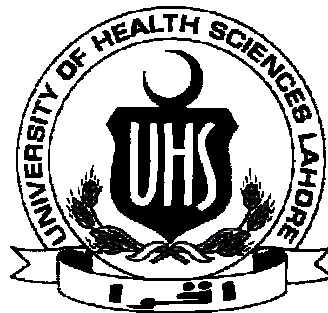

**CURRICULUM / STATUTES & REGULATIONS
FOR
5 YEARS DEGREE PROGRAMME
IN
NEUROSURGERY
(MS Neurosurgery)**



**UNIVERSITY OF HEALTH SCIENCES,
LAHORE**

STATUTES

1. *Nomenclature Of The Proposed Course*

The name of degree programme shall be MS Neurosurgery. This name is well recognized and established for the last many decades worldwide.

2. *Course Title:*

MS Neurosurgery

3. *Training Centers*

Departments of Neurosurgery (accredited by UHS) in affiliated institutes of University of Health Sciences Lahore.

4. *Duration of Course*

The duration of MS Neurosurgery course shall be five (5) years (first year in Part I, first two years in Part II and next three years in Part III) with structured training in a recognized department under the guidance of an approved supervisor. The course is structured in three parts:

Part I is structured for the 1st calendar year. The candidate shall undertake didactic training in Basic Medical Sciences, Behavioural Sciences and Biostatistics & Research Methodology. The clinical training in fundamental concepts of Surgery shall start from the 1st day of enrollment.

Part II is structured for the 1st and 2nd calendar years. The candidate shall undertake clinical training in fundamental concepts of Surgery. At the end of 2nd year the examination shall be held in fundamental concepts of Surgery. The clinical training in Neurosurgery shall start from 3rd year onwards in the recognized institutions.

Part III is structured for 3rd, 4th and 5th calendar years in MS Neurosurgery. It has two components; Clinical and Research. The candidate shall undergo clinical training to achieve educational objectives of MS Neurosurgery (knowledge & skills) along with rotation in relevant fields.

Over the five years duration of the course, candidate will spend total time equivalent to one calendar year for research during the training. Research can

be done as one block in 5th year of training or it can be done in the form of regular periodic rotations over five years as long as total research time is equivalent to one calendar year.

5. Admission Criteria

- I. For admission in MS Neurosurgery course, the candidate shall be required to have:
 - MBBS degree
 - Completed one year House Job
 - One year experience in Neurosurgery/General surgery/Allied surgical discipline in the given order of preference
 - Registration with PMDC
 - Passed Entry Test conducted by the University & aptitude interview by the Institute concerned
 - Having up to the mark credentials as per UHS rules (no. of attempts in each professional, any gold medals or distinctions, relevant work experience, Rural/ Army services, research experience in a recognized institution, any research article published in a National or International Journal) may also be considered on case to case basis.
- II. Exemptions: A candidate holding FCPS/MRCS/Diplomate/equivalent qualification in General Surgery shall be exempted from Part-I & Part-II Examinations and shall be directly admitted to Part-III Examinations, subject to fulfillment of requirements for the examination.

6. Registration And Enrollment

- Total number of students enrolled for the course must not exceed 2 per supervisor/year.
- The maximum number of trainees that can be attached with a supervisor at a given point of time (inclusive of trainees in all years/phases of MS training), must not exceed 6.

- Beds to trainee ratio at the approved teaching site shall be at least 5 beds per trainee.
- The University will approve supervisors for MS courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulation.

7. Accreditation Related Issues Of The Institution

A. Faculty

Properly qualified teaching staff in accordance with the requirements of Pakistan Medical and Dental Council (PMDC)

B. Adequate Space

Including class-rooms (with audiovisual aids), demonstration rooms, computer lab and clinical pathology lab etc.

C. Library

Departmental library should have latest editions of recommended books, reference books and latest journals (National and International).

- Accreditation of Neurosurgery training program can be suspended on temporary or permanent basis by the University, if the program does not comply with requirements for residents training as laid out in this curriculum.
- Program should be presented to the University along with a plan for implementation of curriculum for training of residents.
- Programs should have documentation of residents training activities and evaluation on monthly basis.
- To ensure a uniform and standardized quality of training and availability of the training facilities, the University reserves the right to make surprise visits of the training program for monitoring purposes and may take appropriate action if deemed necessary.

AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of five years MS programme in Neurosurgery is to train residents to acquire the competency of a specialist in the field so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

GENERAL OBJECTIVES

MS Neurosurgery training should enable a student to:

1. Access and apply relevant knowledge to clinical practice:
 - Maintain currency of knowledge
 - Apply scientific knowledge in practice
 - Appropriate to patient need and context
 - Critically evaluate new technology
2. Safely and effectively performs appropriate surgical procedures:
 - Consistently demonstrate sound surgical skills
 - Demonstrate procedural knowledge and technical skill at a level appropriate to the level of training
 - Demonstrate manual dexterity required to carry out procedures
 - Adapt their skills in the context of each patient and procedure
 - Maintain and acquire new skills
 - Approach and carries out procedures with due attention to safety of patient, self and others
 - Critically analyze their own clinical performance for continuous improvement
3. Design and implement effective management plans:
 - Recognize the clinical features, accurately diagnose and manage neurological problems
 - Formulate a well-reasoned provisional diagnosis and management plan based on a thorough history and examination
 - Formulate a differential diagnosis based on investigative findings

- Manage patients in ways that demonstrate sensitivity to their physical, social, cultural and psychological needs
- Recognize disorders of the nervous system and differentiate those amenable to surgical treatment
- Effectively manage the care of patients with neurotrauma including multiple system trauma
- Effectively recognize and manage complications
- Accurately identify the benefits, risks and mechanisms of action of current and evolving treatment modalities
- Indicate alternatives in the process of interpreting investigations and in decision-making
- Manage complexity and uncertainty
- Consider all issues relevant to the patient
- Identify risk
- Assess and implement a risk management plan
- Critically evaluate and integrate new technologies and techniques.

