

***KRISHNA INSTITUTE OF MEDICAL SCIENCES "DEEMED TO BE UNIVERSITY",
KARAD***

Accredited By NAAC With 'A' Grade



Revised Syllabus

M.Ch. NEUROSURGERY curriculum

Programme code : 1401

Course code : 1401 -11 to14

KIMSDU/KIMS/CURICULUM/M.CH. NEUROSURGERY

I. GOALS:

At the end of the training period, the student should have acquired knowledge, skills, aptitude and attitudes to be able to function as an independent clinician/consultant and a teacher acquainted with research methodology.

II. OBJECTIVES:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the subheadings.

1. Knowledge
2. Skills
3. Human values, ethical practice and communications skills.

1. Knowledge

2. Skills

3. Human values, ethical practice and communications skills

1. Knowledge:

- The candidate shall be proficient in all the fields of Neurosurgery including Basic science for the Neurological surgeon, Neuro Oncology, Vascular lesion of the brain, occlusive vascular disease of the brain, intra cerebral hemorrhage, Epilepsy, Functional neurosurgery and Pediatric Neurosurgery, congenital lesions of brain and spinal cord, Management of cranial and spinal trauma, surgery of the spine in addition to Neuro-Anaesthesiology, Neuro-radiology and Neuro-pathology.
- To provide the candidate with the current, scientific and evidence based knowledge pertaining to the above mentioned areas in Neurosurgery.
- To impart the skills to undertake independent clinical practice in the above areas of Neurosurgery and to provide opportunities to the practice of these skills in graded manner and under suitable supervision to a point where the candidate is capable of practicing these skills independently.
- To inculcate in the candidate an attitude of responsibility, accountability and caring, to empower the candidate with a good and sound foundation of ethical values in the practice of Neurosurgery, and to develop in the candidate the ability to effectively communicate with patients, peers, superiors, and the community in the discharge of his / her clinical and research role.

2. Skills

- Should be well acquainted with the current literature on relevant aspects of the basic, investigative, clinical and operative neurosciences.
- Should have learned the indications and performance skills of common neurosurgical operations.
- Should have acquired performance skills and ability to interpret relevant clinical investigations.

- Should be able to diagnose, plan investigations and treat common conditions in the speciality by relevant current therapeutic methods.
- Should be acquainted with allied and general clinical disciplines to ensure appropriate and timely referral.
- Should be capable of imparting basic neurosurgical training.

3. Human values, ethical practice and communications skills

- Adopt ethical principles in all aspects of his / her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
- Provide leadership and get the best out of his / her team in a congenial working atmosphere.
- Apply high moral and ethical standard while carrying out human or animal research.
- Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed,
- Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.

III. COURSE CONTENTS

A brief outline is as follows:

1. Neuroanatomy and embryology
2. Neurobiology
3. Neurophysiology
4. Neuropathology & Microbiology
5. Neurochemistry and Neuro pharmacology

BASIC SCIENCE FOR THE NEUROLOGICAL SURGEON

1. Surgical Anatomy of the Brain
2. Neuroembryology – development of the central nervous system
3. Neurons and Neuroglia
4. Cerebral metabolism and the pathophysiology of Ischemic brain damage
5. The blood brain barrier
6. Physiology of the cerebrospinal fluid and intracranial pressure
7. Cellular and molecular mechanism mediating injury and recovery in the nervous system
8. Electrophysiology properties of the central nervous system.
9. Neuropathology of brain tumors, immunohistochemistry, electron microscopy
10. Neurosurgical epidemiology and outcomes assessment.
11. Human genome and gene therapy, stem cell therapy in CNS
12. Human Connectome Project

CLINICAL SCIENCE

1. History and physical examination.
2. Differential diagnosis of altered states of consciousness.

3. Neuro ophthalmology
4. Neuro Otology
5. Neuro Urology
6. Neuro Psychological assessment of the neurosurgical patient
7. Brain death
8. Legal issues

FUNDAMENTALS OF RADIOLOGY

1. Radiology of the skull
2. Computed Tomography
2. Magnetic Resonance Imaging of the Brain, Functional MR, MR Perfusion
3. Molecular Imaging of the Brain with Positron Emission Tomography
4. Radiology of the Spine
5. Angiography modalities: Digital Subtraction Angiography, CT Angiography, MR Angiography
6. Diffusion Tensor Imaging Tractography
7. Transcranial Doppler

PERIOPERATIVE EVALUATION AND TREATMENT.

