Syllabus for the descriptive type Subject Aptitude Test (SAT) for the recruitment to post of Assistant Professor (Neurosurgery), Class-I (on regular basis) in the Department of Medical Education & Research, H.P. The SAT shall be of 03 hours duration having 120 marks. The SAT paper shall have two parts, i.e. Part-I and Part-II covering following topics of M.Ch. Neuro Surgery 2/3 years course as recognized by M.C.I. after M.S. Surgery or M.B.B.S. and 5 years direct course leading to M.Ch. Neuro Surgery level.

PART-I (60 Marks)

1. **Introduction to Neurological Surgery**
   - Historical Overview of Neurosurgery.

2. **Basic science**
   - Surgical Anatomy of Brain,
   - Molecular Biology Primer for Neurosurgeons,
   - Neuroembryology,
   - Stem Cell Biology in Central Nervous System,
   - Neurons and Neuroglia,
   - Cellular mechanisms of brain energy metabolism,
   - Blood brain barrier,
   - Cerebral edema,
   - Physiology of the cerebrospinal fluid and intracranial pressure,
   - Neurosurgical epidemiology and outcomes assessment.

3. **Approach to the patient**
   - Altered consciousness,
   - Neuroophthalmology,
   - Neurotology,
   - Neurourology,
   - Neuropsychological testing.

4. **Radiologic Fundamentals**
   - Computed tomography and magnetic resonance imaging of the brain,
   - Radiology of spine,
   - Physiologic evaluation of the brain with magnetic resonance imaging,
   - Molecular imaging of the brain with positron emission tomography.

5. **General Neurosurgery**
   - Perioperative care,
   - Neuroanaesthesia: preoperative evaluation,
   - Avoidance of complications in neurosurgery,
   - Intracranial pressure monitoring,
   - Principles of neurocritical care.
   - **General principles and surgical techniques**

- Surgical planning: overview,
- positioning for cranial surgery,
- Patient positioning for spinal surgery,
- positioning in peripheral nerve surgery,
- Incisions and closures,
- Advantages and limitations of cranial endoscopy,
- Thoracoscopic spine surgery,
- Cranioplasty.

6. Geriatric neurosurgery

- Evaluation of adult hydrocephalus,
- Production and flow of cerebrospinal fluid,
- Adult hydrocephalus
- Clinical evaluation, shunting, the role of endoscopic third,
- Ventriculostomy,
- Subdural hematomas,
- Pathophysiology of Subdural hematomas,
- Medical and surgical management of chronic subdural hematomas,
- **Infections**
- Basic science of central nervous system infections,
- Postoperative infections of the head and brain,
- Postoperative infections of the spine,
- The use and misuse of antibiotics in neurosurgery,
- Brain abscess,
- Meningitis and encephalitis,
- Acquired immune deficiency syndrome,
- Parasitic infections,
- Surgical risk of transmittable diseases.

7. Epilepsy

- Basic science of epilepsy
- Epilepsy surgery overview
- Electrophysiological properties of the mammalian central nervous system
- Approach to the patient
- Diagnosis and classifications of seizures and epilepsy
- Antiepileptic medications: principles of clinical use
- Preoperative evaluation for epilepsy
- Neuroradiological evaluation for epilepsy surgery
- Evaluation of patients for epilepsy surgery
- Intraoperative mapping and monitoring for cortical resections
- Intracranial monitoring
- Surgery for extratemporal lobe epilepsy
- Standard temporal lobectomy

- Selective amygdalohippocampectomy
- Tailored resections for epilepsy
- Topectomy and multiple subpial transaction
- Hemispheric disconnection procedures
- Vagus nerve stimulation for intractable epilepsy
- Radiosurgical treatment of epilepsy
- Deep brain stimulation for epilepsy
- Epilepsy surgery: outcome and complications

8. Functional neurosurgery

- Overview: introduction, Basic science of movement disorder
- Anatomy and synaptic connectivity of the basal ganglia
- Rationale for surgical interventions in movement disorders
- Neuropathology of movement disorder
- Neurology of movement disorder
- Clinical overview of movement disorder
- Patient selection criteria for deep brain stimulation in movement disorders
- Functional imaging in movement disorders
- Surgery for movement disorders
- Surgical management of tremor
- Pallidal interventions for parkinson's disease
- Subthalamic deep brain stimulation for parkinson's disease
- Subthalamotomy in parkinson's disease: indications and outcome
- Deep brain stimulation for dystonia
- Deep brain stimulations: mechanism of action
- Emerging and experimental neurosurgical treatments for parkinson's disease
- Selective peripheral denervation for cervical dystonia
- Surgery for psychiatric disorders
- A history of psychosurgery
- Surgical intervention for spasticity
- Treatment of intractable vertigo.