4. Organize diagnostic testing, imaging and consultation as needed:

- Select medically appropriate investigative tools and monitoring techniques in a cost-effective and useful manner
- Appraise and interpret appropriate diagnostic imaging and investigations according to patients' needs
- Critically evaluates the advantages and disadvantages of different investigative modalities

5. Communicate effectively:

- Communicate appropriate information to patients (and their family) about procedures, potentialities and risks associated with surgery in ways that encourage their participation in informed decision making
- Communicate with the patient (and their family) the treatment options including benefits and risks of each
- Communicate with and co-ordinate health management teams to achieve an optimal surgical environment
- Initiate the resolution of misunderstandings or disputes

- Modify communication to accommodate cultural and linguistic sensitivities of the patient

6. Recognize the value of knowledge and research and its application to clinical practice:

- Assume responsibility for self-directed learning
- Critically appraise new trends in neurosurgery
- Facilitate the learning of others.

7. Appreciate ethical issues associated with Neurosurgery:

- Consistently apply ethical principles
- Identify ethical expectations that impact on medico-legal issues
- Recognize the current legal aspects of informed consent and confidentiality
- Be accountable for the management of their patients.

8. Professionalism by:

- Employing a critically reflective approach to Neurosurgery
- Adhering with current regulations concerning workplace harassment
- Regularly carrying out self and peer reviewed audit
- Acknowledging and have insight into their own limitations
- Acknowledging and learning from mistakes

9. Work in collaboration with members of an interdisciplinary team where appropriate:

- Collaborate with other professionals in the selection and use of various types of treatments assessing and weighing the indications and contraindications associated with each type
- Develop a care plan for a patient in collaboration with members of an interdisciplinary team
- Employ a consultative approach with colleagues and other professionals
- Recognize the need to refer patients to other professionals.

10. Management and Leadership

- Effective use of resources to balance patient care and system resources
- Identify and differentiate between system resources and patient needs

- Prioritize needs and demands dealing with limited system resources.
- Manage and lead clinical teams
- Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team.
- Maintain clinically relevant and accurate contemporaneous records

11. Health advocacy:

- Promote health maintenance of patients
- Advocate for appropriate health resource allocation
- Promote health maintenance of colleagues and self scholar and teacher

SPECIFIC LEARNING OUTCOMES

On completion of the training programme, Neurosurgery trainees including those pursuing an academic pathway will be expected to have demonstrated competence in all aspects of the published syllabus. The specific training component would be targeted for establishing clearly defined standards of knowledge and skills required to practice Neurosurgery at secondary and tertiary care level with proficiency in the Basic and applied clinical neurosciences, Basic neurosurgical care, Neurointensive care, Emergency (A&E) medicine and Complementary surgical disciplines.

1. Neuroanatomy:

- To have a working knowledge of the structure and development of the central and peripheral nervous system together with the related parts of the head and spine and associated structures of neurosurgical importance.

2. Neurophysiology:

- To be familiar with the normal and abnormal physiology and metabolism of the body and central nervous system.
- To be familiar with the basic principles of neuropharmacology and
- Neurochemistry with special reference to the actions, interactions and toxic effects of drugs currently used in neurosurgery.
- To be familiar with the basic principles and interpretation of EEG, EMG and other techniques of applied neurophysiology, particularly those used intra-operatively and in neurointensive care.

3. Neuropathology:

- To be familiar with the pathological changes and cellular organization of the central and peripheral nervous system during disease process.
- To have a working knowledge of the gross and microscopic pathology of diseases affecting the nervous system.
- To recognize gross and microscopic preparations
-

- To be familiar with the various pathogenic organisms responsible for infections of the nervous system

4. Neuroradiology:

- To be able to recognize and comment on abnormalities present on plain X-Rays of the skull, spine and other regions of neurosurgical interest and to interpret special investigations such as myelograms, angiograms, CT and MRI scans
- To be familiar with the principles of radiobiology and radiotherapy
- To be familiar with the application of radionuclide studies to the diagnosis of neurological disorders.

5. Neurosurgery Related Clinical Competence:

The ability to construct a differential diagnosis, interpret investigations and construct a management plan for common conditions in practice of neurosurgery in the following specialties:

i. Clinical Neurology:

- To be able to take a neurological history and to assess the value of different symptom patterns in indicating involvement of specific neurological systems and functions and/or particular disease processes
- To be able to conduct and to demonstrate a reliable clinical examination relating to the nervous system and to elicit and interpret signs of dysfunction of different systems and their components
- To be able to arrive at a well reasoned diagnosis and to recognize the common neurological disorders and differentiate those amenable to surgical treatment
- To be conversant with all common neurosurgical disorders
- To be able to describe in detail and to discuss the choice of the appropriate conventional neurosurgical procedures available
- To be conversant with safety in the operating theatre, the use of instruments and infection control procedures
- To demonstrate competence in all aspects of the care of the patient during diagnostic tests, at operations, in the postoperative period and

during rehabilitation

- To be familiar with the principles of psychiatry, neuro-psychology, neuro-ophthalmology, neuro-otology and neuro-anaesthesia
- To be able to demonstrate those attitudes that reflect awareness of, and respect for, individuality and autonomy of patients and careers at all stages of management, including counseling and providing explanations of the nature of disease and potential methods of treatment

ii. Paediatric Neurosurgery:

The resident shall be proficient in the management of developmental disorders of the neuraxis including craniofacial anomalies and spinal dysraphism; all forms of hydrocephalus; intrinsic tumours of the brain and spine and a wide range of rarer pathologies.

