



KHYBER MEDICAL UNIVERSITY

NEUROPHYSIOLOGY TECHNOLOGY CURRICULUM

STUDY GUIDE SEMESTER 6

16 Weeks Activity Planner

2024-25

CENTRAL CURRICULUM & ASSESSMENT COMMITTEE FOR NURSING,
REHABILITATION SCIENCES & ALLIED HEALTH SCIENCES

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Team for TOS Development

S.No.	Name	Designation/Institute
1.	Mr. ABDUL REHMAN	Director KMU-IPMS Peshawar
2.	Mr. ZAR JAMIL KHAN	Subject Specialist KMU-IPMS Peshawar
3.	Mr. AWAL MIR	Coordinator Neurophysiology KMU-IPMS Peshawar
4.	Mr. Mustafa Khan	Coordinator Neurophysiology Zia Ud Din University Karachi
5.	Mr. SAMI ULLAH	Subject Specialist KMU-IPMS Peshawar

S.No.	Reviewed by	Designation/Institute
1.	Muhammad Asif Zeb	Lecturer MLT, KMU-IPMS
2.	Mr. Babar Ali	Demonstrator Cardiac Perfusion, KMU-IPMS

Vision & Mission

Khyber Medical University (KMU) Vision:

Khyber Medical University will be the global leader in health sciences academics and research for efficient and compassionate health care.

Khyber Medical University (KMU) Mission:

Khyber Medical University goals to encourage professional aptitude through learning and innovation for providing comprehensive quality health care to the nation.

Institute of Paramedical Sciences Peshawar (IPMS-PESH) Mission:

To produce allied health professionals who excel in their skills, research, compassionate care, and community involvement, thereby enhancing the healthcare system

Program Introduction

The BS Neurophysiology Technology program at Khyber Medical University is a comprehensive four-year undergraduate degree designed to equip students with the knowledge, skills, and competencies required to become competent neurophysiology technologists. Neurophysiology is a vital healthcare profession that focuses on the diagnosis, treatment, and management of nervous system disorders, muscular system disorders, and diseases. Neurophysiology technologists work closely with patients, healthcare providers, and other medical professionals to provide accurate diagnoses and improve patient outcomes.

This Program is structured to provide students with a strong foundation in the sciences and specialized training in neurophysiology technology. Students will learn about the principles of nervous & muscular systems, pathophysiology, neuropharmacology, and the latest techniques and technologies used in clinical neurophysiology. Throughout the four-year program, students will participate in clinical rotations and internships at top-tier hospitals and healthcare facilities, where they will gain hands-on experience in patient care and develop the skills necessary to work effectively in a fast-paced healthcare environment. Upon completion of the program, graduates will be eligible to take the American Board of Registration of Electroencephalographic and Evoked Potential Technologist (ABRET) certification exam and will be qualified to work as registered electroencephalographic, Polysomnographic, nerve conduction study & evoked potential technologist (R. EEGT, RNCST, R.PSGT. and R.EPT.) throughout the world.

Objectives

By the end of the BS Neurophysiology Degree, the students will be able to:

Cognitive Domain

1. Explain the principles of nervous & muscular system physiology, pathophysiology, and neuropharmacology.
2. Interpret pertinent clinical information to select appropriate diagnostic procedures for neonatal, pediatric, and adult patients.
3. Identify potential expanded roles for clinical neurophysiology professionals by examining professional behavior and the history of the field.
4. Discuss the current professional and clinical roles in clinical neurophysiology.
5. Apply knowledge of the field to address current or future needs related to clinical practice, administration, education, and/or research

Psychomotor Domain

1. Demonstrate proficiency in using the latest techniques and technologies in neurophysiology technology.
2. Perform patient assessments and deliver high-quality diagnoses as well as some kind of therapeutic procedures in a clinical setting.
3. Effectively communicate with patients, healthcare providers, and other medical professionals using appropriate terminology.
4. Work collaboratively with inter-professional teams to deliver effective, patient-centered diagnosis & care.
5. Develop the skills necessary to work efficiently in a fast-paced healthcare environment.

Affective Domain

1. Exhibit professional behavior and adhere to ethical values in the delivery of clinical neurophysiology.
2. Incorporate an evidence-based approach to patient care by identifying and accessing appropriate literature and assessing relevant medical research.
3. Demonstrate leadership skills in the neurophysiology profession, healthcare, and the community.
4. Engage in continuous learning and professional development to stay current with the latest advancements in the field of neurophysiology.
5. Provide compassionate and patient-centered care that respects the dignity and autonomy of each individual

Sixth Semester Subjects for BS Neurophysiology Technology

S. No	Subjects	Duration
1	NEUR-629 Demyelinating Diseases of Nervous System Credit Hours 3 (2+1)	16 weeks
2	NEUR-630 Degenerative Diseases of Nervous System Credit Hours 3 (2+1)	16 weeks
3	NEUR-631 Nerve Conduction Study Credit Hours 3 (2+1)	16 weeks
4	NEUR-632 Infectious Diseases of Central Nervous System Credit Hours 3 (2+1)	16 weeks
5	NEUR-633 Neurophysiological Instruments Credit Hours 3 (2+1)	16 weeks
6	NEUR-615 Electromyography (EMG) Credit Hours 3 (2+1)	16 weeks

NEUR-629 Demyelinating Diseases of Nervous System 3(2+1)

Course Description

This course will introduce the students to basic concepts of the demyelinating, muscular and NMJ diseases affecting the human nervous & muscular system, its clinical evaluation, signs and symptoms & its neurophysiological diagnosis & its importance. Students will be able to understand how to diagnose differentially these pathologies and how to interpret neurophysiological evidence for upper motor neuron & lower motor neuron pathology. This course will cover the different types of demyelinating, muscular & NMJ diseases of the nervous & muscular system like the multiple sclerosis (MS), AIDP/CIDP, acute disseminated encephalomyelitis, neuromyelitis optica, Balo concentric sclerosis, CMT diseases, progressive multifocal leukoencephalopathy, inflammatory demyelination, transverse myelitis, central pontine myelinolysis, Leukodystrophies, osmotic demyelination, adrenoleuko dystrophy, optic neuritis, acute hemorrhage leukoencephalitis, Marburg acute multiple sclerosis, POEMS syndrome (polyneuropathy organomegaly endocrinopathy M-protein and skin changes), muscular dystrophy, NMJ disorder & its relation to other system involvement. It also covers different clinical conditions faced in daily routine electrophysiological evaluation. It will help in developing the practical skill of students by determining the differential & final diagnosis during neurophysiological procedures like NCS, EMG, RNS, EPs, PSG, & EEG.

Learning Objectives

Cognitive Domain

By the end of this course, students should be able to;

1. Describe the upper motor neuron & lower motor neuron demyelinating, muscular & NMJ diseases & its pathology
2. Discuss the clinical features of all these pathologies
3. Explain the clinical/differential diagnosis of all these diseases
4. Describe the neurophysiological evaluation and findings in all these pathologies
5. Demonstrate the interpretation & final diagnosis of all these diseases

Psychomotor Domain

By the end of this course, students should be able to;

1. Perform the procedure of recording the above physiology of Nervous & Muscular System
2. Demonstrate the different pathologies of upper motor neurons & lower motor neurons and their neurophysiological recording
3. Perform clinical examination to know about any pathology related to nervous, muscular system especially demyelination, myositis & NMJ disorder
4. Perform the recording of cerebral cortex activity (EEG), PNS recording potentials & spinal cord recording (SSEP) independently
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently

Affective Domain

By the end of this course, students should be able to;

1. Demonstrate punctuality
2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life
5. Comply with SOPs of practical & procedure effectively.

TABLE OF SPECIFICATIONS

TOS-DEMYELINATING DISEASES OF NERVOUS SYSTEM3(2+1)

S.N	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: INTRODUCTION OF DEMYELINATING DISEASES										
1	Week-1	Introduction	Introduction to demyelinating diseases of nervous system	C1			Interactive Lecture/SGD	2	MCQs	03
2		Clinical features	Explain the clinical presentation/features of demyelinating diseases	C2						
3		Electrophysiological recording	Describe the different electrophysiological recording of these diseases which affect myelin sheath of a neuron	C2						
4		Practical performance	Demonstrate the interpretation of NCS/EMG to see demyelination in the nervous system		P4		Demo	1	OSPE	02
5		SOPs compliance	Comply SOPs for handling NCS/EMG machine			A4	Role Play			
TOPIC: MULTIPLE SCLEROSIS (MS)										
6	Week-2	Introduction	Introduction of multiple sclerosis	C1			Interactive Lecture/SGD	2	MCQs	02
7		Clinical presentations	Describe the clinical presentation of MS	C2						
8		Neurophysiological evaluation	Explain the differential diagnosis, final diagnosis, & interpretation of MS with the help of Visual Evoked Potential (VEP)	C3						
9		Practical performance	Demonstrate the interpretation of VEP & radiological imaging procedures to diagnose MS		P4		Demo	1	OSPE	02
10		SOPs compliance	Adopt how to take care of VEP machine & their accessories			A4	Role Play			
TOPIC: ACUTE DISSEMINATED ENCEPHALOMYELITIS (ADEM)										
11	Week-3	Introduction	Describe ADEM	C2			Interactive Lecture/SGD	2	MCQs	03
12		Clinical presentation	Discuss different clinical features including psychiatric symptoms of ADEM	C2						
13		Lasting effects of ADEM	Explain the lasting effects of ADEM disease	C2						
14		Diagnosis & protocol for ADEM treatment	Discuss the differential & final diagnosis and treatment protocol for ADEM	C3						
15		Practical performance	Demonstrate the diagnosis of ADEM through MRI, LP, EEG, Blood test		P4		Demo	1	OSPE	0
16		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: NEUROMYELITIS OPTICA (NMO)										
17	Week-4	Definition	Introduction to the NMO	C1			Interactive Lecture/SGD	2	MCQs/SEQs	03
18		Triad & S/S of NMO	Explain the signs, symptoms & triad of NMO	C2						
19		Diagnosis of NMO	Discuss different procedures to diagnose NMO.	C3						
20		Practical performance	Demonstrate the interpretation of NMO through VEP, Lumbar Puncture & blood tests		P4		Demo	1	OSPE	0
21		Counseling	Counseling of the patient for VEP & LP procedures			A4	Role Play			

TOPIC: HEREDITARY MOTOR SENSORY NEUROPATHY (HMSN)

22	Week-5	Introduction	Introduction to the HMSN or CMT disease	C1			Interactive Lecture/SGD	2	MCQs/SEQs	05
23		Classification	Explain the classification of CMT diseases	C2						
24		Clinical features	Explain the clinical presentation of CMT diseases	C3						
25		Diagnosis	Explain the differential & final diagnosis of CMT diseases	C3						
26		Practical performance	Demonstrate the demyelination variant of CMT disease during EMG/NCV procedure		P4		Demo	1	OSPE	01
27		Report providence	Provide report to the patient in time			A4	Role Play			