1. Neuroanesthesia; Preoperative Evaluation
2. Complication Avoidance in Neurosurgery
3. Neurosurgical Intensive Care Management
4. Intracranial Pressure Monitoring

SURGICAL EXPOSURES AND POSITIONING

1. General principles of operative positioning, microneurosurgery instruments
2. Surgical positioning and exposures for cranial procedures
3. Surgical exposures and positioning for spinal surgery
4. Peripheral nerves
5. Operating Microscope, Cavitron Suction Apparatus, Intraoperative Electrophysiology, Neuronavigation –image guided, Intraoperative MR and DSA, Lasers in Neurosurgery
6. Stereotaxy Procedures
7. Awake Craniotomy

BASIC SCIENCE OF NEURO ONCOLOGY

1. Brain tumors; general considerations
2. Histopathology classification of brain tumors

3. Central Nervous system immunology
4. Proliferation Marker in Evaluation of Gliomas
5. Molecular Genetics and development of Targets for glioma therapy
6. Growth factors and brain tumors.
7. Tumor suppressor Genes and genesis of brain tumors.
8. Molecular and Cytogenetic techniques
9. Invasion in Malignant glioma.
10. Angiogenesis and brain tumors.
11. Brain Edema and Tumor Host Interactions
12. Brain tumors: Population based epidemiology, Environmental risk factors, Genetic & Hereditary syndromes.
13. Principles of Gene Therapy
14. Clinical features and Neurology of Brain tumor and Paraneoplastic
15. Radiologic features of Central Nervous System tumors.
16. Endovascular techniques for brain tumors.
17. Brain tumor during pregnancy
18. Principles of Chemotherapy
19. Aspects of Immunology applicable to brain tumor pathogenesis and treatment
20. Basic principles of Cranial surgery for brain tumors
21. Basic principles of skull base surgery
22. Surgical complications and their avoidance.
23. Surgical Navigation for brain tumors.
24. ALA and Fluorescence for Brain tumours

INTRAAXIAL TUMORS.

1. Low grade gliomas : Astrocytoma, Oligodendroglioma and Mixed Gliomas
2. Malignant gliomas : Anaplastic astrocytoma, glioblastoma Multiform, Gliosarcoma, Malignant Oligodendroglioma.
3. Primitive Neuroectodermal tumors.
4. Pineal tumors
5. Medulloblastoma.
6. Ependymoma
7. Haemangioblastoma
8. Lymphoma

9. Metastatic brain tumor

EXTRAAXIAL TUMORS.

1. Meningioma
2. Meningeal haemangio-pericytoma
3. Meningeal sarcoma
4. Acoustic neuroma
5. Pituitary tumors : Functioning and non functioning
6. Craniopharyngoma in the Adult
7. Epidermoid, dermoid and neuroenteric cyst
8. Neoplastic meningitis – Diagnosis and Treatment.

VENTRICULAR TUMORS.

SKULL BASE TUMORS

1. Chordoma and Chondrosarcoma.
2. Glomus jugulare tumors.
3. Neoplasms of paranasal sinuses
4. Esthesioneuroblastoma.
5. Trigeminal Schwannoma
6. Juvenile Angiofibroma
7. Osseous tumors
8. Orbital tumors.
9. Skull tumors
10. Scalp tumors.
11. Cerebellopontine angle tumours
12. Petroclival meningioma
13. Foramen magnum Meningioma

NON NEOPLASTIC DISORDERS MIMICKING BRAIN TUMORS.