Paediatric neurosurgeons often contribute to the management of related disorders such as hydrocephalus, spinal dysraphism and epilepsy presenting in young adults.

iii. Neuro-oncology:

The training is based on advances in basic oncological science and the sophisticated delivery of intra-lesional therapies for the management of malignant intrinsic tumours of the nervous system with refinement of surgical techniques using radiological and functional guidance; improvements in adjuvant chemotherapy and radiotherapy; greater understanding of the molecular biology of CNS tumours and better organization of oncology services.

iv. Functional Neurosurgery:

Functional neurosurgery involves the surgical management of a wide range of neurological problems including intractable pain, epilepsy, spasticity and movement disorders. Traditional ablative surgery is being replaced by deep brain and spinal cord stimulation. Research into neuromodulation using gene therapy, biological vectors and pharmacological agents offers the prospect of effective treatment for neurodegenerative and disabling psychiatric diseases

Neurovascular Surgery:

Residents should be proficient in working closely with their interventional colleagues dealing with complex aneurysms, vascular malformations and occlusive cerebrovascular diseases.

v. Skull-base surgery:

Residents are expected to flourish in technical advances in microsurgery, surgical approaches and reconstructions in the routine practice of dealing with disorders of the skull-base including common tumours such as meningiomas, acoustic neuromas and pituitary adenomas. Skull-base surgery is often undertaken jointly with neuro-otological, plastic and maxillofacial surgeons. The resident should also be aware of the adjuvant treatments with sophisticated radiosurgery and fractionated stereotactic radiotherapy for patients with skull-base tumours

vi. Spinal surgery:

Spinal surgery is now the largest subspecialty in neurosurgery and accounts for more than 50% of the operative workload of some departments in European hospitals. The resident should demonstrate a comprehensive service delivery for primary and secondary spinal malignancy, spinal trauma, spinal pain and degenerative spinal disorders.

vii. Traumatology:

The resident must be able to provide a prompt neurosurgical intervention and neurointensive care and management in patients with head injury which remains a major cause of death and disability in children and young adults.

6. Research Experience:

All residents in the categorical program are required to complete an academic outcomes-based research project during their training. This project can consist of original bench top laboratory research, clinical research or a combination of both. The research work shall be compiled in the form of a thesis which is to be submitted for evaluation by each resident before end of the training. The designated Faculty will organize and mentor the residents through the process, as well as journal clubs to teach critical appraisal of the literature.

Curriculum/Statutes & Regulations-MS Neurosurgery

REGULATIONS

1. Scheme of the Course

A summary of five years course in MS Neurosurgery is presented as under:

Course Structure	Components	Examination
Part I	Basic Medical Sciences Anatomy, Physiology, Biochemistry, Pathology, Pharmacology, Behavioural Sciences and Biostatistics & Research Methodology	Part-I examination at the end of 1 st year of MS Neurosurgery programme. <ul style="list-style-type: none"> • Written: Paper I: MCQs Paper II: SEQs
Part-II	<ul style="list-style-type: none"> • Fundamental Concepts in Surgery : Training in basic clinical techniques of Surgery with compulsory rotations for two years starting from first day of enrollment 	Part-II examination at the end of 2 nd year of MS Neurosurgery programme. <ul style="list-style-type: none"> • Written: Papers 1 & 2: Basic Principles of Surgery • Oral & Practical/ Clinical Examination <ul style="list-style-type: none"> • OSCE • Clinical Examination (Long case, Short cases) • Log Book
Part-III	<p style="text-align: center;"><u>Clinical component of Part III</u></p> <ul style="list-style-type: none"> • Professional Education in Neurosurgery : Training in Neurosurgery during 3rd, 4th & 5th year of MS Neurosurgery programme. Three years of training with compulsory & optional rotations in relevant fields <p style="text-align: center;"><u>Research component of Part III</u></p> <ul style="list-style-type: none"> • Research and Thesis Writing: Research work/Thesis writing project must be completed and thesis be submitted before the end of training. 	Part-III examination in specialized components of Neurosurgery at the end of 5 th year of MS Neurosurgery programme. <ul style="list-style-type: none"> • Written: Papers 1 & 2: Problem-based questions in the subject • Oral & Practical/ Clinical Examination <ul style="list-style-type: none"> • OSCE/ • Clinical Examination (Long case, Short cases) • Log Book <p>Part-III thesis examination with defense at the end of fifth (5th) year of MS Neurosurgery programme.</p>

2. Examinations

Part-I Examination

1. All candidates admitted in MS Neurosurgery course shall appear in Part-I examination at the end of first calendar year.
2. The examination shall be held on biannual basis.
3. The candidate who fails to pass the examination in 3 consecutive attempts availed or un-availed, shall be dropped from the course.
4. The examination shall have two components:

▪ Paper-I MCQs (single best)	100 Marks
▪ Paper-II SEQs	100 Marks
5. Subjects to be examined shall be Basic Sciences relevant to Neurosurgery (Anatomy, Physiology, Biochemistry, Pathology, Pharmacology), Behavioural Sciences and Biostatistics & Research Methodology.
6. To be eligible to appear in Part-I examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;
 - ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
 - iii. Examination fee as prescribed by the University
7. To be declared successful in Part-I examination the candidate must secure 60% marks in each paper.

