

SUMANDEEP VIDYAPEETH

(Declared as Deemed to be University under Section 3 of the UGC Act 1956)

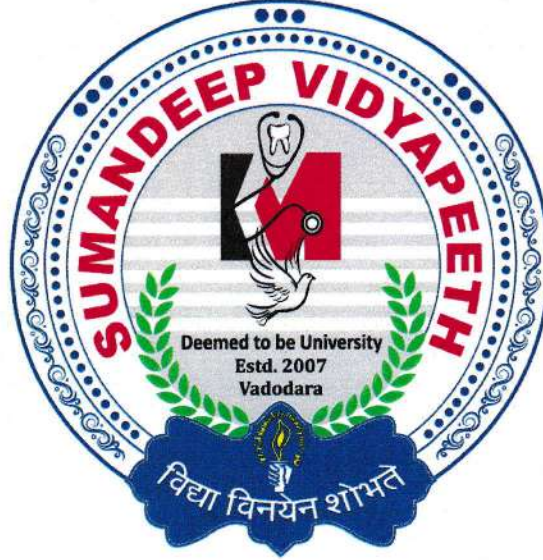
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CURRICULUM Doctor of Medicine (D.M.) in NEUROLOGY

Attested CTC

Anarany
15/2/2021

Vice-Chancellor

Sumandeep Vidyapeeth

An Institution Deemed to be University

VIII. Piparia, Taluka: Waghodia.

Dist. Vadodara-391 760. (Gujarat)



Manchanda

Choudhary



AMENDED UP TO DECEMBER -2020

PROGRAMME OUTCOME: DM

The purpose of post-doctoral education is to create specialists who would provide high quality health care and advance the cause of science through research and training.

Programme specific outcome: DM

POS 1. The goal of the training in DM is to have trained physicians competent to manage patients in hospital and community settings independently and serve as a teacher for training undergraduates/ postgraduates.

POS 2. He / She should also acquire skills in supervision of paramedical staff and be able to work as a team member of the health care providers.

POS 3. In addition, she/he should be well versed to carry out research.

POS 4. Thus, the major components of the curriculum shall cover theoretical knowledge, practical and clinical skills, attitude skills and training in research methodology and social care.

POS 5. Recognize the health needs of the community, and carry out professional obligations ethically and in keeping with the objectives of the national health policy.

COURSE OUTCOME (CO) : At the end of the training course in Neurology the student should be able:

1. to function as Faculty/consultants in the specialty
2. to plan and set up independent Neurology Unit catering to clinical and investigative Neurology
3. to carry out and help in conducting applied research in Neurosciences.

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1. INTRODUCTION

Neurology is the specialty encompassing the diagnosis, investigation and management of patients with neurological diseases. Presently, more than ten centers in the country offer basic training in neurology leading to the qualification which enables one to practice as consultant neurologist. A working document encompassing the basic syllabus, methods of training and methods of assessment during neurology training is a prerequisite for Neurology training programme. With the recent advances in the medical field in general and Neurology in particular, there is also a need to revise and update the existing syllabus.

This document has been divided in three basic subheadings: (A) Syllabus; (B) Training including methods of clinical and research training; and (C) Assessment which includes assessment during the period of training and the final assessment.

2. AIMS

The purpose of this curriculum is to define the competencies needed for the award of DM (Neurology) degree and the process of training and assessment for the DM (Neurology) degree at Smt. B. K. Shah Medical Institute and Research Center at Sumandeep Vidyapeeth, Vadodara, Gujarat.

The goal of the DM (Neurology) course is to produce competent specialists and/or medical teachers in Neurology specialty

1. Who have completed the competency based curriculum and have mastered most of the competencies in Neurological specialty which are required to be practiced
2. Who shall recognize the health needs of community and will carry out professional obligation ethically.
3. Who shall be aware of contemporary advances and developments in the Neurological discipline
4. Who shall be able to carry out basic and clinical research in Neurology

Who shall be able to teach postgraduate students in general medicine and Neurology

SYLLABUS

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This Syllabus defines the minimum levels of competencies required for the award of DM (Neurology) degree. This syllable provides only the broad guidelines about the minimum levels of competencies required. We understand that it may not be possible and/or feasible to assess the competency in every discipline, some of which are highly subjective, for each individual. We have divided the syllabus in three broad categories:

- 1) General and Professional competency
- 2) Competency in management of various Neurological disorders
- 3) Competency in various neurology sub-specialties and allied specialties

1. General and Professional competency

History taking:

Physician should demonstrate the following abilities:

- A. To obtain an appropriate, focussed and comprehensive history, including family history, socio-cultural history, and developmental history and communicate this verbally or in writing and in summary form.
- B. To listen and deal with complex patients (e.g. angry or distressed patient) including appropriate use of an interpreter for patients & families when their first language is different
- C. To obtain relevant information with full awareness of patient and family's sensibilities

Neurological Examination:

Physician should demonstrate the following abilities:

- A. A thorough working knowledge of neuroanatomy
- B. To perform comprehensive neurological examination including fundus examination, screening psychiatric examination and edrophonium, and calorictesting
- C. To generate a hypothesis about the probable neurological localization based upon