TOPIC: ACUTE INFLAMMATORY DEMYELINATING POLYNEUROPATHY (AIDP)

28	Week-6	Introduction	Introduction to AIDP	C1			Interactive Lecture/SGD	2	MCQs/SEQs	10
29		Causes	Explain the causes & pathophysiology of AIDP.	C2						
30		Clinical presentation	Explain the signs and symptoms of AIDP	C3						
31		Diagnosis	Explain the final neurophysiological diagnosis of AIDP	C4						
32		Practical performance	Demonstrate the AIDP diagnosis with the help of NCS & EMG procedure		P4		Demo	1	OSPE	02
33		SOPs compliance	Adopt how to take care of EMG machine & accessories			A4	Role Play			

TOPIC: CHRONIC INFLAMMATORY DEMYELINATING POLYNEUROPATHY (CIDP)

34	Week-7	Introduction	Introduction to the CIDP	C1			Interactive Lecture/SGD	2	MCQs/SEQs	10
35		Causes	Explain the different causes of CIDP	C2						
36		Clinical features	Explain the clinical presentation of CIDP	C3						
37		Complication	Explain the complication of CIDP	C4						
38		Diagnosis & treatment	Explain the clinical & electrophysiological diagnosis of CIDP	C5						
39		Practical performance	Demonstrate the action potentials & MUAPs (motor unit action potentials) of CIDP disease with the help of EMG study		P4		Demo	1	OSPE	02
40		Ethical norms	Adopt how to take care of patient ethical norms			A4	Role Play			

TOPIC: PROGRESSIVE MULTIFICAL LEUKOENCEPHALOPATHY

41	Week-8	Introduction	Introduction to PML	C1			Interactive Lecture/SGD/CBD	2	MCQs/SEQs	03
42		Causes	Explain the causes of PML	C2						
43		Clinical features & diagnosis	Explain the clinical presentation of PML, its differential and final diagnosis	C3						
44		Practical performance	Demonstrate PML diagnosis with the help of brain and spinal cord imaging & CSF analysis		P4		Demo	1	OSPE	0
45		SOPs compliance	Adopt how to take care of brain & spinal cord imaging			A4	Role Play			

TOPIC: INFLAMMATORY DEMYELINATION & TRANSVERSE MYELITIS

46	Week-9	Introduction	Introduction to inflammatory demyelination & transverse myelitis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
47		Causes	Explain the basic pathophysiology of these diseases	C2						

48		Clinical Presentation	Explain the clinical features of these disorders	C3						
49		Diagnosis	Explain the diagnosis of inflammatory demyelination & transverse myelitis	C3						
50		Practical performance	Demonstrate the interpretation of inflammatory demyelination & transverse myelitis with the help of EMG, MRI, LP, nerve biopsy and blood and urine test		P4		Demo	1	OSPE	01
51		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: CENTRAL PONTINE MYELINOLYSIS (CPM)										
52	Week-10	Introduction	Introduction to the central pontine myelinolysis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
53		Causes	Explain the different causes of CPM	C2						
54		Clinical features	Explain the different clinical features of CPM	C3						
55		Diagnosis	Explain the diagnosis of CPM	C3						
56		Practical performance	Demonstrate the interpretation of CPM with the help of Brainstem Evoked Potential (BEP) & other imaging		P4		Demo	1	OSPE	0
57		SOPs compliance	Adopt how to take care of BEP machine			A4	Role Play			
TOPIC: OSMOTIC DEMYELINATION & LEUKODYSTROPHY										
58	Week-11	Introduction	Introduction to the osmotic demyelination syndrome & Leukodystrophies	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
59		Pathophysiology	Explain the pathophysiology of these disorder	C2						
60		Clinical presentation	Explain the clinical presentation of osmotic demyelination	C1						
61		Diagnosis	Explain the diagnosis of osmotic demyelination & leukodystrophy	C2						
62		Practical performance	Demonstrate the interpretation of ODS with the help of BAER/BEP/BERA and other imaging procedures		P4		Demo	1	OSPE	0
63		SOPs compliance	Adopt how to take care of BERA machine			A4	Role Play			
TOPIC: OPTIC NEURITIS & MARBURG ACUTE MS										
64	Week-12	Introduction	Explain the optic neuritis & Marburg Acute MS	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
65		Causes	Explain the main causes of these pathologies	C2						
66		Clinical presentation & life expectancy	Explain the clinical presentation & life expectancy of malignant Marburg MS	C1						
67		Diagnosis	Explain the clinical and physiological diagnosis of these pathologies	C2						
68		Practical performance	Demonstrate the interpretation of pathologies with the help of VEP (visual evoked potential) & radiological imaging		P4		Demo	1	OSPE	01
69		Confidentiality	Take care the confidentiality of the patients			A4	Role Play			
TOPIC: POEMS SYNDROME										
70	Week-13	Introduction	Explain Polyneuropathy, Organomegaly, Endocrinopathy, Monoclonal cell plasma & Skin changes (POEMS) syndrome	C1			Interactive Lecture/CBD	2	MCQs/SEQs	02
71		Causes	Explain the different causes of POEMS syndrome	C2						
72		Clinical features	Explain the clinical presentation of POEMS	C2						

73		Diagnosis	Explain the diagnosis of POEMS	C3						
74		Complications	Explain the complication of POEMS syndrome	C4						
75		Practical performance	Demonstrate interpretation of POEMS syndrome with the help of EMG, bone marrow biopsy, blood/urine analysis & x-rays imaging		P4		Demo	1	OSPE	0
76		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			

TOPIC: MUSCULAR DYSTROPHY (MD)

77	Week -14	Introduction	Introduction to the muscular dystrophy	C1			Interactive Lecture/CBD	2	MCQs/SEQs	10
78		Types of MD	Explain the different types of MD	C2						
79		Clinical presentation	Explain the clinical presentation of MD	C3						
80		Diagnosis	Explain the diagnosis of MD	C4						
81		Complication & rehabilitation	Explain the complication & rehabilitation of MD patients	C4						
82		Practical performance	Demonstrate the electrophysiological evidence of MD with the help of EMG procedure		P4		Demo	1	OSPE	01
83		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			

TOPIC: MYOSITIS

84	Week -15	Introduction	Introduction to the myositis	C1			Interactive Lecture/CBD	2	MCQs/SEQs	05
85		Types	Explain the different types of myositis	C2						
86		Causes	Explain the causes of polymyositis & Dermatomyositis	C3						
87		Signs and symptoms	Explain the signs and symptoms of polymyositis & Dermatomyositis	C3						
88		Complications	Illustrate the complication of myositis	C4						
89		Practical performance	Demonstrate the interpretation of EMG study to diagnose different variants of myositis		P4		Demo	1	OSPE	01
90		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			

TOPIC: NEUROMUSCULAR JUNCTION DISORDER

91	Week -16	Introduction	Introduction to the pre & post synaptic NMJ disorder	C1			Interactive Lecture/CBD	2	MCQs/SEQs	04
92		Pathophysiology	Explain the pathophysiology of NMJ disorder	C2						
93		Clinical features	Explain the clinical features of NMJ disorder	C3						
94		Diagnosis	Explain the diagnosis of pre & post synaptic NMJ disorder	C3						
95		Practical performance	Demonstrate the interpretation of pre & post synaptic disorder with the help of RNS procedure		P4		Demo	1	OSPE	01
96		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			

RECOMMENDED BOOKS;

NAME OF BOOK

AUTHORS

1	Practical Guide for Clinical Neurophysiologic Testing EEG	Thoru Yamada, MD and Elizabeth Meng
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	INTRODUCTION OF DEMYELINATING DISEASES	03	01	Static
2	MULTIPLE SCLEROSIS (MS)	02	02	Static
3	ACUTE DISSEMINATED ENCEPHALOMYELITIS (ADEM)	03	01	Static
4	NEUROMYELITIS OPTICA (NMO)	03	0	-
5	HEREDITARY MOTOR SENSORY NEUROPATHY (HMSN)	05	01	Static
6	ACUTE INFLAMMATORY DEMYELINATING POLYNEUROPATHY (AIDP)	10	02	Static
7	CHRONIC INFLAMMATORY DEMYELINATING POLYNEUROPATHY (CIDP)	10	02	Static
8	PROGRESSIVE MULTIFOCAL LEUKOENCEPHALOPATHY	03	01	Static
9	INFLAMMATORY DEMYELINATION & TRANSVERSE MYELITIS	03	0	-
10	CENTRAL PONTINE MYELINOLYSIS (CPM)	02	0	-
11	OSMOTIC DEMYELINATION & LEUKODYSTROPHY	02	01	Interactive
12	OPTIC NEURITIS & MARBURG ACUTE MS	03	0	-
13	POEMS SYNDROME	02	0	-
14	MUSCULAR DYSTROPHY (MD)	10	01	Static
15	MYOSITIS	05	01	Static
16	NEUROMUSCULAR JUNCTION DISORDER	04	01	Static
	TOTAL	70	14	

NEUR-630 Degenerative Diseases of Nervous System 3(2+1)

Course Description

This course will introduce the students to basic concepts of the degenerative diseases affecting the human nervous system, its clinical evaluation, signs and symptoms, its neurophysiological diagnosis & its importance. Students will be able to understand how to diagnose differentially, clinically these pathologies and how to interpret neurophysiological evidence for upper motor neuron & lower motor neuron degenerative diseases. This course will cover the different types of degenerative diseases of the nervous system like the Huntington disease, AMAN/AMSAN, PD, AD, ALS, CMT, Friedreich ataxia, Dementia with Lewy bodies, Batten disease, Dementia, MND, MSA, SMA, CJD, TSE, Progressive supranuclear palsy, Corticospinal degeneration, spinal and bulbar muscular atrophy, spinocerebellar ataxia, neurofibromatosis, Baggio-yoshinari syndrome & its relation to other system involvement. It also covers different clinical conditions faced in daily routine electrophysiological evaluation. It will help in developing the practical skill of students by determining the differential & final diagnosis during neurophysiological procedures like NCS, EMG, RNS, EPs, PSG, & EEG.

Cognitive Domain

By the end of this course, students should be able to;

1. Describe the upper motor neuron & lower motor neuron degenerative diseases & its pathology
2. Discuss the clinical features of all these pathologies
3. Explain the clinical/differential diagnosis of all these diseases
4. Describe the neurophysiological evaluation and findings in all these pathologies
5. Demonstrate the interpretation & final diagnosis of all these diseases

Psychomotor Domain

By the end of this course, students should be able to;

1. Perform the procedure of recording the above physiology of Nervous & Muscular System
2. Demonstrate the different pathologies of upper motor neurons & lower motor neurons and their neurophysiological recording
3. Perform clinical examination to know about any pathology related to nervous, muscular system especially degenerative disorders
4. Perform the recording of cerebral cortex activity (EEG), PNS recording potentials & spinal cord recording (SSEP) independently
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently.