1. Pseudotumor cerebri
2. Sarcoidosis, Tuberculosis and Xanthogranuloma
3. Multiple Sclerosis.

VASCULAR

1. Cerebral blood flow and metabolism
2. Acute Medical Management of Ischemic disease and Stroke
3. Anesthesia in Cerebro vascular disease

4. Intraoperative Cerebral protection
5. Deep Hypothermic Circulatory Arrest
6. Transcranial Doppler ultra sonography
7. Neurosonology
8. Xenon computed tomography
9. Magnetic Resonance Angiography
10. Positron Emission Tomography
11. AV Malformation
12. ST-MC Direct Revascularization technique and Indirect revascularization techniques

OCCLUSIVE VASCULAR DISEASE

Carotid occlusive Disease, Carotid Endarterectomy, Angioplasty, Stenting, Traumatic Carotid Injury, Vertebral Artery disease, Intracranial arterial disease, Moya Moya, Cerebral Venous and Sinus Thrombosis

INTRA CEREBRAL HEAMORRHAGE

Spontaneous intracerebral hemorrhage; non arteriovenous malformation, non aneurysm
MMD Haemorrhage

HEMMORRHAGIC VASCULAR DISEASE; ANEURYSMS

1. Genetic of Intracranial aneurysm.
2. Natural History of Unruptured Saccular Cerebral aneurysm.
3. Management of Subarachnoid hemorrhage
4. Cerebral vasospasm
5. Surgical approaches for anterior circulation aneurysm
6. Treatment of Intracavernous and paraclinoid internal carotid artery aneurysm
7. Aneurysms of anterior communicating artery, anterior cerebral artery, distal anterior cerebral artery and middle cerebral artery aneurysms.
8. Posterior circulation aneurysms, including the vertebral, basilar and PICA aneurysm.
9. Endovascular Treatment of aneurysm.
10. Giant Aneurysm.
11. Infectious intracranial aneurysm.
12. Revascularization techniques for complex aneurysm and skull base tumors

ARTERIO VENOUS MALFORMATION

1. Natural History of intracranial vascular malformations
2. Classification and treatment, surgical and radiosurgical
3. Endovascular management of AVM
4. Surgical Treatment
5. Dural AVMs

CAVERNOUS MALFORMATIONS

1. Epidemiology and Natural History, Genetics, Surgical management of intracranial cavernous malformation.
2. Cavernous Carotid Fistulas.
3. Spinal AVM
4. Classification, Endovascular Treatment, Surgery

EPILEPSY

1. General, Historical, Basic Science, Classification, Approaches to Diagnosis, Anti epileptic medications.
2. Preoperative Evaluation for Epilepsy surgery; Wada Test, Functional Magnetic Resonance Imaging.
3. Candidates for epilepsy surgery
4. Intraoperative Mapping and Monitoring for cortical resections
5. Epilepsy surgery : outcome and complications.
6. Amygdalohippocampectomy, topectomy, multiple subpial resection, Vagus Nerve Stimulation for intractable epilepsy.

FUNCTIONAL NEUROSURGERY

1. History
2. Anatomy of Basal Ganglia
3. Neuropathology of Movement disorder
4. Rationale for surgical interventions in Movement Disorders
5. Approach to Movement Disorders, patient selections
6. Thalamotomy for tremor
7. Pallidotomy for Parkinson's Disease
8. Surgery for Dystonia
9. Deep brain stimulation
10. Cellular Transplantation, Stem Cell Therapy
11. Neurosurgery of psychiatric disorders.
12. Neurosurgical treatment of spasticity, spasmodic torticollis, intractable vertigo

PAIN

1. Physiologic anatomy of pain
2. Chronic Pain – Medical Management
3. Trigeminal Neuralgia – Non operative management, Percutenous techniques, Microvascular decompression.
4. Surgical Management of intractable pain.

PEDIATRIC NEUROSURGERY

1. Neurological Examination in Infancy and Childhood.
2. Developmental and Acquired Anomalies – Encephalocele, Myelomeningocele, Tethered spinal cord, occult spinal dysraphism, Dandy Walker Syndrome, Arachnoid cyst.
3. Craniosynostosis, Chiari Malformation and Achondroplasia.
4. Hydrocephalus, Endoscopic Third Ventriculostomy
5. Vein of Galen Malformations, AVM and aneurysm in childhood
6. Head and Brain trauma
7. Birth Trauma
8. Tumors – Optic Gliomas, Germ Cell tumors, Choroid plexus tumors, ependymomas, medulloblastomas, cerebellar astrocytoma, brain stem glioma, craniopharyngioma, intraspinal tumors, skull tumors.
9. Cerebral palsy
10. Surgical treatment in Epilepsy in Children
11. Pediatric neuro rehabilitation.