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history and clinical examination

- D. To complete the neurological examination with full respect for patient's personal dignity

Differential diagnosis, Investigations and management

Physician should demonstrate the following abilities:

- A. Knowledge of the different presentations of common and less common neurological diseases
- B. To generate a list of possible differential diagnoses based upon the history and clinical examination
- C. To understanding of the roles and usefulness of various investigations including neuroimaging and neurophysiology and to order relevant investigations specific for the problem in question. Physician should be able to order, carry out and interpret following basic investigations
- a. Lumbar puncture and CSF analysis
 - b. Electroencephalogram and Video-EEG
 - c. Nerve conduction studies and Electromyography
 - d. Evoked potentials
 - e. Polysomnography
 - f. Autonomic function testing
 - g. Electronystagmogram
 - h. Audiometry
 - i. Perimetry
 - j. Radiographic studies including CT scan, MRI, MR and CT angiography, and digital subtraction angiography
 - k. Imaging with ultrasound (Duplex, transcranial Doppler)
- D. To develop an overall plan for the patient based upon above information in consultation with other specialties, if required

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- A. To communicate effectively with the patient, their family and care givers and other staff in relation to the individual needs of the patient and with appropriate regard for confidentiality
- B. To transmit information to patients in a clear and meaningful fashion and to educate patients and their families, and professionals about medical, psychosocial, and behavioral issues
- C. To provide explanations of psychiatric and neurological disorders and their treatment in a language well understood by the patient matching to the educational/intellectual levels of patients and their families
- D. To ensure that the patient and family has understood the communication
- E. To explain the risks and benefits of the proposed treatment plan, including possible side effects of medications and/or complications of non-pharmacologic treatments and alternatives (if any) to the proposed treatment plan
- F. To give a prognosis, to explain the patient's condition, to break bad news, to obtain full and informed consent for investigations and treatment
- G. To obtain, interpret, and evaluate consultations from other medical specialties, take appropriate decisions and discussing the consultation findings with the patient and family
- H. Physicians shall demonstrate the ability to effectively work within a multidisciplinary treatment team, acknowledging and appreciating efforts, contributions and compromises.
- I. To continue to recognize the common purpose of the team and respect their decisions
- J. Able to act as a leader, mentor, educator and role model
- K. To work with and respect nonmedical professionals and paramedical and nursing staff

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Presentation and audit skills

Physicians shall demonstrate the following competencies:

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- A. Ability to give a range of oral presentations with the use of appropriate audio-visual aids including powerpoint presentations. Presentations may involve clinical cases, audits, review topics or research papers.
- B. Ability to instigate and collate an audit project.

Academic and research skills

Physicians shall demonstrate the following competencies:

- A. Ability to formulate a research question, search the relevant literature, reach the relevant conclusions and critically appraise the available evidence
- B. Ability to plan a clinically relevant research study, chalk out the research methodology, and implement the same
- C. Ability to interpret and synthesize the data from a study or trial and formulate meaningful conclusions
- D. Ability to communicate the case reports, original research papers or review articles to scientific journals

2. Competency in management of various Neurological disorders

Physician will demonstrate competency in management of various neurological disorders and will have theoretical and practical knowledge of topics included in the syllabus. This will include, but not limited to, following topics:

Basic sciences related to neurology

NEUROANATOMY

- The Neuroanatomy with special emphasis on development of Neuraxis (brain, spinal cord, neurons and glia) and their maturation process in the post natal, childhood and adolescent states
- Autonomic nervous system

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- The location and significance of stem cells,
- CSF pathways
- Blood supply and sino-venous drainage of brain and spinal cord, the meninges, skull and vertebral column
- Cranial nerves
- Spinal roots, plexuses, and their relation to neighbouring structures
- Anatomy of peripheral nerves, neuromuscular junction and muscles
- Histology of cerebrum, pituitary gland, brain stem and spinal cord, nerves and neuromuscular junction and muscle.
- Functional anatomy of lobes of cerebrum and white matter tracts of brain and spinal cord,
- Functional anatomy of the craniovertebral junction, conus and epiconus, cauda equina, brachial and lumbosacral plexuses
- Cavernous and other venous sinuses
- New developments in understanding of ultrastructural anatomy of neurons, axonal transport, neural networks and synapses and nerve cell function at molecular level.