Part-II Examination

1. All candidates admitted in MS Neurosurgery course shall appear in Part-II examination at the end of second calendar year.
2. The examination shall be held on biannual basis.
3. The candidate who fails to pass the examination within 3 years of passing the Part-I examination shall be dropped from the course.
4. The examination shall have the following components:
 - a. Written 200 Marks
 - b. OSCE 50 Marks
 - c. Clinical examination 100 Marks
 - d. Log Book Evaluation 80 Marks (40 marks per year)
5. There shall be two written papers of 100 marks each:

Papers 1 & 2: Principles of General Surgery
6. The types of questions shall be of Short/Modified essay type and MCQs (single best).
7. Oral & practical/clinical examination shall be held in clinical techniques in General Surgery.
8. To be declared successful in Part-II examination the candidate must secure 60% marks in each component and 50% in each sub-component.
9. Only those candidates, who pass in theory papers, will be eligible to appear in the Oral & Practical/clinical Examination.
10. The candidates, who have passed written examination but failed in oral & practical/ clinical examination, will re-appear only in oral & practical/clinical examination.
11. The maximum number of attempts to re-appear in oral & practical /clinical Examination alone shall be three, after which the candidate shall have to appear in both written and oral & practical/clinical examinations as a whole.
12. To be eligible to appear in Part-II examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;

- ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
- iii. a certificate of having passed the Part-I examination;
- iv. Examination fee as prescribed by the University.

Part-III Examination

1. All candidates admitted in MS Neurosurgery course shall appear in Part-III (clinical) examination at the end of structured training programme (end of 5th calendar year), and having passed the part I & II examinations. However, a candidate holding FCPS / MRCS / Diplomate / equivalent qualification in General Surgery shall be exempted from Part-I & Part-II Examinations and shall be directly admitted to Part-III Examinations, subject to fulfillment of requirements for the examination.
2. The examination shall be held on biannual basis.
3. To be eligible to appear in Part-III examination the candidate must submit;
 - i. duly filled, prescribed Admission Form to the Controller of Examinations duly recommended by the Principal/Head of the Institution in which he/she is enrolled;
 - ii. a certificate by the Principal/Head of the Institution, that the candidate has attended at least 75% of the lectures, seminars, practical/clinical demonstrations;
 - iii. Original Log Book complete in all respect and duly signed by the Supervisor (for Oral & practical/clinical Examination);
 - iv. certificates of having passed the Part-I & part-II examinations;
 - v. Examination fee as prescribed by the University.
4. The Part-III clinical examination shall have the following components:

▪ Written	300 marks
▪ Oral & practical/clinical examination	300 marks
▪ Log Book Evaluation	120 marks (40 marks per year)
5. There shall be two written papers of 150 marks each.
6. Both papers shall have problem-based Short/Modified essay questions and MCQs.
7. Oral & practical/clinical examination shall have 300 marks for:
 - i. 1 Long Case 100
 - ii. 4 Short Cases 100(25 marks each)

iii. OSCE

8. To be declared successful in Part-III examination the candidate must secure 60% marks in each component and 50% in each sub-component.
9. Only those candidates who pass in theory papers, will be eligible to appear in the Oral & Practical/ Clinical Examination.
10. The candidates, who have passed written examination but failed in Oral & Practical/ Clinical Examination, will re-appear only in Oral & Practical / Clinical examination.
11. The maximum number of attempts to re-appear in oral & practical /clinical Examination alone shall be three, after which the candidate shall have to appear in both written and oral & practical/clinical examinations as a whole.
12. The candidate with 80% or above marks shall be deemed to have passed with distinction.
13. *Log Book/Assignments:* Through out the length of the course, the performance of the candidate shall be recorded on the Log Book.
14. The Supervisor shall certify every year that the Log Book is being maintained and signed regularly.
15. The Log Book will be developed & approved by the Advanced Studies & Research Board.
16. The evaluation will be maintained by the Supervisor (in consultation with the Co- Supervisor, if appointed).
17. The performance of the candidate shall be evaluated on annual basis, e.g., 40 marks for each year in five years MS Neurosurgery course. The total marks for Log Book shall be 200. The log book shall reflect the performance of the candidate on following parameters:
 - Year wise record of the competence of skills.
 - Year wise record of the assignments.
 - Year wise record of the evaluation regarding attitude & behaviour
 - Year wise record of journal club / lectures / presentations / clinico-pathologic conferences attended & / or made by the candidate.

3. Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on UHS website.
2. The research topic in clinical subject should have 30% component related to basic sciences and 70% component related to applied clinical sciences. The research topic must consist of a reasonable sample size and sufficient numbers of variables to give training to the candidate to conduct research, to collect & analyze the data.
3. Synopsis of research project shall be submitted by the end of the 3rd year of MS program. The synopsis after review by an Institutional Review Committee shall be submitted to the University for consideration by the Advanced Studies & Research Board, through the Principal / Dean /Head of the institution.

4. Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor.
2. The minimum duration between approval of synopsis and submission of thesis shall be one year, but the thesis can not be submitted later than 8 years of enrolment.
3. The research thesis must be compiled and bound in accordance with the Thesis Format Guidelines approved by the University and available on website.
4. The research thesis will be submitted along with the fee prescribed by the University.

5. Thesis Examination

1. All candidates admitted in MS course shall appear in Part-III thesis examination at the end of 5th year of their training course.
2. Only those candidates shall be eligible for thesis evaluation who have passed Part I, II & III (clinical) Examinations.
3. The examination shall include thesis evaluation with defense.