Affective Domain

By the end of this course, students should be able to;

1. Demonstrate punctuality
2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life
- 5- Comply with SOPs of practical & procedure effectively

TABLE OF SPECIFICATIONS

TOS-DEGENERATIVE DISEASES OF NERVOUS SYSTEM 3(2+1)

S.No	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: INTRODUCTION TO DEGENERATIVE DISEASES OF NERVOUS SYSTEM										
1	Week-1	Introduction	Introduction to Degenerative Diseases of Nervous System	C1			Interactive Lecture/CBL	2	MCQs	05
2		Classification	Explain the classification of these diseases	C2						
3		Clinical features & diagnosis	Explain the signs, symptoms & diagnosis of degenerative diseases	C2						
4		Practical performance	Demonstrate these disease with the help of EMG/EEG procedures		P4		Demo	1	OSPE	01
5		SOPs compliance	Adopt how to take care of neurophysiology machines			A4	Role Play			
TOPIC: PARKINSON DISEASE (PD)										
6	Week-2	Introduction	Introduction to the Parkinson diseases	C1			Interactive Lecture/CBL	2	MCQs	02
7		Pathophysiology	Describe the pathophysiology of PD	C2						
8		Clinical features & diagnosis	Explain the clinical features and diagnosis of PD	C3						
9		Practical performance	Demonstrate the interpretation of EEG and radiological imaging in PD patients		P4		Demo	1	OSPE	01
10		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: ALZHEIMER'S DISEASES (AD)										
11	Week-3	Introduction	Describe briefly Alzheimer's diseases	C1			Interactive Lecture/CBL	2	MCQs	03
12		Causes	Discuss different causes of Alzheimer's disease	C2						
13		Clinical presentation	Explain the clinical presentation of AD patients	C2						
14		Diagnosis	Discuss the diagnosis of AD patients	C3						
15		Practical performance	Demonstrate EEG findings & radiological imaging in AD patients		P4		Demo	1	OSPE	01
16		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: ACUTE MOTOR AXONAL NEUROPATHY (AMAN)										
17	Week-4	Introduction	Introduction to the AMAN & AMSAN	C1			Interactive Lecture/CBL	2	MCQs/SEQs	10
18		Clinical presentation	Explain the different clinical features of AMAN & AMSAN	C2						
19		Diagnosis & complication	Discuss the diagnosis & complications of AMAN & AMSAN	C3						
20		Practical Performance	Demonstrate interpretation of EMG study in AMAN & AMSAN		P4		Demo	1	OSPE	01
21		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			
TOPIC: HUNTINGTON DISEASES (HD)										
22	Week-	Introduction	Introduction to the HD	C1			Interactive	2	MCQs/SEQs	02

23	5	Causes	Explain the different causes of HD	C2			Lecture/CBL			
24		Clinical presentation	Explain the clinical presentation of Huntington disease	C3						
25		Diagnosis & complication	Explain the diagnosis & complication of HD	C3						
26		Practical performance	Demonstrate the neurological examination, family history & psychological evaluation in HD patients and interpretation of genetic testing &, brain imaging		P4		Demo	1	OSPE	0
27		Ethical norms	Adopt how to take care of patient ethical norms			A4	Role Play			

TOPIC: AMYOTROPHIC LATERAL SCLEROSIS (ALS)

28	Week-6	Introduction	Introduction to Amyotrophic Lateral Sclerosis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	10
29		Variants & Clinical findings	Explain different variants & clinical signs / symptoms of ALS	C2						
30		Diagnosis	Explain neurophysiological diagnosis of ALS according to El-Escorial criterion	C3						
31		Complication	Explain the complication of ALS/MND	C4						
32		Practical performance	Demonstrate the electrophysiological findings of ALS patients with the help of EMG/NCV study		P4		Demo	1	OSPE	01
33		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			

TOPIC: FRIEDREICH ATAXIA (FA) AND DEMENTIA

34	Week-7	Introduction	Introduction to the Friedreich ataxia & dementia	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
35		Causes	Explain the causes of these disorder	C2						
36		Clinical evaluation	Explain the clinical features of these disorders	C3						
37		Diagnosis	Explain the diagnosis of these degenerative disorders	C4						
38		Complications	Explain the complications of these diseases	C5						
39		Practical performance	Demonstrate the interpretation of EMG/NCS, ECG, EEG, genetic testing, Echo & imaging scans in FA & dementia patients		P4		Demo	1	OSPE	01
40		SOPs compliance	Adopt how to take care of neurophysiological instruments			A4	Role Play			

TOPIC: BATTEN'S DISEASE

41	Week-8	Introduction	Introduction to Batten's disease	C1			Interactive Lecture/SGD	2	MCQs/SEQs	03
42		Types	Explain the different types of Batten's disease	C2						
43		S/S & diagnosis	Explain the clinical presentation & diagnosis of Batten's disease	C3						
44		Practical performance	Demonstrate interpretation of EEG, CT, ERGs & skin or tissue sampling findings in Batten's disease		P4		Demo	1	OSPE	0
45		SOPs compliance	Adopt how to take care of neurophysiology lab instruments			A4	Role Play			

TOPIC: MOTOR NEURON DISEASE (MND)

46	Week-9	Introduction	Introduction to the MND	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
47		Types/variants	Explain the different types of MND	C2						
48		Clinical features	Explain the clinical presentation of a typical MND patient	C3						
49		Diagnosis & complication	Explain the neurophysiological diagnosis & complication of MND	C3						

50		Practical performance	Demonstrate the interpretation of Neurodiagnostic procedure in MND patients		P4		Demo	1	OSPE	01
51		SOPs compliance	Adopt how to take care of Neurodiagnostic machine			A4	Role Play			

TOPIC: SPINAL MUSCULAR ATROPHY (SMA)

52	Week-10	Introduction	Introduction to the spinal muscular atrophy	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
53		Classification	Explain the classification of SMA	C2						
54		Signs & symptoms	Explain the signs & symptoms of SMA	C3						
55		Diagnosis	Explain the neurophysiological diagnosis of SMA variants							
56		Practical performance	Demonstrate the interpretation of SMA patients with the help of EMG study		P4		Demo	1	OSPE	01
57		Confidentiality	Take care the confidentiality of the patients			A4	Role Play			

TOPIC: CREUTZFELD-JAKOB DISEASS (CJD)

58	Week-11	Introduction	Introduction to the CJD	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
59		Variants and Causes	Explain the different variants & causes of CJD	C2						
60		Clinical presentation	Explain the clinical presentations of CJD	C2						
61		Differential diagnosis	Explain the differential diagnosis of CJD	C3						
62		Practical performance	Demonstrate the interpretation of EEG findings in CJD patients		P4		Demo	1	OSPE	01
63		SOPs compliance	Adopt how to take care of electroencephalography machine			A4	Role Play			

TOPIC: MULTIPLE SYSTEM ATROPHY (MSA) AND SPINA BIFIDA

64	Week-12	Introduction	Explain the Shy-Drager syndrome/MSA & neural tube defect (NTD)	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
65		Clinical presentation	Explain the clinical features of MSA & NDT	C2						
66		Diagnosis	Explain the differential diagnosis of MSA & NDT	C2						
67		Life expectancy	Explain the life expectancy of MSA	C3						
68		Practical performance	Demonstrate the interpretation of imaging study, autonomic testing, bladder function assessment, laboratory tests, genetic testing, biopsy in MSA/Spina Bifida patients		P4		Demo	1	OSPE	01
69		Counseling	Counseling of the patient for imaging, laboratory, & Biopsy procedures			A4	Role Play			

TOPIC: CORTICOBASAL DEGENERATION (CBD)

70	Week-13	Introduction	Explain CBD	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
71		Signs & symptoms	Explain the signs and symptoms of CBD	C1						
72		Diagnosis	Explain the differential diagnosis of CBD	C2						
73		Complications	Describe the complication of CBD	C3						
74		Life expectancy of CBD	Illustrate the life expectancy of CBD	C4						
75		Practical performance	Demonstrate the interpretation of CBD diagnosis with the help of brain imaging, neuropsychological testing , cognitive and neurological examination		P4		Demo	1	OSPE	0
76	SOPs compliance	Adopt how to take care of patients investigations			A4	Role Play				

TOPIC: SPINAL AND BULBAR MUSCULAR ATROPHY (KENNEDY'S DISEASE)

77	Week-14	Introduction	Introduction to the Kennedy's disease	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
78		Causes	Explain the different causes of Kennedy's disease	C2						
79		Clinical features	Explain the clinical features of Kennedy's disease	C3						
80		Diagnosis	Explain the differential diagnosis of SBMA	C4						
81		Life expectancy	Explain the complications of SBMA	C4						
82		Practical performance	Demonstrate the interpretation of SBMA patients with the help of NCS/EMG study		P4		Demo	1	OSPE	01
83	SOPs compliance	Adopt how to take care of electromyography machine			A4	Role Play				

TOPIC: PROGRESSIVE SUPRANUCLEAR PALSY (PSP)

84	Week-15	Introduction	Introduction to PSP	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
85		Causes/pathophysiology	Explain the different causes of PSP	C2						
86		Clinical features	Explain the clinical presentation of PSP	C3						
87		Diagnosis	Explain the differential diagnosis of PSP patients	C3						
88		Complications	Illustrate the complication & life expectancy of PSP	C4						
89		Practical performance	Demonstrate neurological exam and interpretation of imaging, CSF analysis in PSP patients		P4		Demo	1	OSPE	01
90	Confidentiality	Take care the confidentiality of the patients			A4	Role Play				

TOPIC: CEREBRAL PALSY (CP)

91	Week-16	Introduction	Introduction to the cerebral palsy	C1			Interactive Lecture/CBL	2	MCQs/SEQs	08
92		Pre & post natal causes	Explain the pre-natal & post-natal causes of CP	C2						
93		Classification	Explain the different types of CP patients according to anatomy & physiology	C3						
94		Diagnosis	Explain the diagnosis of a CP child	C3						
95		Practical performance	Demonstrate the interpretation of EEG, brain imaging findings in a CP patients		P4					
96		SOPs compliance	Adopt how to take care of neurophysiological instruments.			A4	Role Play			

RECOMMENDED BOOKS;