NEUROPHYSIOLOGY

Neurophysiology will cover all the physiological changes in the nervous system during its normal function. This includes:

- Neuromuscular junction and synaptic transmission
- Muscle contraction
- Visual, auditory and somatosensory and cognitive evoked potentials
- Regulation of secretions by glands
- Neural control of viscera such as heart, respiration, GI tract, bladder and sexual function
- Sleep-wake cycles
- Maintenance of consciousness
- Special senses including visual system
- Control of pituitary functions
- Control of autonomic functions
- Functions of various lobes of brain

Cerebellar functions

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- Extrapyramidal functions
- Upper and lower motor neuron functions, motor unit
- Concepts of motor and sensory system

MOLECULAR BIOLOGY

- Principles of molecular biology including Gene Structure
- Expression and regulation of genes
- Recombinant DNA Technology
- PCR Techniques
- Molecular basis for neuronal and glial function
- Molecular and cellular biology of the membranes and ion-channels
- Mitochondrial genome
- Role of RNA in normal neuronal growth and functional expression
- Receptors of neurotransmitters, molecular and cellular biology of muscles and neuromuscular junction, etc.
- The Human Genome and its future implications for Neurology including developmental and neurogenetic disorders
- Bioethical implications and genetic counseling
- Nerve growth and other trophic factors and neuroprotectors
- Neural Tissue modification by genetic approaches including Gene Transfer, stem cell therapy etc.
- Molecular Development of neural tissue in peripheral nerve repair

NEUROCHEMISTRY

- All aspects of normal and abnormal patterns of neurochemistry including neurotransmitters associated with different anatomical and functional areas of brain and spinal cord
- Dopaminergic, serotonergic, adrenergic and cholinergic systems
- Opioids, excitatory and inhibitory amino acids
- Role of various neurotransmitters in pathogenesis of parkinsonism, depression, migraine, dementia, epilepsy
- Neuromuscular junction and muscle contractions

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- Carbohydrate, amino acid and lipid metabolism and the neural expression of disorders of their metabolism
- Electrolytes and their effect on encephalopathies
- Muscle membrane function, storage disorders, porphyrias

NEUROPHARMACOLOGY

- Medical therapy of various neurological disorders including epilepsy, parkinsonism, stroke, other movement disorders, immune mediated disorders, neuropsychiatric syndromes, spasticity, pain syndromes, disorders of sleep and dysautonomic syndromes
- Pharmacokinetics, pharmacodynamics and adverse effect profile of various drugs used in neurology

NEUROPATHOLOGY

- Pathological changes in various neurological diseases with special reference to vascular, immunemediated, de/dysmyelinating, metabolic and nutritional, genetic and developmental, infectious and iatrogenic and neoplastic disorders
- Pathological changes in nerve and muscle in neuropathies and myopathies
- Ultrastructural pathologies such as apoptosis, ubiquitinopathies, mitochondrial disorders, channelopathies, peroxisomal disorders, inclusion bodies, prion diseases, disorders mediated by antibodies against various cell and nuclear components, paraneoplastic disorders etc.

NEUROMICROBIOLOGY

- Microbiological aspects of infectious neurologic diseases including encephalitis, meningitis, brain abscess, granulomas, myelitis, cold abscess, cerebral malaria, parasitic cysts of nervous system, rhinocerebral mycoses, leprosy neuritis, neuroleptospirosis, primary and secondary Neuro HIV infections, congenital TORCH infections of brain, slow virus infections such as CJD and SSPE, neurological complications of viral infections such as Polio, EBV, Chickenpox, Rabies, Herpes, Japanese encephalitis and other epidemic viral infections.

NEUROTOXICOLOGY

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- Organophosphorus poisoning, hydrocarbon poisoning, lead, arsenic, botulinum toxin toxicity
- Snake, scorpion, spider, wasp and bee stings and their neurological manifestations

NEUROGENETICS AND PROTEOMICS:

- Autosomal dominant and recessive and X-linked inheritance patterns,
- Disorders of chromosomal anomalies
- Gene mutations
- Trinucleotide repeats
- Dysregulation of gene expressions
- Enzyme deficiency syndromes
- Storage disorders,
- Disorders of polygenic inheritance

NEUROEPIDEMIOLOGY:

- Basic methodologies in community and hospital based neuroepidemiological studies such as systematic data collection, analysis, derivation of logical conclusions
- Concepts of case-control and cohort studies, correlations, regressions and survival analysis
- Basic principles of clinical trials

CLINICAL NEUROLOGY

GENERAL EVALUATION OF THE PATIENT

- The science and art of history taking and physical Examination including elements of accurate history taking and evaluation of symptoms associated with neurological disease,
- The physical examination of adults, children, infants and neonates
- Examination of syndromes associated with congenital and acquired neurological disease and cutaneous markers
- Examination of unconscious patients
- Examination of higher mental functions
- Examination of cranial nerves
- Examination of the ocular fundus

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- Examination of motor system including evaluation for bulk, tone and power of muscles
- Proper elicitation of superficial and deep reflexes including the alternate techniques and neonatal and released reflexes
- Neurodevelopmental assessment of children
- Examination of sensory system and peripheral nerves
- Evaluation for signs of Meningeal irritation
- Skull and spine examination including measurement of head circumference, shortness of neck, carotid pulsations and vertebral bruits.