4. The Vice Chancellor shall appoint three external examiners for thesis evaluation, preferably from other universities and from abroad, out of the panel of examiners approved by the Advanced Studies & Research Board. The examiners shall be appointed from respective specialty. Specialists from General Surgery and Allied surgical Disciplines may also be appointed/co-opted, where deemed necessary.
5. The thesis shall be sent to the external examiners for evaluation, well in time before the date of defense examination and should be approved by all the examiners.
6. After the approval of thesis by the evaluators, the thesis defense examination shall be held within the University on such date as may be notified by the Controller of Examinations. The Controller of Examinations shall make appropriate arrangements for the conduct of thesis defense examination in consultation with the supervisor, who will co-ordinate the defense examination.
7. The thesis defense examination shall be conducted by two External Examiners who shall submit a report on the suitability of the candidate for the award of degree. The supervisor shall act as coordinator.

6. Award of MS Neurosurgery Degree

After successful completion of the structured courses of MS Neurosurgery and qualifying Part-I, Part-II and Part-III examinations, the degree with title MS Neurosurgery shall be awarded.

CONTENT OUTLINE

Part I MS Neurosurgery

Basic Sciences:

Student is expected to acquire comprehensive knowledge of Anatomy, Physiology, Pathology (Microbiology), Biochemistry, Pharmacology relevant to surgical practice appropriate for Neurosurgery

1. Anatomy

- Detailed Anatomy of the organ systems of body, their blood supply, nerve supply, lymphatic drainage and important gross relations to other organs as appropriate for neurosurgical operations
- Developmental Anatomy and associated common congenital abnormalities
- Features of Surface, Imaging and Applied Anatomy within skull, brain, spinal cord, peripheral nervous system and head and neck
- Relate knowledge to assessment of clinical situation or progress of disease condition

Embryogenesis of the brain and spinal cord

- Embryogenesis of supporting structures - skull and vertebral column
- Common anatomical variations and developmental abnormalities
- Embryogenesis of the skeleton and muscle development

Structure, blood supply, innervation, surface and three-dimensional relationships of the:

- Scalp
- Skull
- Meninges
- Orbit
- Cranial fossae
- Cranial foraminae
- Cranial nerves

Cortical Topography:

- Projection and association tracts
- Organization of the basal ganglia
- Structure, organization and connections of the cerebellum, pons and brainstem
- Cranial nerves and their relationships
- Visual and auditory pathways
- Ventricular system and choroid plexus
- Subarachnoid space and cisterns
- Circle of Willis and principle regional and segmental blood supply
- Venous drainage and dural sinuses

Structure, blood supply, innervation, surface and three-dimensional relationships of the:

- Vertebral column

- Spinal cord: ascending and descending tracts
- Spinal nerve roots
- Cauda equina

Structure, innervation and Distribution of autonomic and peripheral nervous system:

- Sympathetic and parasympathetic pathways
- Visceral and pelvic innervation: control of sphincter function
- Brachial plexus
- Lumbosacral plexus
- Course, distribution and innervation of the major peripheral nerves

Applied Anatomy

- Stereotaxis
- Embryology and mal-development
- Differences between foetal, infant, child and adult brain
- Development of facial and cranial skeleton
- Branchial arches and the vascular system
- Development of the ventricular system
- Development of the cerebral hemispheres
- Development of brain stem and cranial nerves
- The notochord
- The subependymal plate (subventricular zone)
- Development of the pituitary gland
- The external granular layer of the cerebellum
- Spinal cord development
- Applied embryology of the CNS and its coverings

2. Physiology

- Functional Neurophysiology: Cellular organization, structure function correlations and physiological alterations in the central and peripheral nervous systems of body
- Clinical Neurophysiology: Relate knowledge to assessment of clinical situation or progress of disease condition

Functional Neurophysiology:

- Structure and function of neurons and glial cells
- Synaptic function, action potentials and axonal conduction
- Higher cerebral functions
- Sleep and coma
- Memory and disorders of the limbic system
- Control of motor function: ascending and descending pathways, basal ganglia and cerebellar function
- The special senses
- Hypothalamic-pituitary function
- Cerebral blood flow and metabolism
- Cerebral auto-regulation and vasospasm
- Blood brain barrier and cerebral edema

- Intracranial pressure dynamics
- Cerebral ischaemia and neuroprotection
- CSF hydrodynamics - production and absorption

Autonomic Nervous System:

- Differing effects of sympathetic and parasympathetic innervation
- Effects on differing physiological processes

Clinical Neurophysiology:

- Principles of electroencephalography
- Principles of somatosensory, motor and brainstem evoked potential monitoring
- Peripheral neuropathies and entrapment neuropathies including:
 - Structure and function of peripheral nerves
 - Use of nerve conduction studies
- Disorders of the neuromuscular junction including:
 - Structure and function of smooth and striated muscle
 - Use of electromyographic studies

Clinical Skills

- Interpretation of the results of EEG, EMG and NC studies

3. Biochemistry

- Membrane biochemistry and signal transduction
- Enzymes and biologic catalysis
- Tissue metabolism
- Carbohydrate metabolism
- Lipid metabolism
- Nitrogen metabolism

Neurochemistry (Including Neuroendocrinology)

- Fundamentals of Chemistry
- Introduction to acid-base chemistry and equilibrium
- Fundamentals of Neurochemistry
- CNS metabolism
- Principle of neuronal communication
- Mechanism controlling transmitter release
- Transduction mechanisms in the post-synaptic cells
- Characteristics of synaptic potential
- Process of synaptic summation (spatial and temporal)
- Neurotransmitters & Synaptic Transmission
- Neurotransmitters and receptors
- Important neurotransmitters and chemical messengers
- Chemical Classification
 - Nitric Oxide
 - Eicosanoids
 - Acetylcholine