PERIPHERAL NERVES

1. History – Physiology, Evaluation, Investigations of Peripheral Nerve disorders.

2. Carpel Tunnel Syndrome, Entrapment syndromes Peripheral Nerve tumors, Acute Peripheral nerve injury

RADIATION THERAPY AND RADIOSURGERY

1. General, Historical considerations
2. Radiobiology
3. Principles of Radiotherapy
4. Radio surgery for tumors, functional radio surgery, Radio surgery for AVMs
5. Interstitial and Intracavitary irradiation for brain tumors
6. Techniques of radio surgery – linac, Gamma Knife, Proton Radio surgery, Stereotactic.

SPINE

1. Overview and History
2. Concepts and Mechanisms of Biomechanics
3. Intraoperative Electrophysiology - Monitoring
4. Bone metabolism
5. Approach to patient with spinal disorder
6. Failed back surgery syndrome
7. Infections of spine and spinal cord
8. Degenerative disease – cervical spondylosis, lumbar spinal stenosis, codification of posterior longitudinal ligament, spondylolysis and spondylolisthesis, treatment of disc disease.
9. Acquired abnormalities of Craniovertebral junction – basilar invagination, AAD
10. Principles of spinal internal fixation, bone graft harvest and spinal fusion.
11. Instrumentation - anterior cervical, posterior cervical, occipito cervical, anterior thoracic, posterior thoracic, anterior lumbar and posterior lumbar.
12. Image guided spinal navigation.
13. Endoscopic approaches, percutaneous treatment of disc disease.
14. Tumors of spine – Haemangiomas, multiple myeloma, metastases
15. Spinal trauma, approach and diagnosis, treatment of fractures and spinal cord trauma
16. MISS (Minimal invasive Spine Surgery)
17. Lumbar Microdiscectomy

PERIPHERAL NERVES

1. Acute and chronic injuries of peripheral nerves, brachial plexus and lumbosacral plexus
2. Electromyography, nerve conduction studies
3. Peripheral nerve tumors and compressive neuropathies

TRAUMA

1. Modern neurotraumatology – brief historical review
2. Cellular basis of injury and recovery from trauma.
3. Clinical Pathophysiology of traumatic brain injury
4. Mild head injury in adults.
5. Moderate and severe traumatic brain injury – initial resuscitation and patient evaluation, critical care management, surgical management
6. Sequels of traumatic brain injury – cerebro vascular injury, cranio facial trauma and

- cerebro spinal fluid fistula.
7. Rehabilitation and prognosis after traumatic brain injury
 8. Cisternostomy

INFECTIONS OF THE CENTRAL NERVOUS SYSTEM

1. Diagnosis and Management
2. Acute: Pyogenic and viral meningitis
3. Chronic: Tuberculous, Fungal, Parasitic
4. Human Immunodeficiency related pathologies

PRACTICAL & ORAL EXAMNATIONS:

1. Clinical Neurosurgery including history taking, physical examination, diagnosis, selection and planning of relevant investigations, appropriate treatment and rehabilitation of patients with neurosurgical disorders including those presenting as emergencies.
2. Essentials of clinical Neurology especially with reference to disorders common in India and those likely to present to the Neurosurgeons.
3. Basic medical sciences relevant to the practice of Neurosurgery.
4. Surgical Neuropathology and the essentials of the Pathology of Neurological disorders likely to present to the Neurosurgeon.
5. Performance and interpretation of Neuroradiological procedures and its interpretation.
6. Principles and interpretation of common Neurophysiological, Neuro-ophthalmological Neurootological and Neuroendocrinological tests especially with reference to Neurosurgical disorders.
7. Principles and interpretation of computerized axial tomography, MRI and other modern investigations.
8. Performance of common neurosurgical operations in the supra and infra-tentorial compartments in the spinal canal and on the peripheral nerves – initially under supervision and later independently. Ability to use the operating microscope is mandatory.
9. Familiarity with various types of anesthesia used in neurosurgery their indications and contraindications, the use of ventilators and techniques of monitoring and resuscitation.
10. Pharmacology of various drugs used in Neurosurgery.
11. Knowledge of the history of neurological surgery and its allied disciplines with special reference to India.
12. Knowledge of recent advances in the field of neurological surgery.
13. Preparation of papers for presentation at scientific conferences and for publication.
14. Introduction to the techniques involved in the organization and development of a department, its subsections and newer facilities.
15. It is desirable to have microsurgical laboratory training where candidates learn dissection/suturing of fine arteries/nerves under microscope and skull base dissections.
16. Development of proper attitudes towards patients, subordinates, colleagues and seniors.
17. Should have basic knowledge about application of computers
18. Fundoscopy/Ophthalmoscope