PART-II (60 Marks)

1. Neuro-Oncology

- Brain tumors: general considerations
- Basic science of neurooncology
- Brain tumors: an overview of current histopathologic classifications
- Brain tumor immunology and inmmunotherapy
- Brain tumor stem cells
- Proliferation markers in the evaluation of gliomas
- Molecular genetics and the development of targets for glioma therapy
- Growth factors in glial tumors

- The genetic origins of brain tumors
- Invasion in malignant glioma,
- Angiogenesis and brain tumors: molecular targets and molecular scalpels
- Barriers to delivery of therapeutics to brain tumors
- Epidemiology of brain tumors
- Gene- and viral – based therapies for gliomas
- Clinical features: neurology of brain tumor and paraneoplastic disorders
- Radiologic features of central nervous system tumors
- Endovascular techniques for tumor embolisation
- Brain tumors during pregnancy
- Principles of chemotherapy
- Brain tumour outcome studies: design and interpretation
- Frame and frameless stereotactic brain biopsy
- Basic principles of cranial surgery for brain tumors
- Basic principles of skull base surgery
- Surgical complications of brain tumors and their avoidance
- Navigations for brain tumors
- Endoscopic approaches to brain tumors
- Intraoperative magnetic resonance imaging
- **Intrinsic tumours**
- Low grade gliomas: astrocytoma, oligodendroglioma, and mixed glioma
- Malignant gliomas: anaplastic astrocytoma, glioblastoma multiforme, gliosarcoma
- Unusual gliomas
- Primitive neuroectodermal tumors
- Pineal tumors
- Medulloblastoma
- Intracranial ependymoma in adults
- Hemangioblastomas
- Central nervous system lymphoma
- Metastatic brain tumors
- **Extrinsic tumors**
- Meningiomas
- Meningeal sarcomas and meningeal hemangiopericytomas
- Acoustic neuroma
- Pituitary tumors: Functioning and non-functioning
- Craniopharyngioma
- Epidermoid, dermoid, and neurenteric cysts
- Neoplastic meningitis
- Ventricular tumors
- Overview of skull base tumors
- Chordomas and chondrosarcomas
- Glomus tumors
- Neoplasm of paranasal sinuses

- Esthesioneuroblastoma
- Triageminal schwannomas
- Juvenile nasal angiofibroma
- Osseous tumors
- Tumors of the orbit
- Skull tumors
- Scalp tumors
- Nonneoplastic disorders mimicking brain tumors
- Pseudotumor cerebri
- Sarcoidosis, tuberculosis, and xanthogranuloma
- Demyelinating disease.

2. Pain

- Pain: general historical considerations
- Anatomy and physiology of pain
- Molecular basis of nociception
- Nonsurgical therapy
- Approach to the pateient with chronic pain
- Pharmacologic treatment of pain
- Management of pain by anesthetic techniques
- Treatment of trigeminal neuralgia
- Evidence- based approach to the treatment of facial pain
- Trigeminal neuralgia: diagnosis and nonoperative management
- Percutaneous procedures for trigeminal neuralgia
- Stereotactic radiosurgery for trigeminal neuralgia
- Microvascular decompression for trigeminal neuralgia
- Surgical procedures for nontrigeminal pain
- Neurosurgical management of intractable p[ain
- Neuro modulation
- Evidence based neuro stimiulation for pain
- Peripheral nerve stimulation for neuropathic pain
- Spinal canal stimulation
- Motor cortex stimulation
- Destructive procedures
- Evidence based on destructive procedures,
- Diagnosis and management of painful neuromas
- Dorsal root entry zone lesions
- Percutaneous cordotomy and trigeminal tractiotomy – nucleotomy.