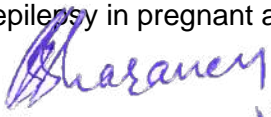
COMA

- Pathophysiology and diagnosis of Coma
- Diagnosis and management of coma
- Delirium and acute confusional states,
- Reversible and irreversible causes of coma
- Persistent vegetative states and brain death
- Neurophysiological evaluation and confirmation of these states
- Mechanical ventilation and other supportive measures of comatose patient and prevention of complications of prolonged coma.
- The significance of timely brain death in organ donation and ICU resource utilization
- Prognosis of comatose patients of various etiologies

SEIZURES, EPILEPSY AND SYNCOPE

- Diagnosis of seizures
- Definition, pathophysiology, classification and etiology of epilepsy and epilepsy syndromes
- Clinical assessment and diagnosis
- Differentiation from pseudoseizures, syncope and other organic events
- EEG and epilepsy
- Video-EEG monitoring
- Structural and functional brain imaging and epilepsy
- Medical management of epilepsy including pharmacology of antiepileptic drugs
- Special situations such as epilepsy in pregnant and nursing mothers, epilepsy in children and elderly




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- Significance of epilepsy for driving, risky occupations and its social stigmas
- Use of conventional and newer anti-epileptic drugs, their drug interactions and adverse effects etc.
- Management of intractable epilepsies including ketogenic diet, Vagal nerve stimulation, epilepsy surgery and about presurgical evaluation of patients
- Management of status epilepticus and refractory status epilepticus
- *New seizure and epilepsy classification*
- *Concept of drug resistant epilepsy*
- *Medical and surgical management of drug resistant epilepsy*
- *Concept of presurgical evaluation in epilepsy*
- *Indication and evaluation of Video-EEG monitoring*
- *Concept, utility, and limitations of interictal and ictal EEG*
- *Utility and limitations of various noninvasive presurgical source localization methods: PET, SPECT, MEG, EEG-fMRI*

HEADACHES AND OTHER CRANIAL NEURALGIAS

- Acquisition of skills in analysis of headaches of various causes such as those from raised intracranial pressures,
- Epidemiology, pathophysiology, diagnosis and management of migraine and other primary headache disorders
- Autonomic cephalgias
- Cranial neuralgias
- Vascular malformations and headache
- Meningeal irritation and headache
- Psychogenic headaches
- Pharmacologic management of various headache disorders
- *Classification of headache disorders*
- *Autonomic cephalgias including cluster headache, paroxysmal hemicranias, hemicrania continua, SUNCT, SUNA*
- *Rare headache disorders such as hypnic headache*
- *Newer therapies in migraine*

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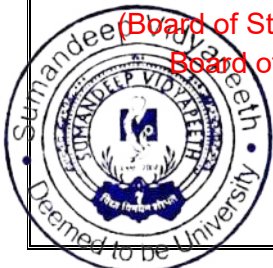
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(Board of Studies letter no.: SBKSMIRC/Dean/874, dated 18/06/2020 and Vide Notification of Board of Management Resolution Ref: No. SVDU/R/3383-A/2019-20 dated 31/07/2020) □

- *Intervention procedures for various headaches such as botulinum toxin and occipital nerve blockade*

CEREBROVASCULAR DISEASES

- Vascular anatomy of brain and spinal cord,
- Various causes, types, pathophysiology and management of cerebrovascular syndromes
- Ischemic and haemorrhagic strokes
- Arterial and venous strokes
- Anterior and posterior circulation strokes,
- OCSF and TOAST classifications
- Investigations of strokes including neuroimaging using dopplers, CT and MR imaging and angiography
- Thrombolytic therapy,
- Interventional therapy of cerebrovascular diseases
- Principles of diagnosis and management of subarachnoid hemorrhage
- Special situations like strokes in the young
- Strategies for primary and secondary prevention of stroke
- *Indications and contraindications for thrombolytic therapy including intra-arterial therapy*
- *Concept of diffusion and perfusion mismatch and diffusion FLAIR mismatch*
- *Current concepts in interventional therapy of acute stroke including mechanical thrombectomy and decompressive craniotomy*
- *Carotid endarterectomy and carotid stenting for symptomatic and asymptomatic carotid stenosis*

DEMENTIAS

- Concept of minimal cognitive impairment
- Reversible and irreversible dementias

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- Epidemiology, pathophysiology, diagnosis and management of various degenerative dementias including Alzheimer's disease, vascular cognitive impairment and fronto-temporal dementias
- Dementias associated with parkinsonism
- Genetic and familial syndromes
- Pharmacotherapy of dementias
- Potential roles of cognitive rehabilitation and special care of the disabled patients with dementias

PARKINSONISM AND MOVEMENT DISORDERS

- Disorders of extrapyramidal system such as parkinsonism, chorea, dystonias, athetosis, tics including their diagnosis and management
- Pathophysiology and diagnosis of parkinson's disease and parkinsonism plus syndromes including progressive supranuclear palsy, multiple system atrophy, cortico basal ganglionic degeneration and diffuse Lewy body disease
- Pharmacotherapy of parkinsonism and its complications
- Management of advanced parkinson's disease including principles of deep brain stimulation and lesion surgeries
- Use of EMG guided botulinum toxin therapy, management of spasticity using intrathecal baclofen and TENS
- *Recent advances in the genetics of Parkinson's disease*
- *Recent advances in deep brain stimulation and transplant therapy for Parkinson's disease*

ATAXIC SYNDROMES

- Differential diagnosis of various ataxias
- Differentiation of cerebellar and sensory ataxias
- Epidemiology, pathophysiology, diagnosis, classification and management of various hereditary ataxias
- Secondary ataxias related to para-infectious etiology, demyelination and cerebellar tumours