NAME OF BOOK

AUTHORS

1	Practical Guide for Clinical Neurophysiologic Testing EEG	Thoru Yamada, MD and Elizabeth Meng
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	INTRODUCTION TO DEGENERATIVE DISEASES OF NERVOUS SYSTEM	05	01	Static
2	PARKINSON DISEASE (PD)	02	02	Interactive/Static
3	ALZHEIMER'S DISEASES (AD)	03	01	Static
4	ACUTE MOTOR AXONAL NEUROPATHY (AMAN)	10	01	Static
5	HUNTINGTON DISEASES (HD)	02	01	Static
6	AMYOTROPHIC LATERAL SCLEROSIS (ALS)	10	01	Static
7	FRIEDREICH ATAXIA (FA) AND DEMENTIA	03	01	Static
8	BATTEN'S DISEASE	03	01	Static
9	MOTOR NEURON DISEASE (MND)	05	01	Static
10	SPINAL MUSCULAR ATROPHY (SMA)	05	01	Static
11	CREUTZFELD-JAKOB DISEASE (CJD)	03	01	Static
12	MULTIPLE SYSTEM ATROPHY (MSA) AND SPINA BIFIDA	03	0	-
13	CORTICOBASAL DEGENERATION (CBD)	02	0	-
14	SPINAL AND BULBAR MUSCULAR ATROPHY (KENNEDY'S DISEASE)	03	0	-
15	PROGRESSIVE SUPRANUCLEAR PALSY (PSP)	03	0	-
16	CEREBRAL PALSY (CP)	08	02	Static
	TOTAL	70	14	

NEUR-631 Nerve Conduction Study 3(2+1)

Course Description

This course will introduce students to the basic concepts of the nerve conduction study, including Blink reflex study, late response studies and repetitive nerve stimulation (RNS) studies. It will cover to help identify nerve damage, such as neuropathy, and can help to determine the location of abnormal sensations like tingling, numbness and pain. Students will learn how determine the cause, severity, and prognosis of a nerve disorders. NCS can help monitor the progression of a disease and take appropriate corrective measures. The course will also address various types of pathologies that affect the spinal nerve and some cranial nerves. Additionally, it will cover different clinical conditions encountered during routine electrophysiological evaluations. The course aims to develop students' practical skills by helping them determine differential and final diagnoses during neurophysiological procedures such as nerve conduction studies (NCS), electromyography (EMG), repetitive nerve stimulation (RNS), evoked potentials (EPs), Blink Reflex study, somatosensory-evoked responses (SSR), heart rate variability (HRDB), and electroencephalography (EEG).

Learning Objectives

Cognitive Domain

By the end of this course, students should be able to

1. Describe the parameters of nerve conduction study (NCS), RNS & Blink-reflex study
2. Discuss the NCS findings in neuropathic & myopathic disorders
3. Explain the repetitive nerve stimulation findings in NMJ disorders
4. Describe the normative data for nerve conduction study
5. Demonstrate nerve conduction study (NCS), RNS & Blink-reflex examination and procedures

Psychomotor Domain

By the end of this course, students should be able to

1. Perform the procedure of recording peripheral nerves signals through NCS, RNS & Blink reflex
2. Demonstrate the difference between demyelinating, axonal, NMJ disorder & muscular diseases
3. Perform clinical examination to know about any pathology related to lower motor neuron, NMJ & muscle disorder
4. Perform the recording of PNS independently through NCS, RNS, late response & Blink reflex study
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently

Affective Domain

By the end of this course, students should be able to

1. Demonstrate punctuality
2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life
5. Comply with SOPs of practical & procedure effectively

TABLE OF SPECIFICATIONS

TOS-NERVE CONDUCTION STUDY 3(2+1)

S.No	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: INTRODUCTION TO NERVE CONDUCTION STUDY										
1	Week-1	Introduction	Explain the NCS/electro diagnostic procedure	C1			Interactive Lecture/SGD	2	MCQs	05
2		Parameters	Explain different parameters of NCS	C2						
3		AIM/Goals of study	Explain major goals of the study	C2						
4		Practical performance	Demonstrate the interpretation of NCS procedure		P4		Demo	1	OSPE	
5		SOPs compliance	Adopt how to take care of NCS/EMG machine			A4	Role Play			
TOPIC: CARDINAL ROLES OF NERVE CONDUCTION STUDY										
6	Week-2	Introduction	Define the cardinal roles of the study	C1			Interactive Lecture/SGD	2	MCQs	02
7		Patients Encounter	Describe the patient encounter during nerve conduction study	C3						
8		Types of disorders	Explain which type of disorders are diagnosed through this study	C2						
9		Practical performance	Demonstrate the interpretation of NCS findings in different pathologies		P4		Demo	1	OSPE	
10		Report providence	Provide report to the patient in time			A4	Role Play			
TOPIC: MOTOR CONDUCTION STUDY (MCS)										
11	Week-3	Introduction	Describe the motor conduction study	C1			Interactive Lecture/CBL	2	MCQs	02
12		Parameters	Discuss the different parameters of MCS; DML, Amplitude, MCV, Duration, Area & distance	C2						
13		Normative data	Explain the normative data for MCS in both Upper Limbs & Lower limbs.	C2						
14		Units of parameters	Discuss the different units for each parameters	C3						
15		Practical performance	Demonstrate the interpretation of MCS in different patients		P4		Demo	1	OSPE	
16		SOPs compliance	Adopt how to take care of NCS machine			A4	Role Play			
TOPIC: SENSORY CONDUCTION STUDY (SCS)										
17	Week-4	Introduction	Define the sensory conduction study, its parameters & basic units	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
18		Types	Explain the Orthodromic & Antidromic sensory recordings	C2						
19		Normative data	Discuss the normative data for both upper & lower limbs	C3						
20		Practical performance	Demonstrate interpretation of both SCS in different age group patients		P4		Demo	1	OSPE	
21		Counseling	Counseling of the patient for NCS procedure			A4	Role Play			
TOPIC: MIXED CONDUCTION STUDY										
22	Week-5	Introduction	Define mixed conduction study	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
23		Temporal dispersion	Describe temporal dispersion	C2						

24		Phase cancellation	Discuss phase cancellation in nerve conduction study	C3						
25		Principles of stimulation	Explain the principles of nerve stimulation during nerve conduction study	C3						
26		Practical performance	Demonstrate interpretation of Mixed Conduction Study in different patients		P4		Demo	1	OSPE	01
27		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			

TOPIC: IMPORTANT BASIC PATTERN OF NCS

28	Week-6	Introduction	Define the importance of basic pattern seen during NCS recordings	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
29		Classification	Classify nerve pathology seen during NCS recording (Axonal/Demyelinating)	C2						
30		NCS findings	Describe NCS findings in both pathologies	C3						
31		Interpretation	Discuss the interpretation of NCS in both pathology	C4						
32		Practical performance	Demonstrate the interpretation of NCS in axonal & demyelinating polyneuropathy patients		P4		Demo	1	OSPE	0
33		SOPs compliance	Adopt how to take care of NCS machine & its electrodes			A4	Role Play			

TOPIC: LATE RESPONSES

34	Week-7	Introduction	Define late responses in nerve conduction study & F-estimate	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
35		Types	Describe different types of late responses; F-wave, H-reflex	C2						
36		Normative data	Discuss normal data for both upper & lower limbs	C3						
37		Parameters	Describe different parameters of late responses	C4						
38		Procedure	Discuss briefly the procedure of recording late responses	C5						
39		Practical performance	Demonstrate the interpretation of late responses in NCS procedure		P4		Demo	1	OSPE	01
40		SOPs compliance	Adopt how to take care of NCS machine cables & electrodes			A4	Role Play			

TOPIC: BLINK REFLEX STUDY

41	Week-8	Introduction	Define the blink reflex study/procedure	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
42		Pattern of abnormalities	Describe the different pattern of abnormalities during BRS	C2						
43		Interpretation	Discuss the interpretation of Blink-Reflex with NCS recording	C3						
44		Practical performance	Demonstrate the interpretation of blink-reflex study in NMJ disorders		P4		Demo	1	OSPE	01
45		Confidentiality	Take care the confidentiality of the patients			A4	Role Play			

TOPIC: REPETITIVE NERVE STIMULATION (RNS)

46	Week-9	Introduction	Define RNS in details.	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
47		Types of RNS	Explain the two types of RNS; Slow-RNS, Fast-RNS	C2						
48		Procedure	Describe the decrement & increment procedures of RNS	C3						
49		RNS findings	Describe the RNS findings in NMJ disorders	C3						
50		Practical performance	Demonstrate the interpretation of RNS recordings in pre & post synaptic NMJ diseases		P4		Demo	1	OSPE	01
51		SOPs compliance	Adopt how to take care of NCS machine			A4	Role Play			

TOPIC: ROUTINE UPPER EXTREMITY NCS

52	Week-10	Introduction	Describe routine upper limb nerve conduction study; MCS, SCS & Mixed	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
53		Recording sites	Discuss upper limb recording sites & distance for NCS recording	C2						
54		Stimulating sites	Describe upper limb distal & proximal stimulating sites in detail	C1						
55		Normal data	Discuss normal data values for upper limbs study	C2						
56		Practical performance	Demonstrate interpretation of routine upper extremity findings in NCS recording		P4		Demo	1	OSPE	01
57		SOPs compliance	Adopt how to take care of NCS machine			A4	Role Play			

TOPIC: ROUTINE LOWER EXTREMITY NERVE CONDUCTION TECHNIQUES

58	Week-11	Introduction	Describe routine lower limb nerve conduction study; MCS & SCS	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
59		Recording sites	Discuss lower limbs recording sites & standard distance in details	C2						
60		Stimulating sites	Discuss different nerve stimulating sites for recording LLs NCS	C1						
61		Normal data	Discuss normal data values for lower limbs nerves in adults	C2						
62		Practical performance	Demonstrate interpretation of lower limbs NCS findings in neonate & adult patients		P4		Demo	1	OSPE	01
63		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			

TOPIC: NCS IN POLYNEUROPATHY (DEMYELINATING)

64	Week-12	Introduction	Define NCS findings in demyelinating polyneuropathy	C1			Interactive Lecture/CBL	2	MCQs/SEQs	09
65		Criteria	Discuss the NCS main criteria for demyelinating neuropathy	C2						
66		Temporal course	Discuss the acute, sub-acute, chronic, progressive, stepwise relapsing pattern of neuropathy	C1						
67		Fiber involvement	Discuss which fiber types are involved, motor, large sensory, small sensory and autonomic?	C2						
68		Practical performance	Demonstrate interpretation of NCS findings in demyelinating neuropathy patients		P4		Demo	1	OSPE	01
69		SOPs compliance	Adopt how to take care of NCS machine			A4	Role Play			

TOPIC: NCS IN POLYNEUROPATHY (AXONAL)

70	Week-13	Introduction	Define NCS in axonal polyneuropathy	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
71		Criteria	Describe the NCS criteria for axonal degeneration neuropathy	C1						
72		Temporal course	Discuss the acute, sub-acute, chronic, progressive, stepwise relapsing pattern of neuropathy	C2						
73		Neuropathy & neuronopathy	Describe interpretation of NCS findings in neuronopathy	C3						
74		Comparison study	Discuss the importance of comparison study for axonal neuropathy	C4						
75		Practical performance	Demonstrate interpretation of NCS/EMG recordings/findings in axonal polyneuropathy patients		P4		Demo	1	OSPE	01
76		Communication	Communicate the procedure of NCS/E MG in an effective way to the patient			A4	Role Play			