3. Pediatric neurosurgery

- Overview and approach
- Neuroanesthesia in children
- Neuro critical care in children

- Cranial developmental abnormality
- Normal and abnormal embryology of brain
- Encephalocele
- Dandy walker syndrome
- Arachnoid cyst
- Chiari malformations
- Craniopagus twins
- Craniosynostosis
- Genetics of craniosynostosis
- Craniosynostosis
- Sysndromic craniosynostosis
- Endoscopic treatment of craniosynostosis
- Plagiocephaly
- Hydrocephalus
- Hydrocephalus in chil;dren: approach to
- Infantile post hemorrhagic hydrocephalus
- Cerebrospinal fluid physiology
- Experimental hydrocephalus
- Ventricular shunting procedures
- Neuroendoscopy
- Cerebrospinal fluid devices
- Shunt infections and their treatment
- Pediatric cranial and intracranial tumors
- General approaches and consideration for pediatris brain tumors
- Optic pathway hypothalamic gliomas
- Thalamic tumours
- Corod plexus tumours
- Pediatric craniopharyngiomas
- Suprotentorial hemesperic tumours
- Ependymoma
- Medulloblastoma in children
- Cerebellar astroicytomas
- Brainstem gliomas
- Intracranial germ cell tumours
- Familial tumours (neurocutaneous syndromes)
- Skull tumours and fibrous dysplasia
- Vascular diseases
- Moya moya diseases
- Vein of Galen Aneurysmal Malformation
- Head and Brain Trauma
- Management of Severe Head Injury in Children
- Child Abuse
- Growing Skull Fracture

- Birth Head Trauma
- Birth Brachial Plexus Injury
- Spine Disorders in Children
- Myelomeningocele and Myelocystocele
- Lipomyelomeningocele
- Split Spinal Cord
- Tethered Spinal Cord: Fatty Filum Terminal, Meningocele Manqué and Dermal Sinus Tracts
- Development Abnormalities of the Craniocervical Junction
- Achondroplasia and Other Dwarfisms
- Cervical Spine Disorder
- Intramedullary Spinal Cord Tumors in Children
- Spinal Tumors in Children
- Thoracolumbar Spinal Disorders in Pediatric Patients
- Vertebral column and Spinal cord Injury in children
- Cerebral Palsy, Spasticity, and Dystonia
- Clinical Features and Management of Cerebral palsy
- Intrathecal Baclofen Therapy for Cerebral palsy.

4. Peripheral Nerve

- General principles in Evaluating and Treating Peripheral Nerve Pathology, Injury, and entrapments and Their Historical context •
- Basics Science of Peripheral Nerve Disorders
- Pathophysiology of Surgical Nerve Disorders
- Approach to the Patients with peripheral Nerve Disorders
- Peripheral Nerve Examination Evaluation and biopsy
- Electrodaiognostic Evaluation of peripheral Nerves: Peripheral Neuropathies
- Operative Neurophysiology of Peripheral Nerves
- Image for peripheral Nerve Disorders
- Management of Peripheral Nerve Entrapment
- Distal Entrapment Syndromes: Carpal Tunnel, Cubital tunnel, Peroneal and Tarsal tunnel
- Thoracic Outlet Syndrome
- Piriformis Syndrome,Obturator Internus Syndrome,pudendal Nerve Entrapment and other pelvic entrapments
- Management and repair of peripheral nerve in juries
- Techniques and options in nerve reconstructions and repair
- Management of acute peripheral nerve injuries
- Early mangenmnent of brachial plexus injuries
- Secondary procedures for brachial plexus injuries
- Nerve injuries of the lower extremity
- Management of peripheral nerve tumors
- Bening tumors of the peripheral nerves
- Surgery for malignant peripheral nerve sheath tumors

- Management of pain and complications in peripheral nerve surgery
- Pain, complications, and latrogenic injury in nerve surgery.

5. Radiation

- General and historical consideration of radiotherapy and radiosurgery
- Basic science of radio techniques
- Principle of radiation therapy
- The radiobiology and physics of radio surgery
- Fractionated radiation therapy for malignant brain tumors
- Fractionated radiation therapy for benign brain tumors
- Fractionated radiation therapy for spine tumors
- Interstitial and intra cavitory radiations of brain tumors
- Techniques of radio surgery
- Proton radio surgery
- Linear acceleratory radio surgery : technical aspect
- Gamma knife radio surgery
- Image guided robotic radio surgery: the cyber knife
- Intracranial stereotactic radio surgery
- Radio surgery of malignant and benign tumors
- Radio surgery for intracranial vascular ,malformations Radio surgery for functional disorders
- Extra cranial stereotactic radio surgery
- Stereotactic radio surgery for the treatment of spinal metastasis
- Radio surgery for benign spine tumours and vascular malformations.