Vestibular disorders

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- Diagnosis and management of brainstem disorders

CRANIAL NEUROPATHIES

- Disorders of smell and vision
- Evaluation of visual pathways, pupillary pathways and reflexes, internuclear and supranuclear ophthalmoplegia, other oculomotor disorders
- Anatomy and testing of all cranial nerves
- Bell's palsy and differentiation from UMN facial lesions
- Brainstem reflexes
- Investigations of vertigo and dizziness, differentiation between central and peripheral vertigo, differential diagnosis of nystagmus
- investigations of deafness, bulbar and pseudobulbar syndromes

CNS INFECTIONS

- Epidemiology, etiology, pathophysiology, diagnosis and management of various viral encephalitis
- Meningitis: Bacterial, tubercular, fungal
- Parasitic infections such as cysticercosis
- Cerebral malaria
- SSPE
- HIV and CNS involvement.

NEUROIMMUNOLOGIC DISEASES

- Epidemiology, etiology, pathophysiology, diagnosis and management of multiple sclerosis and neuromyelitis optica
- Central nervous system vasculitis including primary CNS vasculitis
- Diagnosis and management of GBS and CIDP
- Autoimmune encephalitis including anti-NMDA antibody and anti-VGKC antibody mediated encephalitis
- Myasthenia gravis
- Polymyositis

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- *Collagen vascular disorder and neurology*
 - *Use of immune-modulatory agents in the management of various immunological disorders including mycophenolate, Rituximab and Natalizumab*
 - *Advances in the Use of immune-modulatory agents in the management of various immunological disorders including mycophenolate, Rituximab and Natalizumab*
 - *Advances in the therapy of multiple sclerosis including teriflunomide, dimethyl fumarate, fingolimod, alemtuzumab, rituximab and ocrelizumab*
 - *Concepts of newer biomarkers for multiple sclerosis*
 - *Newer advances in autoimmune encephalitis including pathogenesis, various autoantibodies, and management*
 - *Newer autoimmune neurological disorders including neuromyelitis optica spectrum disorders and MOG associated disorders.*
 - *Therapy of multiple sclerosis including teriflunomide, dimethyl fumarate, fingolimod, alemtuzumab, rituximab and ocrelizumab*
 - *Concepts of newer biomarkers for multiple sclerosis*
 - *Newer advances in autoimmune encephalitis including pathogenesis, various autoantibodies, and management of Newer autoimmune neurological disorders including neuromyelitis optica spectrum disorders and MOG associated disorders. (Board of Studies letter no.: SBKSMIRC/Dean/874, dated 18/06/2020 and Vide Notification of Board of Management Resolution Ref: No.: SVDU/R/3383/2019-20 dated 31/07/2020*

NEUROGENETIC DISORDERS

- Various chromosomal diseases
- Single gene mutations such as enzyme deficiencies
- Autosomal dominant and recessive conditions and X-linked disorders
- Trinucleotide repeat disorders
- Disorders of DNA repair
- Genetics of Huntington's disease

Familial dementias

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- Storage disorders
- Hereditary ataxias
- hereditary spastic paraplegias
- Hereditary sensory motor neuropathies
- Muscular dystrophies
- Mitochondrial inheritance disorders

DEVELOPMENTAL DISORDERS OF NERVOUS SYSTEM

- Neuronal migration disorders
- Craniovertebral junction diseases
- Spinal dysraphisms,
- Phacomatoses and other neurocutaneous syndromes- their recognition and management.

MYELOPATHIES

- Clinical diagnosis of distinction between compressive and non-compressive myelopathies, spinal syndromes such as anterior cord, subacute combined degeneration, central cord syndrome, Brown-sequard syndrome, tabetic syndrome
- Diagnosis of spinal cord and root compression syndromes
- CV junction lesions
- Syringomyelia
- Conus and caudal lesions,
- Spinal AVMs
- Hereditary and tropical hereditary spastic paraplegias
- Various noncompressive myelopathies
- Epidemiology, pathophysiology, diagnosis and management of motor neuron diseases including amyotrophic lateral sclerosis

PERIPHERAL NEUROPATHIES

- Epidemiology, pathophysiology, diagnosis and management of immune mediated neuropathies

Classification and diagnosis of hereditary sensory motor neuropathies

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- Toxic, nutritional and metabolic neuropathies
- infectious type peripheral neuropathies including leprosy neuropathy
- Clinical and electrophysiological diagnosis of neuropathies including principles of nerve conduction studies and electromyography

MYOPATHIES AND NEUROMUSCULAR JUNCTION DISORDERS

- Clinical evaluation of patients with known or suspected muscle diseases aided by EMG
- Epidemiology, pathophysiology, diagnosis and management of muscular dystrophies,
- Inflammatory myopathies
- Toxic, nutritional and metabolic myopathies
- Channelopathies
- Congenital and mitochondrial myopathies
- Neuromuscular junction disorders such as myasthenia gravis, Botulism, Eaton-Lambert syndrome, snake bite and organophosphorus poisoning, their electrophysiological diagnosis and management
- Epidemiology, pathophysiology, diagnosis and management of myasthenia gravis
- Myotonia
- Stiff person syndrome.