TOPIC: NCS IN MYOPATHY & NMJ DISORDERS

77	Week-14	Introduction	Define the importance of NCS in myopathy & NMJ disorders	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
78		NCS findings	Describe the NCS findings in myopathy & NMJ disorders	C2						
79		Interpretation	Discuss the interpretation of NCS with EMG in myopathy and NMJ disorders	C3						
80		NCS protocol	Explain the NCS protocol for myopathy diagnosis	C4						
81		NCS protocol	Explain the NCS protocol for NMJ disorders	C4						
82		Practical performance	Demonstrate the interpretation of NCS/EMG findings in myopathic & NMJ disorder patients		P4		Demo	1	OSPE	01
83	SOPs compliance	Adopt how to take care of EMG/NCS machine and its accessories			A4	Role Play				

TOPIC: NCS IN AMYOTROPHIC LATERAL SCLEROSIS (ALS)

84	Week-15	Introduction	Discuss the NCS importance in ALS patients	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
85		Diagnosis criteria	Explain the NCS diagnostic criteria for ALS patients	C2						
86		NCS findings	Describe the NCS findings in ALS patients	C3						
87		Prognosis	Discuss the prognosis of ALS patients according to NCS findings	C3						
88		Study protocol	Illustrate the study protocol for ALS patients	C4						
89		Practical performance	Demonstrate interpretation of NCS findings in ALS patients		P4		Demo	1	OSPE	01
90	SOPs compliance	Comply SOPs for the NCS machine			A4	Role Play				

TOPIC: NORMAL NCS PEDIATRIC VALUES

91	Week-16	Introduction	Define normal pediatric values of nerve conduction study	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
92		Parameters	Describe different parameters of pediatric values, DML, CV, AMP, F waves	C2						
93		Portable study	Discuss NCS monitoring in ICU patients	C3						
94		Interpretation	Describe the interpretation of pediatric NCS & portable recording	C3						
95		Practical performance	Perform the procedure of NCS in pediatric & ICU patients independently		P4		Demo	1	OSPE	01
96		SOPs compliance	Comply to SOPs for neurophysiological instruments			A4	Role Play			

RECOMMENDED BOOKS;

NAME OF BOOK

AUTHORS

1	Practical Guide for Clinical Neurophysiologic Testing EEG	Thoru Yamada, MD and Elizabeth Meng
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	INTRODUCTION TO NERVE CONDUCTION STUDY	05	01	Static
2	CARDINAL ROLES OF NERVE CONDUCTION STUDY	02	01	Static
3	MOTOR CONDUCTION STUDY (MCS)	02	01	Static
4	SENSORY CONDUCTION STUDY (SCS)	05	01	Static
5	MIXED CONDUCTION STUDY	03	0	Static

6	IMPORTANT BASIC PATTERN OF NCS	05	01	Interactive/Static
7	LATE RESPONSES	05	01	Static
8	BLINK REFLEX STUDY	02	01	Static
9	REPETITIVE NERVE STIMULATION (RNS)	05	01	Static
10	ROUTINE UPPER EXTREMITY NCS	05	01	Static
11	ROUTINE LOWER EXTREMITY NERVE CONDUCTION TECHNIQUES	05	01	Static
12	NCS IN POLYNEUROPATHY (DEMYELINATING)	09	01	Static
13	NCS IN POLYNEUROPATHY (AXONAL)	05	01	Static
14	NCS IN MYOPATHY & NMJ DISORDERS	05	01	Static
15	NCS IN AMYOTROPHIC LATERAL SCLEROSIS (ALS)	05	01	Static
16	NORMAL NCS PEDIATRIC VALUES	02	0	-
	TOTAL	70	14	

NEUR-632 Infectious Diseases of Central Nervous System 3(2+1)

Course Description

This course will introduce the students to basic concepts of the infectious diseases affecting the human central nervous system, its clinical evaluation, signs and symptoms, its neurophysiological diagnosis & importance. Students will be able to understand how to diagnose differentially, clinically these pathologies and how to interpret neurophysiological evidence for infectious diseases of CNS. This course will cover the different types of infectious diseases of the central nervous system like the different types of meningitis, different types of encephalitis, brain abscesses, toxoplasmosis, rabies, Lyme disease spirochete, epidural abscess, Epstein-Barr virus, Herpes simplex virus, Measles, Myelitis, Sepsis-associated encephalitis, SSPE, ventriculitis, LKS/LGS, Leprosy/Hansen disease, TSE, sub-dural empyema, intra-cranial epidural abscess, spinal epidural abscess, cysticercosis, tetanus, botulism, seizures and epilepsies & its relation to other system involvement. It also covers different clinical conditions faced in daily routine electrophysiological evaluation. It will help in developing the practical skill of students by determining the differential & final diagnosis during neurophysiological procedures like NCS, EMG, RNS, EPs, PSG, & EEG.

Learning Objectives

Cognitive Domain

By the end of this course, students should be able to;

1. Describe the infectious diseases of CNS & its pathology
2. Discuss the clinical features of all these pathologies
3. Explain the clinical/differential diagnosis of all these diseases
4. Describe the neurophysiological evaluation and findings in all these pathologies
5. Demonstrate the interpretation & final diagnosis of all these diseases

Psychomotor Domain

By the end of this course, students should be able to;

1. Perform the procedure of recording the above pathology of Central Nervous System
2. Demonstrate the different pathologies of CNS infection and their neurophysiological recording
3. Perform clinical examination to know about any pathology related to CNS especially infectious diseases
4. Perform the recording of cerebral cortex activity (EEG), PNS recording potentials & spinal cord recording (SSEP) independently
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently.

Affective Domain

By the end of this course, students should be able to;

1. Demonstrate punctuality
2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life
5. Comply with SOPs of practical & procedure effectively

TABLE OF SPECIFICATIONS

TOS-INFECTIOUS DISEASES OF CENTRAL NERVOUS SYSTEM 3(2+1)

S.No	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: INTRODUCTION TO CNS INFECTIOUS DISEASES										
1	Week-1	Introduction	Introduction to the infectious diseases of CNS	C1			Interactive Lecture/SGD	2	MCQs	05
2		Clinical presentation	Explain the clinical features of CNS infectious diseases	C2						
3		Classification	Explain the classification of CNS infection	C2						
4		Practical performance	Demonstrate the interpretation of EEG, radiological imaging & CSF analysis in CNS infectious diseases		P4		Demo	1	OSPE	
5		Communication	Communicate the procedure of EEG in an effective way to the patient			A4	Role Play			
TOPIC: MENINGITIS										
6	Week-2	Introduction	Introduction to the meningitis	C1			Interactive Lecture/CBL	2	MCQs	03
7		Classification	Describe the pathophysiology & classification of meningitis	C3						
8		Clinical features	Explain the clinical features of different types of meningitis	C2						
9		Practical performance	Demonstrate the interpretation of EEG findings in meningitis patients		P4		Demo	1	OSPE	
10		SOPs compliance	Adopt how to take care of neurophysiology instruments			A4	Role Play			
TOPIC: ENCEPHALITIS (PYOGENIC)										
11	Week-3	Introduction	Describe briefly encephalitis	C1			Interactive Lecture/CBL	2	MCQs	05
12		Pathophysiology	Discuss pathophysiology of encephalitis	C2						
13		Types	Explain the different types of encephalitis	C2						
14		Clinical findings	Discuss the clinical findings in encephalitic patients	C3						
15		Practical performance	Demonstrate the interpretation of CSF analysis & radiological imaging in encephalitic patients		P4		Demo	1	OSPE	
16		SOPs compliance	Adopt how to take care of neurophysiology laboratory equipment's			A4	Role Play			
TOPIC: ENCEPHALITIS (VIRAL)										
17	Week-4	Introduction	Introduction to the types of encephalitis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
18		Signs & symptoms	Explain the characteristics s/s of different encephalitis	C2						
19		Diagnosis	Discuss the clinical, differential & final diagnosis of different encephalitis	C3						
20		Practical performance	Demonstrate the interpretation of EEG findings in different patients of encephalitis		P4		Demo	1	OSPE	
21		SOPs compliance	Adopt how to take care of electroencephalogram			A4	Role Play			

TOPIC: BRAIN ABSCESS

22	Week-5	Introduction	Introduction to brain abscess	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
23		Types/pathophysiology	Explain the different types & pathophysiology of brain abscesses	C2						
24		Signs & symptoms	Explain the different signs & symptoms of these abscesses	C3						
25		Diagnosis	Explain the clinical & final diagnosis of these abscesses	C3						
26		Practical performance	Demonstrate the interpretation of neurophysiological findings & imaging in these abscess		P4		Demo	1	OSPE	01
27		SOPs compliance	Adopt how to take care of EEG machine & its recording electrodes			A4	Role Play			

TOPIC: LYME DISEASE

28	Week-6	Introduction	Introduction to the Lyme disease	C1			Interactive Lecture/CBL	2	MCQs/SEQs	02
29		Causes	Explain the different causes of Lyme disease	C2						
30		Clinical features	Explain the signs & symptoms of Lyme disease	C3						
31		Diagnosis	Explain the diagnosis of Lyme disease	C4						
32		Practical performance	Demonstrate clinical history, interpretation of laboratory testing/serology & CSF analysis in patients having Lyme disease		P4		Demo	1	OSPE	0
33		Ethical norms	Adopt how to take care of patient ethical norms			A4	Role Play			

TOPIC: RABIES

34	Week-7	Introduction	Introduction to the rabies	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
35		Pathogenesis/incubation p.	Explain the pathogenesis of rabies	C2						
36		Clinical features	Explain the clinical features of rabies	C3						
37		Diagnosis	Explain the diagnosis of rabies	C4						
38		Prevention & management	Explain the prevention, management & vaccination of rabies	C5						
39		Practical performance	Demonstrate the interpretation of laboratory diagnosis & neurophysiological findings of a rabid patients		P4		Demo	1	OSPE	01
40		SOPs compliance	Adopt how to take care of neurophysiology instruments sterilization			A4	Role Play			

TOPIC: BOTULISM

41	Week-8	Introduction	Introduction to botulism	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
42		Pathogenesis/incubation p.	Explain the pathogenesis of botulism	C2						
43		S/S & diagnosis	Explain the clinical features & diagnosis of botulism	C3						
44		Practical performance	Demonstrate the interpretation of NCS/EMG, RNS, single fiber EMG in a patient of botulism		P4		Demo	1	OSPE	01
45		Counseling	Counseling of the patient for NCS/EMG procedure			A4	Role Play			

TOPIC: TRANSVERSE MYELITIS™

46	Week-9	Introduction	Introduction to the myelitis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	04
47		Causes	Explain the different causes of myelitis	C2						
48		S/S	Explain the clinical presentation of myelitis patients	C3						

