c) Infection and immunity
- d) Important bacteria, viruses, and parasites
- e) Normal microbial flora of body, bacteriology of water and air, hospitalinfection