PAEDIATRIC NEUROLOGY:

- Normal development of motor and mental milestones in a child
- Cerebral palsy
- Attention deficit disorder
- Autism
- Developmental dyslexias
- Intrauterine TORCH infections
- Storage disorders
- Inborn errors of metabolism affecting nervous system
- Developmental malformations
- Child hood seizures and epilepsies
- Neurodegenerative diseases including leukodystrophies and polydystrophies

COGNITIVE NEUROLOGY AND NEUROPSYCHIATRY:

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- Detailed techniques of higher mental function evaluation
- Basics of primary and secondary neuropsychiatric conditions such as anxiety, depression, schizophrenia, acute psychosis, acute confusional reactions (delirium), organic brain syndrome, primary and secondary dementias, differentiation from pseudodementia

TROPICAL NEUROLOGY

- Conditions which are specifically found in the tropics like neurocysticercosis, tuberculosis, cerebral malaria, tropical spastic paraplegia, Snake/scorpion/ Chandipura encephalitis, Madras motor neuron disease etc. will be dealt with in special detail in the curriculum

Sleep disorders

- Knowledge of narcolepsy, daytime hypersomnolence, parasomnias, obstructive sleep apnoea, effects of neurological conditions on sleep
- Indications, scope and limitations of the sleep laboratory
- Principles of physical and pharmacological treatment of sleep disorders
- An understanding of the effects of sleep on the EEG
- Knowledge of driving regulations and the consequences and complications of sleep disorders.

CSF disorders

- CSF composition and dynamics
- Anatomy and radiology of the ventricular system
- Genesis of hydrocephalus
- Biochemistry and immunology of CSF
- Blood brain barrier
- Indications, techniques, and contraindications of CSF examination
- Methods of intracranial pressure monitoring
- Treatments of raised intracranial pressure
- Management of shunts

Disorders of autonomic nervous system

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- Anatomy and physiology of ANS
- Clinical features of ANS disorders alone and as part of other condition e.g. multi-system atrophy
- Investigations including autonomic function tests
- Pharmacological and physical managements of urinary retention, erectile disorder, constipation, postural hypotension, autonomic dysreflexia

Pain

- Theories of pain generation
- Pain patterns in neurological and systemic diseases
- Effective use of pharmacological agents and other measures for pain relief including nerve blocks, TENS, acupuncture and neurosurgical interventions
- Role of Pain Clinic
- Psychological and social effects of chronic pain

DIAGNOSTIC AND INTERVENTIONAL NEUROLOGY INCLUDING NEUROLOGICAL INSTRUMENTATION

DIAGNOSTIC NEUROLOGY

- Performing and interpreting Digital Electroneurogram
- Electromyogram,
- Evoked potentials,
- Electroencephalography
- Interpretation of skull and spine X rays,
- Computerized tomography of brain and spine
- Magnetic resonance images of brain including correct identification of various sequences
- Angiograms
- MR spectroscopy
- Basics of functional MRI
- Interpretation of digital subtraction imaging
- SPECT scans of brain
- Subdural EEG recording, transphenoidal electrode EEG Techniques for temporal lobe seizures

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- Video EEG interpretation of phenomenology and EEG-phenomenology correlations
- Transcranial Doppler in the diagnosis and monitoring of acute ischemic stroke and subarachnoid hemorrhage
- Colour duplex scanning in Carotid and vertebral extracranial segments screening

INTERVENTIONAL NEUROLOGY AND NEUROINSTRUMENTATIONS

To acquire skills in Procedures like

- Intrathecal administration of antispasticity drugs, beta interferons in demyelination, opiates in intractable pain etc.,
- EMG guided Botox therapy for dystonias
- Subcutaneous administration of antimigraine and antiparkinsonian drugs
- Intrarterial thrombolysis in extended windows of thrombolysis in ischemic strokes
- Transcranial Ultrasound clot-bust intervention in a registry in acute stroke care unit
- Planning deep brain stimulation therapy in uncontrolled dyskinesias and on-off phenomena in long standing parkinsonism
- Planning vagal nerve stimulation in intractable epilepsy

RECENT ADVANCES IN NEUROLOGY

- ADVANCES IN NEUROIMAGING TECHNIQUES:** Integration of CT, MR, SPECT images with each other and with EEG, EVOKED potentials based brain maps in structural and functional localization in neurological phenomena and diseases, Fluorescent Dye tagged study of neurons in diseases in animal models in vivo and in tissue cultures in-vitro.

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- b. **BIONICS IN NEURAL PROSTHESIS AND REHABILITATION:** Advanced techniques in neuro-rehabilitation such as TENS, principles of man-machine interphase devices in cord, nerve and plexus injuries, cochlear implants, artificial vision.
- c. **NEUROPROTEOMICS AND NEUROGENETICS**

STEM CELL AND GENETHERAPY

- Principles of ongoing experiments on stem cell therapy for nervous system disorders such as foetal brain tissue transplants in parkinsonism, intrathecal marrow transplants in MND, MS, Spinal trauma, myoblasts infusion therapy in dystrophies

NEUROEPIDEMIOLOGICAL STUDIES AND CLINICAL TRIALS

The students of the DM course will be trained in conducting sound neuroepidemiological studies on regionally and nationally important neurological conditions as well as on diseases of scientific and research interest to the department.