- Amino acid transmitters
- Serotonin
- Catecholamines
- Peptides

Functional Classification

- Metabolism
- Important second messenger pathways
- Pathophysiologic mechanism of conditions interfering chemical transmission
- Neurochemistry of common neurological diseases (Alzheimer's disease, alcoholism, anxiety, sleep disorders etc.)
- Neuroendocrinology and Neurohormones
- Molecular bases of neuroendocrine regulation
- Neuroendocrinology of hypothalamus, pituitary gland, hypothalamic-pituitary-gonadal axis, sleep and arousal etc.)
- Homeostasis and biological rhythms
- Gene expression and the synthesis of proteins
- Bioenergetics; fuel oxidation and the generation of ATP
- Biotechnology and concepts of molecular biology with special emphasis on use of recombinant DNA techniques in medicine and the molecular biology of cancer

4. Pharmacology

- The Evolution of Medical Drugs
- British Pharmacopia
- Introduction to Pharmacology
- Receptors
- Mechanisms of Drug Action
- Pharmacokinetics
- Pharmacokinetic Process
 - Absorption
 - Distribution
 - Metabolism
 - Desired Plasma Concentration
 - Volume of Distribution
 - Elimination
 - Elimination rate constant and half life
 - Creatinine Clearance
- Drug Effect
 - Beneficial Responses
 - Harmful Responses
 - Allergic Responses
- Drug Dependence, Addiction, Abuse and Tolerance
- Drug Interactions
- Dialysis
- Drug use in pregnancy and in children

5. Pathology

Pathological alterations at cellular and structural level in infection, inflammation, ischaemia, neoplasia and trauma affecting the nervous system.

Cell Injury and adaptation

- Reversible and Irreversible Injury
- Fatty change, Pathologic calcification
- Necrosis and Gangrene
- Cellular adaptation
- Atrophy, Hypertrophy,
- Hyperplasia, Metaplasia, Aplasia

Inflammation

- Acute inflammation
- Cellular components and chemical mediators of acute inflammation
- Exudates and transudate
- Sequelae of acute inflammation
- Chronic inflammation
- Etiological factors and pathogenesis
- Distinction between acute and chronic (duration) inflammation
- Histologic hallmarks
- Types and causes of chronic inflammation, non-granulomatous & granulomatous,

Haemodynamic disorders

- Etiology, pathogenesis, classification and morphological and clinical manifestations of Edema, Haemorrhage, Thrombosis, Embolism, Infarction & Hyperaemia
- Shock; classification etiology, and pathogenesis, manifestations.
- Compensatory mechanisms involved in shock
- Pathogenesis and possible consequences of thrombosis
- Difference between arterial and venous emboli

Neoplasia

- Dysplasia and Neoplasia
- Benign and malignant neoplasms
- Etiological factors for neoplasia
- Different modes of metastasis
- Tumor staging system and tumor grade

Immunity and Hypersensitivity

- Immunity
- Immune response
- Diagnostic procedures in a clinical Immunology laboratory
- Protective immunity to microbial diseases
- Tumour immunology
- Immunological tolerance, autoimmunity and autoimmune diseases.
- Transplantation immunology
- Hypersensitivity
- Immunodeficiency disorders
- Immunoprophylaxis & Immunotherapy

Related Microbiology

- Role of microbes in various central and peripheral nervous system diseases
- Infection source
- Nosocomial infections
- Bacterial growth and death
- Pathogenic bacteria
- Vegetative organisms
- Spores
- Important viruses
- Important parasites
- Surgically important microorganisms
- Sources of infection
- Asepsis and antisepsis
- Sterilization and disinfection
- Infection prevention
- Immunization
- Personnel protection from communicable diseases
- Use of investigation and procedures in laboratory

Special Pathology

- Cerebral hypoxia and ischaemia
- Cytopathology of neurons and glial in response to ischaemia, hypoxia and trauma
- Diffuse axonal injury
- Congenital malformations of the nervous system
- Cerebral and spinal vascular disorders and lesions of extracranial vessels
- Brain and spinal cord trauma
- Acute and chronic inflammatory processes in the CNS
- Meningitis, encephalitis, brain abscess and other disorders of bacterial, viral, fungal or parasitic origin
- Principles and practice of antibiotic therapy
- Slow viruses and the brain
- Bacterial, fungal and parasitic meningitis, encephalitis and abscess formation
- Viral encephalitis
- Slow viruses, CJD and vCJD
- HIV associated infections, tumours and leucoencehalopathies
- The dementias
- Causes of epilepsy
- Demyelinating diseases
- Diseases of the scalp, skull and meninges
- Diseases and degenerative disorders of the spine
- Inborn errors of metabolism
- Diseases of muscle
- Brain shifts, herniation and raised intracranial pressure
- Classification, epidemiology and pathology of CNS tumours
- Techniques of biopsy and tissue preparation, staining and immunohistochemical

- Orbital tumours
- Tumour biology, cell kinetics, tumour markers, immunocytochemistry

6. Biostatistics & Research Methodology

1. Introduction to Bio-Statistics
2. Introduction to Bio- Medical Research
3. Why research is important?
4. What research to do?
 - Selecting a Field for Research
 - Drivers for Health Research
 - Participation in National and International Research
 - Participation in Pharmaceutical Company Research
 - Where do research ideas come from
 - Criteria for a good research topic
5. Ethics in Health Research
6. Writing a Scientific Paper
7. Making a Scientific Presentation
8. Searching the Literature