6. Spine

- Overview and historical considerations of basic science of the spine
- Concepts and mechanism of spinal biomechaniques
- Biomaterials and biomechanics of spinal orthoplasty
- Principles of translation of biologic therapies in spinal cord injuries
- Current status and future directions of management of spinal cord injuries
- Intraoperative monitoring of spinal cord and nerve roots
- Concepts of disc degenerations and re generations
- Bone metabolism and osteoporosis and its effects on spinal diseases and surgical treatments
- Approach to the patient
- Diffential diagnosis and initial management of spine pathology
- Diagnosis and management of discogenic lower back pain
- Metabolic and other non-degenerative causes of low back pain
- Evaluation, indications, and techniques of revision spine surgery
- Infections of the spine
- Fungal and tubercular infections of spine
- Degenerative disease of the spine

- Treatment of disc and ligamentous diseases of the cervical spine
- Posterior approach to cervical degenerative diseases
- Anterior approach for cervical spondylotic myelopathy
- Spondyloarthropathies, (including ankylosis spondylosis)
- Ossifications of the posterior longitudinal ligaments and other ensthesopathies
- Treatment of thoracic disc herniations
- Treatment of disc disease of the lumber spine
- Lumber spine stenosis
- Paediatric spondylolisthesis
- Adult thoracolumbar scoliosis
- Flat back and sagittal plane deformity
- Congenital and developmental anomalies of the spine
- Techniques for spinal procedures
- Basic principles of spinal internal fixations,
- Bone graft options, substitutes, and bone harvest
- Cervical and lumber arthoplasty
- Nucleoplasty
- Instrumentation in spinal surgery
- Anterior and posterior instrumentation in cervical, thoracic, and lumber spine
- Posterior, transforminal, and anterior lumber interbody fusion: techniques and instrumentation
- Tumors of the spine, craniovertebral junctions
- Spinal cord tumours in adults : benign and malignant and metastasis.

7. Spinal trauma

- Assessment of cervical spine trauma
- Evaluation and management of craniocervical dissociations,
- Atlantoaxial rotatory subluxations and transvers ligament injuries
- Odontoid and hangman's fractures
- Thoracic spine fractures, lumber spine and sacral fractures,
- Osteoporotic fractures: vertebroplasty and kyphoplasty.

8. Traumatic brain injury:

- Epidemiology, biomechanical basis, neuropathology, animal models, neurochemical and patho mechanisms
- Regeneration and repair, and hypothermia
- Imaging of traumatic brain injury
- Management of traumatic brain surgery :pathophysiology, mild, moderate , severe concussions,
- Initial resuscitation, prehospital care, emergency room care, critical care, surgical managements
- Penetrating and traumatic head injuries
- Blast induced neurotrauma
- Cranial decompression after trauma

- Craniofacial injuries, CSF Fistulas
- Sequel, outcome and rehabilitation.

9. Cerebrovascular neurosurgery

- Cerebral blood flow, metabolism, ischemia,
- Acute medical management of ischemic/ hemorrhagic stroke, intraoperative cerebral protection, circulatory arrest, deep hypothermia, transcranial Doppler USG, neurovascular imaging
- Occlusive vascular diseases: carotid occlusive diseases, endartectomy, angioplasty, stenting,
- Blunt cerebrovascular injury
- Non-atherosclerotic carotid lesions
- Extra cranial vertebral artery diseases
- Adult moya moya diseses
- Cerebral venous and sinus thrombosis
- Nonlesional spontaneous intracerebral haemorrhage
- Intracranial aneurysms: Genetics
- Natural history of cerebral aneurysms
- Pathobiology of intracranial aneurysms
- Surgical decision making for treatment of intracranial aneurysms
- Perioperative management of subarachnoid haemorrhage
- Cerebral vasospasm
- Surgical approaches to intracranial aneurysms, microsurgery of paraclinoid aneurysm
- Intracranial ICA aneurysms
- Microsurgery for Acoma aneurysms, DACA aneurysms, mca aneurysms,
- Microsurgery of VA, PICA, VB junction aneurysms
- Basilar trunk aneurysms, basilar apex aneurysms,
- Endovascular approaches to intracranial aneurysms
- Endovascular coiling , stenting of intracranial aneurysms
- Endovascular hunterian ligation
- Microsurgical management of giant intracranial aneurysms
- Infectious intracranial aneurysms
- Revascularisation techniques for complex intracranial aneurysms
- Multimodality management of complex cerebrovascular lesions
- Traumatic cerebral aneurysms
- True arteriovenous malformations
- Pathobiology, natural history, therapeutic disiopn making, endovascular, microsurgical and radiosurgical management
- Arteriovenous fistulas
- Carotid-cavernous fistulas, other intracranial Dural AV fistulas,
- Cavernomas: natural history, genetics, locations, management
- AVM AND AVF of spine; classifications, endovascular treatment
- Pregnancy and vascular lesions.