EVIDENCE BASED MEDICINE IN NEUROLOGY

- Principles of evidence based medicine
- Understanding the different levels of evidence
- Formulating a research question, search the relevant evidence and its critical appraisal
- Evidence based management of various neurological disorders

ALLIED SPECIALITIES

Clinical Neurophysiology

Technical aspects of EEG and EMG recording

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- Normal awake and sleep EEG in adults and children
- Benign epileptiform variants
- Common focal and generalized epileptiform abnormalities
- Common ictal patterns
- EEG in ICU
- EEG in brain death
- Technical aspects and principles of EMG, NCS, repetitive stimulation
- Abnormalities in common nerve entrapments, peripheral neuropathies; motor neuron disease; disorders of neuromuscular junction; muscle disease
- Principles and applications of evoked potentials

Neuroendocrinology

- Clinical features and investigations in endocrine disorders
- Emergency management of disorders
- Relationships with neurological disorders
- Steroid therapy and its complications

Neurootology

- Applied anatomy and physiology of hearing and balance
- History and examination techniques including vestibular manoeuvres
- Conditions affecting the vestibulocochlear system
- Clinical evaluation of vertigo

Neuropsychiatry

- Understanding of common psychiatric disorders including learning disability, pervasive developmental disorders, and attention deficit hyperactivity disorders
- Neurological features which may have psychiatric causes including medically unexplained symptoms, conversion disorder, somatisation
- Evaluation and management of psychiatric symptoms in neurological disorders

Neuropsychology

- Understanding of neuroanatomical and neurophysiological basis of memory, attention, language and perception
- Understand the value and limitations of neuropsychological interventions such as Cognitive Behavioural Therapy
- Understand mini-mental state examination and basic neuropsychological tests employed by Clinical Psychologists such as e.g. NART, WAIS

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Neuroradiology

- Request, interpret and utilise neuro-radiological investigations appropriately
- Explain the nature, risks and benefits of neuroradiological investigations
- Basic aspects, utility and interpretations of routine tests including CT scan, cranial angiography, MR scan, spinal angiography, catheter angiography, diagnostic/interventional myelography, carotid and transcranial ultrasound, other special investigations e.g. PET, SPECT

Neurosurgery

- Understand the role of neurosurgery in the management of head injury, raised intracranial pressure, intracranial haemorrhage and ischaemic stroke, aneurysm, vascular malformation and tumours, spinal cord and root disorder and peripheral nerve lesions
- Understand the purpose, limitations, process and complications of biopsy procedures (brain, muscle, nerve)
- Understanding of the principles of general and specific risks and complications of neurosurgical interventions

Neurorehabilitation

- Understand the difference between pathology, impairment, activity & participation
- Understand the potential and limitations of neurorehabilitation
- Understand the social perspective, relevant social work legislation and availability of care in the community

Neurourology

- Understand normal control of micturition and sexual function
- Differential diagnosis of causes of disordered micturition and erectile dysfunction
- Understand hypo- and hyper-sexuality
- Understand treatment strategies for disorders of micturition and sexual function

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4. TRAINING

Responsibility for the organization and delivery of neurology training will rest with the Head of the Department of Neurology and other senior faculty members of the department. Each candidate will have clinical postings for two years during the first and third years of training. Each candidate will be posted in neurophysiology section for six months for the hands on training in EEG and VEEG reporting, nerve conduction studies, electromyography and evoked potential studies. Similarly candidates will be posted for one month in allied specialties of neurosurgery, neuroradiology, neuropsychology and neuropathology. All trainees will have one month of posting at one of the other prominent neurology departments in the country as per his/her choice.

Teaching and Learning Methods

The curriculum and training will be delivered through a variety of methods and learning experiences. Trainees will learn clinical skills from practice and through hands on training while managing patients on outdoor and inpatient departments. There will be a balance of different modes of learning from formal teaching programmes to experiential learning 'on the job'. This will include following:

Learning with Peers: Students will come in contact with their peers having varied levels of experience and will be encouraged to learn from senior colleagues. Trainees will be encouraged to create local forums for peer learning opportunities. These include trainee led journal clubs, discussion of cases and participation in regional or departmental grand round presentations

Work-based Experiential Learning: This will include active participation in neurology clinics including specialty clinics. After initial induction, trainees will review patients in outpatient clinics, under direct supervision. The degree of responsibility will increase with increasing levels of competency. Trainees will assess 'new to review' patients and present their findings to

consultants. It is expected that trainees will complete the equivalence of 2-3 outpatient clinics per week (max 4 per week) throughout the training program. Two of these will be general



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neurology clinics and the remainders will be specialty clinics. Trainees will also be responsible for the management of in patients admitted under their care under direct supervisions from consultants. They will learn by evaluating the patients admitted in wards, planning their management and accompanying consultants on rounds. This will also include day-to-day review of the patient, note keeping, and the initial management of the acutely ill patient with referral to and liaison with clinical colleagues as necessary. They will be encouraged for critical and clinical based reading. They will also be encouraged to learn through discussion with clinicians in other disciplines and while seeing patients referred from other specialities. Trainees will also learn, under supervision, reporting EEGs and VEEGs and conducting and interpreting evoked potential studies, nerve conduction and electromyographystudies.