49		Diagnosis	Explain the diagnosis of different myelitis patients	C3						
50		Practical performance	Demonstrate interpretation of CSF analysis & radiological imaging findings in TM patients		P4		Demo	1	OSPE	0
51		SOPs compliance	Adopt how to take care of neurophysiology laboratory instruments			A4	Role Play			

TOPIC: SUBACUTE SCLEROSING PANENCEPHALITIS (SSPE)

52	Week-10	Introduction	Introduction to the SSPE/Dowson disease	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
53		Pathogenesis & stages	Explain the pathogenesis & 4 stages of Dowson disease	C2						
54		S/S	Explain the clinical presentation of Dowson disease patient	C1						
55		Diagnosis	Explain the diagnostic criteria for Dowson disease							
56		Practical performance	Demonstrate interpretation of EEG findings in SSPE patients		P4		Demo	1	OSPE	01
57		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			

TOPIC: VENTRICULITIS

58	Week-11	Introduction	Introduction to the ventriculitis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
59		Causes	Explain the different causes of ventriculitis	C2						
60		S/S	Explain the signs & symptoms of ventriculitis	C1						
61		Diagnosis	Explain the diagnosis of ventriculitis	C2						
62		Practical performance	Demonstrate interpretation of brain imaging and CSF analysis in patients having ventriculitis		P4		Demo	1	OSPE	0
63		SOPs compliance	Adopt how to take care of neurophysiological instruments			A4	Role Play			

TOPIC: TRANSMISSIBLE SPONGIFORM DISEASES (TSE)

64	Week-12	Introduction	Explain the TSE/Prion disease	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
65		Causes	Explain the main causes of Prion disease	C2						
66		S/S	Explain the clinical features of TSE	C1						
67		Diagnosis	Explain the diagnosis of TSE/Prion disease	C2						
68		Practical performance	Demonstrate interpretation of clinical signs & brain biopsy findings in TSE patients		P4		Demo	1	OSPE	01
69		SOPs compliance	Adopt how to take care of neurophysiology software			A4	Role Play			

TOPIC: LANDAU-KLEFFNER SYNDROME (LKS)

70	Week-13	Introduction	Explain the LKS/infantile acquired aphasia	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
71		Causes	Explain the main causes of LKS	C1						
72		S/S	Explain the clinical findings in LKS patients	C2						
73		Diagnosis	Explain the diagnosis of LKS	C3						
74		Complication/Life expectancy	Explain the life expectancy of LKS patients	C4						
75		Practical performance	Demonstrate the interpretation of EEG findings in LKS patients		P4		Demo	1	OSPE	01
76		SOPs compliance	Adopt how to take care of electroencephalogram			A4	Role Play			

TOPIC: LENNOX-GASTAUT SYNDROME (LGS)

77	Week-14	Introduction	Introduction to the LGS	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
78		Causes	Explain the main causes of LGS	C2						
79		S/S	Explain the different S/S of LGS	C3						
80		Diagnosis	Explain the diagnosis of LGS	C4						
81		Complication/life expectancy	Explain the complication & life expectancy of LGS patients	C4						
82		Practical performance	Demonstrate interpretation of EEG findings in LGS patients		P4		Demo	1	OSPE	01
83		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			

TOPIC: SEIZURE DISORDER

84	Week-15	Introduction	Introduction to the seizures	C1			Interactive Lecture/CBL	2	MCQs/SEQs	07
85		Classification	Explain the different classification of seizures	C2						
86		S/S	Explain the clinical S/S of different types of seizures	C3						
87		Diagnosis	Explain the diagnosis of seizures	C3						
88		Complications	Illustrate the complications of seizures if untreated	C4						
89		Practical performance	Demonstrate interpretation of EEG findings in different types of seizures		P4		Demo	1	OSPE	02
90		Report providence	Provide report to the patient in time			A4	Role Play			

TOPIC: EPILEPSY

91	Week-16	Introduction	Introduction to the epilepsy	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
92		Classification	Explain the classification of epilepsy	C2						
93		S/S	Explain the clinical presentation of epilepsy	C3						
94		Diagnosis	Explain the diagnosis of epilepsy & describe status epilepticus	C3						
95		Practical performance	Demonstrate interpretation of EEG findings waves in epileptic patients		P4		Demo	1	OSPE	01
96		SOPs compliance	Adopt how to take care of neurophysiology instruments			A4	Role Play			

RECOMMENDED BOOKS;

NAME OF BOOK

AUTHORS

1	Practical Guide for Clinical Neurophysiologic Testing EEG	Thoru Yamada, MD and Elizabeth Meng
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	INTRODUCTION TO CNS INFECTIOUS DISEASES	05	01	Static
2	MENINGITIS	03	01	Static
3	ENCEPHALITIS (PYOGENIC)	05	01	Static
4	ENCEPHALITIS (VIRAL)	05	01	Static
5	BRAIN ABSCESS	05	01	Static
6	LYME DISEASE	02	0	-

7	RABIES	05	01	Static
8	BOTULISM	05	01	Static
9	TRANSVERSE MYELITIS TM	04	0	-
10	SUBACUTE SCLEROSING PANENCEPHALITIS (SSPE)	05	01	Static
11	VENRICULITIS	03	0	-
12	TRANSMISSIBLE SPONGIFORM DISEASES (TSE)	03	01	Interactive
13	LANDAU-KLEFFNER SYNDROME (LKS)	03	01	Static
14	LENNOX-GASTAUT SYNDROME (LGS)	05	01	Static
15	SEIZURE DISORDER	07	02	Static
16	EPILEPSY	05	01	Static
	TOTAL	70	14	

NEUR-633 Neurophysiological Instruments 3(2+1)

Course Description

This course will introduce the students to basic concept of electricity & electronics in order to perform routine electro diagnostic (EDX) studies. Although a degree in electrical engineering certainly is not needed, the answer clearly is yes. First, and most important, understanding the basics of electricity is essential to safely perform EDX studies & prevent potential electrical injures to patients. Secondly students will be able to understand all of the responses recorded during different procedures. These potentials are small electrical signals that are amplified, filtered, and then displayed electronically. Knowledge of electricity and electronics allows for a better understanding of what these potentials represent. Finally, and equally this course as important, knowledge of electricity and electronics is critical to understand and correct the variety of technical problems that frequently arise during neurophysiological studies. It also covers different types of biomedical instruments such as diagnostic, therapeutic & assistive/rehabilitation devices. It will help in developing the practical skill of students by determining the differential & final diagnosis during the neurophysiological procedures like EEG, EMG/NCS, EP, PSG, TMS, TES, and MEP.

Learning Objectives

Cognitive Domain

By the end of this course, students should be able to

1. Describe the biomedical instruments (BMI)
2. Discuss the different types of BMI
3. Explain the basics of electricity used in neurophysiological instruments
4. Describe electronics & its importance in instruments used in neurophysiology technology
5. Demonstrate the parts of different electronics in neurophysiological instruments

Psychomotor Domain

By the end of this course, students should be able to

1. Perform to reduce electrical artifacts during routine neurophysiological procedures
2. Demonstrate the different parts of electronics used in neurophysiological instruments
3. Perform different techniques to record accurate electrical potentials during routine procedures
4. Perform the recording of cerebral cortex small potentials with the help of different electronics used in diagnostic machines
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently

Affective Domain

By the end of this course, students should be able to

- 1-Demonstrate punctuality
2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life
5. Comply with SOPs of practical & procedure effectively

TABLE OF SPECIFICATION

TOS-NEUROPHYSIOLOGICAL INSTRUMENTS 3(2+1)

S.No	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: BIOMEDICAL INSTRUMENTATION (BMI)										
1	Week-1	Introduction	Introduction to basic biomedical instruments	C1			Interactive Lecture/SGD	2	MCQs	05
2		Types & components	Explain the main types of biomedical devices/instruments and its components	C2						
3		Characteristics	Explain the characteristics of BMI	C3						
4		Practical performance	Demonstrate the EEG machine components in neurophysiology laboratory		P4		Demo	1	OSPE	
5		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: BASIC ELECTRONICS										
6	Week-2	Introduction	Introduction to the basic electronics	C1			Interactive Lecture/SGD	2	MCQs	05
7		Elements	Describe elements and its different parts	C3						
8		Conductor	Explain conductor and resistor	C2						
9		Practical performance	Demonstrate the EEG machine parts, junction box, electrodes & its cables		P4		Demo	1	OSPE	
10		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: DIRECT CURRENT AND ALTERNATING CURRENT (AC & DC)										
11	Week-3	Introduction	Introduction to the DC & AC	C1			Interactive Lecture/SGD	2	MCQs/SEQs	03
12		Characteristic	Explain the characteristics of AC & DC	C2						
13		Importance	Explain the importance of AC & DC in BMI	C3						
14		Practical performance	Demonstrate the EMG machine power supply and its earthing/grounding		P4		Demo	1	OSPE	
15		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: ELECTRIC CIRCUIT										
16	Week-4	Introduction	Introduction to the electric circuit	C1			Interactive Lecture/SGD	2	MCQs/SEQs	02
17		Types of circuit	Explain different types of circuits	C2						
18		Characteristics	Discuss characteristics of different circuits	C3						

19		Practical performance	Demonstrate the EMG machine parts, stimulator, recording electrodes & junction box		P4		Demo	1	OSPE	01
20		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			

TOPIC: KIRCHOFF'S LAW

21	Week-5	Introduction	Introduction to the Kirchoff's law	C1			Interactive Lecture/SG D	2	MCQs/SEQs	03
22		Current circuit	Explain open circuit, short circuit & close circuit	C2						
23		Resistive circuit	Explain simple resistive circuit	C3						
24		Reactance/impedance	Explain reactance and impedance	C3						
25		Practical performance	Demonstrate the Kirchoff's law working in neurophysiological instruments with the help of color charts		P4		Demo	1	OSPE	01
26		SOPs compliance	Adopt how to take care of neurophysiological instruments			A4	Role Play			

TOPIC: RESISTOR AND OHM'S LAW

27	Week-6	Introduction	Introduction to the resistor	C1			Interactive Lecture/SG D	2	MCQs/SEQs	05
28		Ohm's law	Explain the Ohm's law in detail	C2						
29		Characteristic	Explain the characteristics of resistor	C3						
30		Importance	Explain the importance of resistor in series and parallel	C3						
31		Practical performance	Demonstrate the EMG machine parts and its software application in computer system		P4		Demo	1	OSPE	01
32		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			

TOPIC: POWER TRANSFORMER

33	Week-7	Introduction	Introduction to the power transformer	C1			Interactive Lecture/SG D	2	MCQs/SEQs	02
34		Characteristics	Explain the characteristics of power transformer	C2						
35		Parts	Explain the different parts of power transformer	C3						
36		Advantages	Explain the advantages of power transformer used in neurophysiology instruments	C3						
37		Coil turn ratio	Illustrate the best power transformer coil turn ratio	C4						
38		Practical performance	Demonstrate different parts of power transformer used in neurophysiology instruments with the help of color charts		P4		Demo	1	OSPE	01
49		SOPs compliance	Adopt how to take care of EEG/EMG/PSG machines			A4	Role Play			