7. Behavioural Sciences

- Bio-psycho-social (BPS) model of health care
- Use of non-medicinal interventions in clinical practice
 - Communication skills
 - Counseling
 - Informational skills
- Crisis intervention/disaster management
- Conflict resolution
- Breaking bad news
- Medical ethics, professionalism and doctor-patient relationship
 - Hippocratic oath
 - Four pillars of medical ethics (autonomy, beneficence, non-maleficence and justice)
 - Informed consent and confidentiality
 - Ethical dilemmas in a doctor's life
- Delivery of culturally relevant care and cultural sensitivity
- Psychological aspects of health and disease
 - Psychological aspect of health
 - Psychological aspect of disease
 - Stress and its management
 - Psychological aspect of pain
 - Psychological aspect of aging

Part II

MS Neurosurgery

Fundamental Principles of Surgery

- History of surgery
- Preparing a patient for surgery
- Principles of operative surgery: asepsis, sterilization and antiseptics
- Surgical infections and antibiotics
- Basic principles of anaesthesia and pain management
- Acute life support and critical care:
 - Pathophysiology and management of shock
 - Fluids and electrolyte balance/ acid base metabolism
 - Haemostasis, blood transfusion
- Trauma: assessment of polytrauma, triage, basic and advanced trauma
- Accident and emergency surgery
- Wound healing and wound management
- Nutrition and metabolism
- Principles of burn management
- Principles of surgical oncology
- Principles of laparoscopy and endoscopy
- Organ transplantation
- Informed consent and medicolegal issues
- Molecular biology and genetics
- Operative procedures for common surgical manifestations e.g cysts, sinuses, fistula, abscess, nodules, basic plastic and reconstructive surgery
- Principles of basic diagnostic and interventional radiography
- Principles and interpretation of conventional and advanced radiographic procedures

Common Surgical Skills

Incision of skin and subcutaneous tissue:

- Langer's lines
- Healing mechanism
- Choice of instrument
- Safe practice

Closure of skin and subcutaneous tissue:

- Options for closure
- Suture and needle choice
- Safe practice

Knot tying:

- Choice of material
- Single handed
- Double handed
- Superficial
- Deep

Tissue retraction:

- Choice of instruments
- Placement of wound retractors
- Tissue forceps

Use of drains:

- Indications
- Types
- Insertion
- Fixation
- Management/removal

Incision of skin and subcutaneous tissue:

- Ability to use scalpel, diathermy and scissors

Closure of skin and subcutaneous tissue:

- Accurate and tension free apposition of wound edges

Haemostasis:

- Control of bleeding vessel (superficial)
- Diathermy
- Suture ligation
- Tie ligation
- Clip application
- Plan investigations
- Clinical decision making
- Case work up and evaluation; risk management

Pre-operative assessment and management:

- Cardiorespiratory physiology
- Diabetes mellitus
- Renal failure
- Pathophysiology of blood loss
- Pathophysiology of sepsis
- Risk factors for surgery
- Principles of day surgery
- Management of comorbidity

Intraoperative care:

- Safety in theatre
- Sharps safety
- Diathermy, laser use
- Infection risks
- Radiation use and risks
- Tourniquets
- Principles of local, regional and general anaesthesia

Post-operative care:

- Monitoring of postoperative patient
- Postoperative analgesia
- Fluid and electrolyte management
- Detection of impending organ failure
- Initial management of organ failure
- Complications specific to particular operation
- Critical care

Blood products:

- Components of blood
- Alternatives to use of blood products
- Management of the complications of blood product transfusion including children

Antibiotics:

- Common pathogens in surgical patients
- Antibiotic sensitivities
- Antibiotic side-effects
- Principles of prophylaxis and treatment

Safely assess the multiply injured patient:

- History and examination
- Investigation
- Resuscitation and early management
- Referral to appropriate surgical subspecialties

Technical Skills

- Central venous line insertion
- Chest drain insertion
- Diagnostic peritoneal lavage
- Bleeding diathesis & corrective measures, e.g. warming, packing
- Clotting mechanism; Effect of surgery and trauma on coagulation
- Tests for thrombophilia and other disorders of coagulation
- Methods of investigation for suspected thromboembolic disease
- Anticoagulation, heparin and warfarin
- Role of V/Q scanning, CT angiography and thrombolysis
- Place of pulmonary embolectomy
- Awareness of symptoms and signs associated with pulmonary embolism and DVT
- Role of duplex scanning, venography and d-dimer measurement
- Initiate and monitor treatment

Diagnosis and Management of Common Paediatric Surgical Conditions:

- Child with abdominal pain
- Vomiting child
- Trauma
- Groin conditions
 - Hernia
 - Hydrocoele
 - Penile inflammatory conditions
 - Undescended testis
 - Acute scrotum
- Abdominal wall pathologies
- Urological conditions
- Constipation
- Head / neck swellings
- Intussusception
- Abscess
- In growing toenail

In terms of general experience it is expected that trainees would have gained exposure to the following procedures and to be able to perform those marked (*) under direct supervision.