Formal Postgraduate Teaching: This will include department based teaching sessions and attending regional, national and international meetings. This will include:

- Case presentations: Twice aweek
- Journal clubs: Once aweek
- Research and audit projects: Once in threemonths
- Lectures and small group teaching: Once aweek
- Grand Rounds; Once aweek
- Clinical skills demonstrations and teaching: Once aweek
- Critical appraisal and evidence based medicine and journal clubs: Once aweek
- Joint specialty meetings: Once aweek

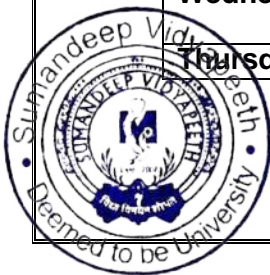
Table 1. Proposed teaching program and time table

Day	Teaching program	Time	Presenter
Monday	Journal Club/Neuroradiology	3-4 pm	Neurology/Medicine/Neurosurgery/Radiology Residents
Tuesday	Case Presentation	3-4 pm	Neurology, Residents Medicine Residents
Wednesday	Didactic lectures	3-4 pm	Dr.Sanjay Prakash Dr.Chatarbhuji Rathore
Thursday	Seminars	3-4 pm	Neurology Residents

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		pm	Medicine Residents
Friday	Clinical meeting	3-4 pm	Neurology Residents Medicine Residents
Saturday	Grand Round	9-11am	All departments

Independent Self-Directed Learning: This will be done through variety of ways such as,

- Reading, including web-based material
- Maintenance of personal portfolio (self-assessment, reflective learning, personal development plan)
- Audit and research projects
- Reading journals
- Achieving personal learning goals beyond the essential core curriculum

Research

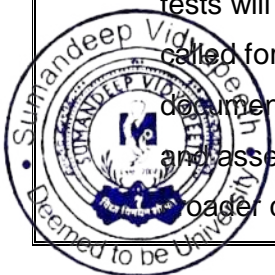
Trainees will have to undertake at least two research projects with an aim of publishing in peer reviewed journals. They are expected to understand the basic aspects of research methodologies, fundamentals of case control and cohort studies and learn the art of critically appraising research articles.

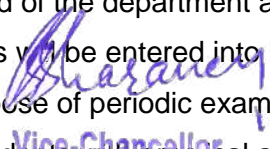
5. ASSESSMENT

Periodic evaluation of training and internal assessment

A student who is registered for DM neurology course will undergo summative as well as formative assessment. Day to day evaluation will be done and would be recorded in the logbook. Following structured internal evaluation will also be done.

During the course of three years, the department will conduct two tests. Both of them will be annual, one at the end of first year and other at the end of second year. The test may include the written papers, clinical examination and viva voce. Records and marks obtained in such tests will be maintained by the head of the department and will be sent to the University when called for. Results of all evaluations will be entered into log book and departmental file for documentation purpose. Main purpose of periodic examination and accountability is to ensure and assess clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.



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External Evaluation

An external evaluation will be carried out at the completion of three years of training. This will include evaluation of theoretical and practical knowledge a comprehensive evaluation process consisting of theory papers, practical examinations and viva voce. The external examination will be conducted as per the rules laid down by the university and will be in the presence of two external examiners. The relative distribution of marks and examination scheme will be as under:

Theory Examination: (400 Marks)

Paper number	Topics	Marks	Time
I	Neurology I: Basic sciences as applied to neurology with special emphasis on neuroanatomy and neurophysiology	100	3 Hours
II	Neurology II: Clinical Neurology	100	3 Hours
III	Neurology III: Diagnostic Neurology and allied specialities	100	3 Hours
IV	Neurology IV: General neurology with recent advances in neurology	100	3 Hours

Note: The distribution of topics in each paper is arbitrary. There may be overlapping of relevant topics in question papers

Each Paper shall have 5 Questions; all will be compulsory.

Question-1: Long Question (1)	20 marks
Question-2: Long Question (1)	20 marks
Question-3: Long Question (1)	20 marks
Question-4: Short Notes— (2)	20 marks
Question-5: Short notes --(4)	20 marks

Practical Examination: (400 Marks + 200 marks for viva voce)= 600 marks Duration: Minimum 2 days

Exercise number	Description	Marks	Time	Assessment
1	Long case (1)	200	120 min	All Four examiners
2	Short case (2)	200 (100 each)	30 minutes for each case	All Four examiners
3	Viva voce Including specimen, EEG recordings, muscle biopsies and neuroradiology Tableviva	200	60 minutes	All Four examiners

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