TOPIC: VOLTAGE DIVIDER

40	Week-8	Introduction	Introduction to the voltage divider	C1			Interactive Lecture/SG D	2	MCQs/SEQs	03
41		Applications	Explain the applications of voltage divider in neurophysiology instruments	C2						
42		Advantages	Explain the advantages of voltage divider	C3						
43		Practical	Demonstrate common problems of earthing in neurophysiology laboratory during		P4		Demo	1	OSPE	0

		performance	different procedures							
44		SOPs compliance	Adopt how to take care of EEG/EMG machines			A4	Role Play			

TOPIC: ISOLATION TRANSFORMER

45	Week-9	Introduction	Introduction to the isolation transformer	C1			Interactive Lecture/SG D	2	MCQs/SEQs	02
46		Characteristics	Explain the characteristics of isolation transformer	C2						
47		Usage	Explain the usage of isolation transformer in neurophysiology equipment	C1						
48		Operation	Explain the transformer operation in neurophysiology instruments	C2						
49		Practical performance	Demonstrate the isolation transformer diagram working in neurophysiological instruments with the help of color charts		P4		Demo	1	OSPE	0
50		SOPs compliance	Adopt how to take care of EEG/EMG machines			A4	Role Play			

TOPIC: DIGITAL SIGNAL ANALYSIS

51	Week-10	Introduction	Introduction of Analog-to-Digital Conversion (ADC) of signals	C1			Interactive Lecture/SG D	2	MCQs/SEQs	05
52		Characteristics	Explain the characteristics of ADC	C2						
53		Nyquist frequency	Explain Nyquist frequency in detail	C1						
54		Importance	Explain the importance of ADC in clinical neurophysiology instrumentation	C2						
55		Practical performance	Demonstrate the interpretation of ADC signals of EEG during electroencephalography procedure		P4		Demo	1	OSPE	01
56		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			

TOPIC: CAPACITOR AND TRANSDUCER

57	Week-11	Introduction	Describe briefly capacitor and transducer	C1			Interactive Lecture/SG D	2	MCQs	05
58		Inductor	Discuss inductor and its importance	C2						
59		Characteristics	Explain characteristic of inductor	C2						
60		Charge/current	Discuss charge and current in detail	C3						
61		Practical performance	Demonstrate the different types of software working in EMG machine		P4		Demo	1	OSPE	01
62		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			

TOPIC: AMPLIFIER

63	Week-12	Introduction	Introduction to the amplifier	C1			Interactive Lecture/SG D	2	MCQs/SEQs	10
64		Types /classes	Explain the different classes of amplifier	C2						
65		Characteristic	Explain main characteristics of an amplifier used in neurophysiology instruments	C3						
66		CMRR	Explain common mode rejection ratio (CMRR) in details	C4						
67		Practical performance	Demonstrate interpretation of EEG waves with the help of high frequency filter (HFF) and low frequency filter (LFF)		P4		Demo	1	OSPE	01

68		SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play			
TOPIC: GROUNDING LOOP										
69	Week-13	Introduction	Explain the grounding loop in detail	C1			Interactive Lecture/SGD	2	MCQs/SEQs	05
70		Characteristics	Explain the characteristics of grounding loop	C1						
71		Operation	Explain the operation of grounding loop	C2						
72		Disadvantage	Explain the disadvantages of grounding loop	C3						
73		Diagram	Explain the diagram of grounding loop	C4						
74		Practical performance	Demonstrate common problems in neurophysiology Lab during different procedures		P4		Demo	1	OSPE	01
75		SOPs compliance	Adopt how to take care of neurophysiology machines			A4	Role Play			
TOPIC: NEUROPHYSIOLOGY ELECTRODES										
76	Week-14	Introduction	Introduction to neurophysiology electrodes	C1			Interactive Lecture/SGD	2	MCQs/SEQs	10
77		Types/Classes	Explain different types of skin electrodes used in clinical neurophysiology laboratory	C2						
78		Impedance	Explain the different electrodes impedance used in clinical neurophysiology	C1						
79		Needle electrode	Explain needle electrodes in detail	C2						
80		Practical performance	Demonstrate the EEG recording electrodes in clinical neurophysiology laboratory		P4		Demo	1	OSPE	02
81			SOPs compliance	Adopt how to take care of EEG recording cables/electrodes			A4	Role Play		
TOPIC: EEG CALIBRATION										
82	Week-15	Introduction	Introduction to EEG calibration	C1			Interactive Lecture/SGD	2	MCQs/SEQs	02
83		Types	Explain the different types of calibration in EEG machine	C2						
84		Importance	Explain the importance of calibration	C3						
85		Paper speed	Explain the paper speed during recording EEG activity	C4						
86		Pen alignment	Explain the pen alignment and damping in EEG recording	C5						
87		Practical performance	Demonstrate the interpretation of EEG calibration with the help of electroencephalography machine		P4		Demo	1	OSPE	01
88			SOPs compliance	Adopt how to take care of EEG machine			A4	Role Play		
TOPIC: ELECTRICAL SAFETY										
89	Week-16	Introduction	Introduction to the electrical safety	C1			Interactive Lecture/SGD	2	MCQs/SEQs	03
90		Lethal current	Explain the limitation of lethal current	C2						
91		Basic requirements	Explain basic requirements for proper grounding of neurophysiological instruments	C3						

92		Leakage current	Explain leakage current & how can be minimize leakage current	C3						
93		Practical performance	Demonstrate different protocol for electrical safety of the instruments & patients		P4		Demo	1	OSPE	0
94		SOPs compliance	Adopt how to take care of neurophysiology machines/instruments.			A4	Role Play			

RECOMMENDED BOOKS;**NAME OF BOOK****AUTHORS**

1	Practical Guide for Clinical Neurophysiologic Testing EEG	Thoru Yamada, MD and Elizabeth Meng
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	BIOMEDICAL INSTRUMENTATION (BMI)	05	02	Static
2	BASIC ELECTRONICS	05	01	Static
3	DIRECT CURRENT AND ALTERNATING CURRENT (AC & DC)	03	01	Static
4	ELECTRIC CIRCUIT	02	01	Static
5	KIRCHOFF'S LAW	03	01	Static
6	RESISTOR AND OHM'S LAW	05	01	Static
7	POWER TRANSFORMER	02	01	Static
8	VOLTAGE DIVIDER	03	0	-
9	ISOLATION TRANSFORMER	02	0	-
10	DIGITAL SIGNAL ANALYSIS	05	01	Static
11	CAPACITOR AND TRANSDUCER	05	01	Interactive
12	AMPLIFIER	10	01	Static
13	GROUNDING LOOP	05	01	Static
14	NEUROPHYSIOLOGY ELECTRODES	10	01	Static
15	EEG CALIBRATION	02	01	Static
16	ELECTRICAL SAFETY	03	0	-
	TOTAL	70	14	

NEUR-615 Electromyography (EMG) 3(2+1)

Course Description

This course will introduce the students the basic concepts of electromyography & its importance. After the nerve conduction studies, the electrophysiologic evaluation moves on to the needle electromyography (EMG). EMG study must be individualized based on the clinical findings and differential diagnosis and modified as the test proceeds and more data are obtained. Almost every muscle in the body can be studied with EMG. Students will be able to understand how different pathologies affecting the human skeletal muscular system. This course will cover the different types of EMG which evaluate the multiple muscle diseases & its relation to other system involvement. It also covers different clinical conditions faced in daily routine electrophysiological evaluation. It will help in developing the practical skill of students by determining the differential & final diagnosis during the neurophysiological procedures like **Single Fiber EMG**, routine **EMG**, **PSG**, **MWT**, **MSLT**, **NCS**, **RNS**, **EPs**, & **EEG**.

Learning Objectives

Cognitive Domain

By the end of this course students should be able to

1. Describe the principles of electromyography, its different types
2. Discuss electromyography findings/pattern in different muscle diseases
3. Explain single fiber electromyography & its application
4. Describe motor unit action potentials (MUAPs) in EMG & its related terminology, applications, and interpretations of these procedures
5. Demonstrate EMG, its types, clinical applications, parameters, measuring units & finally interpretation of EMG

Psychomotor Domain

By the end of this course students should be able to

1. Perform the procedure of electromyography under the supervision of neurophysiologist/HOD
2. Demonstrate the different types of EMG
3. Perform clinical examination to know about any pathology related to muscle disorders
4. Perform the recording of all muscles used in interpretation of EMG
5. Perform all electrophysiological investigations independently
6. Perform clinical & differential diagnosis independently

Affective Domain

By the end of this course students should be able to

1. Demonstrate punctuality

2. Follow the specified norms of the IL, SGD teaching & learning effectively
3. Demonstrate humbleness and use socially acceptable language during academic and social interactions with human models, colleagues, and teachers.
4. Demonstrate ethically competent decisions when confronted with an ethical, social, or moral problem in professional or personal life

TABLE OF SPECIFICATION

TOS-ELECTROMYOGRAPHY (EMG) 3(2+1)

S.No	Weeks	Contents	Learning Outcome	Domain			MIT's	Time/Hours	Assessment	No of Items
				C	P	A				
TOPIC: BASIC PRINCIPLES OF ELECTROMYOGRAPHY										
1	Week-1	Introduction	Introduction to the basic principles of electromyography (EMG)	C1			Interactive Lecture/CBL	2	MCQs	02
2		Patient preparation	Explain patient preparation for EMG procedure	C2						
3		Needle selection	Explain the EMG needle selection for each patient	C2						
4		Practical performance	Demonstrate the interpretation of EMG findings in muscle pathology		P4		Demo	1	OSPE	01
5		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: ANATOMY FOR NEEDLE ELECTROMYOGRAPHY										
6	Week-2	Introduction	Introduction to basic anatomy and physiology for EMG	C1			Interactive Lecture/CBL	2	MCQs	05
7		Upper extremity	Explain the upper limbs nerve innervated muscles in detail	C2						
8		Lower extremity	Explain the lower limbs nerve innervated muscles in detail	C3						
9		Cranial innervated muscle	Explain the cranial nerve innervated muscles in detail	C3						
10		Activation	Illustrate the activations of all these skeletal muscles during EMG	C4						
11		Practical performance	Demonstrate the skeletal muscle belly during routine EMG with the help of color charts and models		P4		Demo	1	OSPE	02
12		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: TYPES OF ELECTROMYOGRAPHY										
13	Week-3	Introduction	Introduction to the different types of EMG	C1			Interactive Lecture/CBL	2	MCQs	02
14		Surface EMG	Describe surface electromyography & its importance	C3						
15		Intramuscular EMG	Explain intramuscular electromyography in detail	C2						
16		Practical performance	Demonstrate the interpretation of EMG procedure in myopathic patients		P4		Demo	1	OSPE	01
17		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: ELECTROMYOGRAPHY ELECTRODES										
18	Week-4	Introduction	Describe briefly EMG recording electrodes	C1			Interactive Lecture/CBL	2	MCQs	02
19		Types	Discuss different types of EMG recording electrodes	C2						
20		Characteristics	Explain characteristics of EMG recording electrodes	C2						