TRAINING ON SUB-SPECIALITY OF NEUROSCIENCES

- **Neuro – Anaesthesiology**
 - Resuscitation

- Life support system
- Monitoring of patients
- Neuro –Anaesthetic drugs & interactions
- Awake Craniotomy
- Temporary induced Cardiac arrest for Brain Vascular surgeries
- **Neuro – Radiology**
 - X-rays (Skull / Spine / Chest)
 - CT
 - MRI (including Perfusion techniques / functional MR)
 - Angiography (CT / MR / DSA)
- **Neuro – Pathology**
 - Brain cutting & anatomy methods
 - Frozen sections
 - Staining procedures
 - Identification of histologic features of common neurological disorder

IV) TEACHING AND LEARNING ACTIVITIES:

A) Theoretical Teaching:

1. **Lecture:** Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated.
2. **Journal clubs:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with names of the students and the moderator should be announced in advance.
3. **Subject Seminars:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with names of the students and the moderator should be announced in advance.
4. **Case Discussion:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with names of the students and the moderator should be announced in advance.
5. **Ward Rounds:** Ward rounds may be service or teaching rounds.
 - a) **Service Rounds:** Postgraduate students should do service rounds every day for the care of patients. Newly admitted patients should be worked up by the post graduate students and presented to the faculty members the following day.
 - b) **Teaching Round:** Every unit should have ‘grand rounds’ for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post-graduate students.

Entries of (a) and (b) should be made in the Log book.

- 6) **Inter-Departmental Meetings:** Recommended particularly with departments of Neurology, Pathology and Radio-Diagnosis at least once a month. These meetings should be attended by post-graduate students and relevant entries must be made in the log Book.
Radio-diagnosis: Interesting cases and the imaging modalities should be discussed. Emphasis should be given for the radiological differential diagnosis.
- 7) **Mortality Meeting:** The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records will be discussed in detail during this meeting.
- 8) **Teaching Skills:** Post-graduate students must teach under graduate students (e.g. Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in Log Book. Training of postgraduate students in Educational Science and Technology is recommended.
- 9) **Operating Skills:** The candidate in the 1st year will assist the different surgeries in the department; during 2nd year he may perform surgeries under supervision and in 3rd year he may be allowed to do it independently at the discretion of concerned teaching staff. He has to maintain in log book the list surgeries seen, assisted & done (both under supervision & independently).
- 10) **Continuing Medical Education (CME) Programs:** Recommended that at least one national level CME program should be attended by each student during the course.
- 11) **Conference:** Attending conference is compulsory. Postgraduate student should attend at least one national conference during the course.
- 12) **Research Activities:** The Post-graduate students to be encourage to carry out research activities in the department.
 - a) The Candidate shall furnish proof of having undertaken the original research of higorder. The research work shall be performed by the student during his / her study period under the supervision of the postgraduate teacher. This work shall be submitted to the university six months prior to the final examination.

OR

The candidate shall publish at least one research paper in a national indexed journal.

b) In addition, the candidate shall present at least one paper in the national or international conference.