21		Materials/configuration	Discuss the material & configuration of EMG electrodes	C3						
22		Practical performance	Demonstrate different types of EMG electrodes with the help of color charts & models		P4		Demo	1	OSPE	01
23		SOPs compliance	Adopt how to take care of charts and models			A4	Role Play			
TOPIC: MUSCLE SIGNAL ANALYSIS										
24	Week-5	Introduction	Introduction to the muscle signal analysis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
25		Types	Explain Time-Domain analysis, Frequency-Domain analysis, Time-Frequency analysis & Non-Linear analysis in details	C2						
26		Applications	Discuss the different applications of muscle signal analysis	C3						
27		Practical performance	Demonstrate the interpretation of muscle signal analysis during EMG procedure		P4		Demo	1	OSPE	01
28		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: ELECTROMYOGRAPHY IN CLINICAL DIAGNOSIS										
29	Week-6	Introduction	Introduction to EMG role in clinical diagnosis	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
30		Types	Explain different types of EMG, Macro-EMG & concentric needle EMG	C2						
31		EMG findings	Explain EMG findings in clinical diagnosis	C3						
32		Benefits/limitations of EMG	Explain the benefits/limitations of EMG in clinical diagnosis	C3						
33		Practical performance	Demonstrate the interpretation of EMG findings in clinical conditions		P4		Demo	1	OSPE	01
34		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: ELECTROMYOGRAPHY IN SPORTS AND EXERCISE SCIENCE										
35	Week-7	Introduction	Introduction to the EMG in sports and exercise science	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
36		Applications	Explain muscle activity analysis, injury prevention & rehabilitation, exercise techniques analysis, muscle fatigue analysis and neuromuscular training	C2						
37		EMG in specific sports	Explain EMG role in Golf, Tennis, Football, Cycling, & Running	C3						
38		Benefits of EMG	Explain the benefits of EMG in Sports & Exercise science in detail	C4						
39		Practical performance	Demonstrate the EMG role in Sports & Exercise Science with the help of color charts & models		P4		Demo	1	OSPE	0
40		SOPs compliance	Adopt how to take care of charts and models			A4	Role Play			
TOPIC: ELECTROMYOGRAPHY IN PROSTHETICS AND ORTHOTICS										
41	Week-8	Introduction	Introduction to EMG in Prosthetic and Orthotics	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
42		Application in Prosthetics	Explain the upper, lower limbs prosthetic & prosthetic limb control	C2						
43		Orthotics & EMG	Explain the orthotic device control, muscle activation pattern & rehabilitation/training	C3						

44		Benefits of EMG	Explain the different benefits of EMG in Prosthetics & orthotics	C4						
45		Emerging trends	Explain the emerging trends in advanced Prosthetic limbs, Exoskeleton, Wearable devices & personalized Prosthetics & Orthotics	C5						
46		Practical performance	Demonstrate the interpretation of EMG activity in Prosthetic & Orthotics with the help of videos		P4		Demo	1	OSPE	0
47		Communication	Communicate the procedure of E MG in an effective way to the patient			A4	Role Play			
TOPIC: ELECTROMYOGRAPHY IN NEUROPROSTHETICS AND BRAIN-COMPUTER INTERFACES										
48	Week-9	Introduction & applications	Introduction to the BCI, neuroprosthetics & its applications in detail	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
49		MCI/EMG-BCIs/Hybrid BCIs	Explain muscle computer interfaces, EMG-based BCI & Hybrid BCIs	C2						
50		EMG in neuroprosthetics	Explain neuroprosthetics limb, EMG-controlled Exoskeletons, Neural Prosthetic Devices	C3						
51		Practical performance	Demonstrate the EMG-BCIs with the help of videos & color charts, models		P4		Demo	1	OSPE	01
52		SOPs compliance	Adopt how to take care of charts and models			A4	Role Play			
TOPIC: ADVANCED ELECTROMYOGRAPHY TECHNIQUES										
53	Week-10	Introduction	Introduction to the advance EMG techniques	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
54		Surface EMG	Explain the surface electromyography techniques	C2						
55		High-Density EMG	Explain HD surface EMG in detail	C3						
56		Advantages	Explain the advantages of surface EMG & High Density EMG	C3						
57		Practical performance	Demonstrate the interpretation of surface EMG independently		P4		Demo	1	OSPE	01
58		SOPs compliance	Adopt how to take care of EMG machine and its parts			A4	Role Play			
TOPIC: CLINICAL APPLICATIONS OF ELECTROMYOGRAPHY IN NEUROLOGICAL DISORDERS										
59	Week-11	Introduction	Introduction to the clinical application of EMG in different disorders	C1			Interactive Lecture/CBL	2	MCQs/SEQs	10
60		Neuropathy	Explain EMG findings in neuropathic diseases/disorders	C2						
61		Myopathic	Explain the EMG findings in myopathic diseases/disorders	C1						
62		Neuronopathy	Explain EMG findings in neuronopathy/anterior horn cell disorders							
63		Practical performance	Demonstrate the interpretation of EMG findings in neurological disorders		P4		Demo	1	OSPE	02
64		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: PARAMETERS OF ROUTINE ELECTROMYOGRAPHY										
65	Week-12	Introduction	Introduction to the different parameter of EMG activity	C1			Interactive Lecture/CBL	2	MCQs/SEQs	08
66		Amplitude/Voltage	Explain the MUAP amplitude recording during routine EMG	C2						
67		Phases	Explain the phases of a MUAPs during recording EMG activity	C1						

68		Interference pattern	Explain the interference pattern & recruitment of a MUAP recording	C2						
69		Practical performance	Demonstrate the interpretation of different parameters of routine EMG recording		P4		Demo	1	OSPE	01
70		SOPs compliance	Adopt how to take care of EMG cables			A4	Role Play			
TOPIC: SPONTANEOUS ACTIVITY & INSERTIONAL ACTIVITY ANALYSIS										
71	Week-13	Introduction	Explain the spontaneous & Insertional activity in detail	C1			Interactive Lecture/CBL	2	MCQs/SEQs	08
72		Spontaneous/triggered EMG	Explain the different b/w spontaneous, Insertional & triggered EMG	C2						
73		Types	Explain the different types of spontaneous & Insertional activity	C1						
74		Recording	Explain the parameter of different spontaneous & Insertional activity	C2						
75		Practical performance	Demonstrate interpretation of Insertional/spontaneous activity during routine EMG		P4		Demo	1	OSPE	01
76		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: MOTOR UNIT ACTION POTENTIALS ANALYSIS										
77	Week-14	Introduction	Explain the motor unit action potentials (MUAPs) in detail	C1			Interactive Lecture/CBL	2	MCQs/SEQs	05
78		MUAPs recording	Explain the MUAPs recording in detail	C1						
79		Morphology	Explain the morphology of a MUAPs in detail	C2						
80		Components of MUAPs	Explain the components of a motor unit action potentials	C3						
81		Factors affecting MUAPs	Explain the different factors which affect MUAPs morphology	C4						
82		Practical performance	Demonstrate interpretation of MUAPs during EMG procedure		P4		Demo	1	OSPE	01
83		SOPs compliance	Adopt how to take care of EMG machine & its electrodes			A4	Role Play			
TOPIC: SINGLE FIBER ELECTROMYOGRAPHY										
84	Week-15	Introduction	Introduction to the single fiber EMG	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
85		What it measures /history	Explain which action potential can be measured in Sf-EMG & its history	C2						
86		Usage	Explain the usage of single fiber EMG	C3						
87		Procedure	Explain the procedure of Sf-EMG in detail	C4						
88		Interpretation	Explain the interpretation of single fiber EMG	C4						
89		Practical performance	Demonstrate interpretation of Sf-EMG in NMJ disorder patients		P4		Demo	1	OSPE	0
90		SOPs compliance	Adopt how to take care of EMG machine			A4	Role Play			
TOPIC: APPROACH TO PEDIATRIC ELECTROMYOGRAPHY										
91	Week-16	Introduction	Introduction to the pediatric electromyography	C1			Interactive Lecture/CBL	2	MCQs/SEQs	03
92		EMG findings	Explain the EMG findings in SMA, Polio & other inherited diseases in pediatric patients	C2						

93		Demyelinating diseases	Explain the EMG findings in demyelinating pathology in pediatric pt.	C3						
94		Axonal/degenerative	Explain the EMG findings in axonal pathology in pediatric patients	C3						
95		Practical performance	Demonstrate the interpretation of EMG findings in pediatric cases		P4		Demo	1	OSPE	0
96		Confidentiality	Take care the confidentiality of the patients			A4	Role Play			

RECOMMENDED BOOKS;

NAME OF BOOK

AUTHORS

1		
2	Electromyography and Neuromuscular Disorders	David C. Preston and Barbara E. Shapiro
3		

ASSESSMENT BREAKDOWN

S. No	TOPICS	No of MCQs	No of OSPE/OSCE STATIONS	STATIC/INTERACTIVE
1	BASIC PRINCIPLES OF ELECTROMYOGRAPHY	02	01	Static
2	ANATOMY FOR NEEDLE ELECTROMYOGRAPHY	05	02	Static
3	TYPES OF ELECTROMYOGRAPHY	02	01	Static
4	ELECTROMYOGRAPHY ELECTRODES	02	01	Static
5	MUSCLE SIGNAL ANALYSIS	05	01	Static
6	ELECTROMYOGRAPHY IN CLINICAL DIAGNOSIS	05	01	Static
7	ELECTROMYOGRAPHY IN SPORTS AND EXERCISE SCIENCE	03	0	-
8	ELECTROMYOGRAPHY IN PROSTHETICS AND ORTHOTICS	03	01	Static
9	ELECTROMYOGRAPHY IN NEUROPROSTHETICS AND BRAIN-COMPUTER INTERFACES	03	01	Static
10	ADVANCED ELECTROMYOGRAPHY TECHNIQUES	03	01	Static
11	CLINICAL APPLICATIONS OF ELECTROMYOGRAPHY IN NEUROLOGICAL DISORDERS	10	01	Interactive
12	PARAMETERS OF ROUTINE ELECTROMYOGRAPHY	08	01	Static
13	SPONTANEOUS ACTIVITY & INSERTIONAL ACTIVITY ANALYSIS	08	01	Static
14	MOTOR UNIT ACTION POTENTIALS ANALYSIS	05	01	Static
15	SINGLE FIBER ELECTROMYOGRAPHY	03	0	-
16	APPROACH TO PEDIATRIC ELECTROMYOGRAPHY	03	0	-
	TOTAL	70	14	

THE END