B) CLINICAL & PRACTICAL TRAINING:

During the course duration of three years, the candidate will be posted to various departments as mentioned below:

a) PARENT DEPARTMENT (NEUROSURGERY)

30 ½ MONTHS

b) ROTATIONAL / EXTERNAL POSTINGS

- Internal (K.L.E)

I. CLINICAL NEUROLOGY AND NEUROPHYSIOLOGY

Candidates should have 2 months (1 month in the beginning and 1 month in the middle of course) training under Neurology department to familiarize themselves regarding common neurological disorders. During this period candidate should also familiarize themselves with the technique and interpretation of EEG/EMG/NCV and evoked potentials (End of 1st year)

- ii. Pediatric Neurology – 15 days posting
- iii. Neuro radiology – 15 days posting

- External – Neurosurgical institute posting (1 month)
- Pathology – NIMHANS 15 days posting
- Candidate in 3rd year (Post MS) should visit other neurosurgical centers recognized by MCI for about 4 weeks to be able to observe difference in approaches to various neurosurgical problems. It is desirable to have training in certain special areas to be arranged outside the institute, when necessary like micro surgical lab training if not available within the dept.

V. Other Criteria to be fulfilled for the Degree Course:

1. Internal Evaluation: During the course of three years, the department will conduct three tests. Two of them will be annual, one at the end of first year and other at the end of second year. The third test will be a preliminary examination which may be held three months before the final examination. The test may include the written papers, practical's / clinical 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 should be entered into PG's diary and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a Log book/ work diary and record his/her participation in the training programs conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the postgraduate students should be entered in the Log book. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the University practical / clinical examination.

VI. SCHEME OF EXAMINATION:

Candidates will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and research / publication work is satisfactory.

i) Theory

400 Marks

After completing of 3 years the theory examination shall consist of four question papers, each of three hours duration. Each paper shall carry maximum of 100 marks and that total maximum marks would be 400. The format for the theory paper shall be as follows:

Type of Questions	No. of Questions	Marks for each question	Total Marks
Long Essay	02	20	40
Short Essay	06	10	60
Grand Total			100

Paper I

Basic sciences

Paper II

General Neurosurgery

Paper III

Allied Neurosciences

Paper IV

Advances in neurosurgery

Note: The distribution of topics shown against the papers is suggestive only and may overlap or change.

B) CLINICAL EXAMINATIONS

200 Marks

Types of Cases	No. of Cases	Marks	Duration
Long Cases	1	100	1 Hours
Short Cases	2	100 (50 x 2)	30 mins. Each
Total	3	200	

C) VIVA-VOCE EXAMINATION

100 Marks

(Including specimen, radiology and operative techniques & details)

Aims : To elicit candidate's knowledge and investigative/ therapeutic skills.

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given gross specimens, histopathology slides. Radiological investigations including CT scan and Magnetic Resonance Imaging, etc., for interpretation and questions on these as well as use of instruments will be asked. Student's knowledge on use of instruments and drugs will also be evaluated during viva-voce examination.

D) MAXIMUM MARKS:

THEORY	CLINICAL EXAMINATION	VIVA INCLUDING SPOTTERS	GRAND TOTAL
400	200	100	700

E) PASSING CRITERION:

To pass the examination the candidate must secure 50% of the marks in each head of theory and practical's separately.

VII. RECOMMENDED BOOKS (LATEST EDITIONS):

S. No.	Title	Author	Publisher
01	Operative Neurosurgical Techniques	Sweet & Schmidek	Saunders
02	Youman's Neurological Surgery	H. Richard Winn	Saunders
03	Textbook of Operative Neurosurgery	Ramamurthy, Ravi Ramamurti	B.I.Publications
04	Textbook of Neurosurgery	Wilkins & Rengachary	Churchill Livingstone
05	Operative Textbook of Neurosurgery	Rhoton	Elsevier
06	Clinical book of Neurosurgery	De Jong	Wolters Kluwer
07	Clinical book of Neurosurgery	Paul and Brazis	Wolters Kluwer

VIII. REFERENCE JOURNALS:

S. No.	Title	Publisher
05	Journal of Neurosurgery	American Association of Neurological Surgeons (USA)
06	Neurosurgery	Congress of Neurologist Surgeons
07	British Journal of Neurosurgery	Society of British Neurological Surgeons, Informal UK Ltd.
08	Acta Neurochirurgica	Springer
09	Journal of Clinical Neurosciences	Churchill Livingstone
10	Neurology India	Medknow Publications
11	Neurosurgery clinics of month America	Saunders Elsevier