- Elective Procedures
 - Inguinal hernia
- (not neo-natal)
 - Orchidopexy
 - Circumcision*
 - Lymph node biopsy*
 - Abdominal wall herniae
 - Insertion of CV lines
 - Management of in growing toenails*
 - EUA rectum*
 - Manual evacuation*
 - Open rectal biopsy
 - Excision of skin lesions*
- Emergency Procedures
 - Appendicectomy
 - Incision and drainage of abscess*
 - Pyloromyotomy
 - Operation for testicular torsion*
 - Insertion of pleural drain*
 - Insertion of suprapubic catheter*
 - Reduction of intussusception

Part III- MS Neurosurgery **Clinical Component**

1. Common Neurosurgical Disorders

Congenital and Paediatric Neurosurgery

- Neurological evaluation of the neonate and infant
- Developmental malformations of the CNS and its coverings
- Spina bifida and its variants; aetiology
- Encephalocoele
- Craniosynostosis; principles of craniofacial reconstruction
- Paediatric head injury
- Prevention and treatment of secondary insults relating to transfer and emergency surgery in head-injured children
- Subdural effusions of infancy
- Intracranial and spinal tumours in children
- Phakomatoses (neurofibromatoses; tuberous sclerosis)
- Craniovertebral anomalies
- Vascular lesions in the paediatric age-group
- Epidemiology, natural history, pathophysiology and clinical features of subarachnoid haemorrhage, haemorrhagic stroke and ischaemia stroke in children secondary to intracranial aneurysms, arteriovenous malformations and fistulae, cavernomas, arterial dissection, moya-moya disease and venous sinus thrombosis
- Surgical and endovascular strategies for the management of acute intracranial vascular disorders in children
- Ethical considerations
- Hydrocephalus and CSF disturbances
- CSF physiology
- Pathophysiology, investigation and classification of hydrocephalus and its complications
- Benign intracranial hypertension
- Medical and surgical methods of treatment of hydrocephalus and long term complications

Cerebrovascular Neurosurgery

- Pathophysiology and clinical diagnosis of cerebral ischaemia
- Extracranial carotid/vertebral disease; carotid endarterectomy; brain revascularisation
- Medical prevention of occlusive cerebrovascular disease
- Spontaneous intracranial/spinal haemorrhage especially SAH and intracerebral haemorrhage

Pathology, classification and natural history of cerebral aneurysms and AVM's

- Surgery of and perioperative management of aneurysms, AVM's, cavernomas and haematomas
- Miscellaneous cerebrovascular lesions e.g. Caroticocavernous fistulae, venous thrombosis.

- Role of interventional radiology

Trauma - Head and Spine

(For neurointensive care and rehabilitation - see relevant sections)

- Mechanisms and patterns of traumatic brain and spinal cord damage
- Pathophysiology of CNS trauma
 - Cerebral perfusion and oxygenation
 - Raised intracranial pressure
 - Impaired intracranial compliance
- Intracranial herniation
- Epidemiology and prevention of head and spinal injury
- Pathophysiology of spinal cord injury
- Classification of cervical spinal fracture dislocations
- Biomechanics of spinal instability
- Indications for halo traction and external stabilization
- Indications for and principles of open reduction and stabilization
- Transport, retrieval and pre-hospital care
- Initial resuscitation and triage
- Clinical Assessment
- Natural history of recovery from head injury including neurological, cognitive and behavioural disability and post- traumatic epilepsy
- Management including operation for 'surgical' complications (eg. acute and chronic haematoma, open injury, CSF fistula, traumatic vascular injuries, spinal instability, late hydrocephalus).
- 'Medical' management of persisting unconsciousness
- Assessment of outcome, factors affecting prognosis and late sequelae
- Perioperative and neuro-intensive care
- Respiratory functions and ventilation
- Management of disorders of fluid balance; nutrition and feeding
- Blood coagulation and transfusion
- DVT and pulmonary embolism
- Fever in neurosurgical patients
- Confusion, restlessness and agitation in neurosurgery
- Informed consent and medicolegal aspects
- Postoperative seizures
- Diagnosis of brainstem death
- Monitoring techniques in Neurointensive care and Theatre
- Principles of prophylactic drug treatment
- Other post-operative complications
- The neurogenic bladder

Infections

- The pathophysiology of intracranial and spinal sepsis
- Infective complications of neurosurgical procedures – treatment and prophylaxis
- Intracranial and spinal abscess/ empyema-clinical features, investigation and management
- The aetiology and pathophysiology of spinal sepsis
- Indications for drainage of spinal epidural abscess by laminectomy and multiple laminotomies
- Bacterial, viral, fungal and parasitic infections of the CNS and spine
- Opportunistic infections, HIV and AIDS

- The aetiology and pathophysiology of vertebral osteomyelitis and discitis, including pyogenic, tuberculous and atypical infections
- Indications for percutaneous and open biopsy
- Principles of anti-microbial chemotherapy
- Indications for operative intervention
- Principles of peri-operative care
- Surgical complications and their management

Neuro-oncology

- Presenting features and investigations of tumours involving the central nervous and peripheral nervous system
- Classification, natural history and pathology of benign and malignant intracranial neoplasia
- Pathophysiology of raised intracranial pressure associated with space occupying tumours
- Diagnostic imaging of intracranial tumours including the interpretation of CT and MRI scans and the role of MRS
- Principles and techniques of tumour biopsy
- Stereotaxy, robotics/ endoscopic techniques in CNS tumour management
- Operative management of intracranial and spinal tumours.
- Principles of fractionated radiotherapy, stereotactic radiotherapy and radiosurgery
- Role of adjuvant chemotherapy
- Principles of clinical trials and their application to neuro-oncology
- Specific management of tumours of the brain, skull base and orbit including glioma, meningioma, pituitary and parasellar tumours, cerebellar pontine angle tumours, metastases, tumours of the ventricular system and pineal region, lymphoma, medulloblastoma, epidermoid, dermoid, haemangioblastoma and chordoma
- Specific management of primary and secondary tumours involving the spinal column, intramedullary, intra and extra dural tumours of the spinal canal and tumours of the nerve roots and peripheral nerves
- Prognosis of CNS and peripheral nerve tumours
- Principles of palliative care

Spinal disorders (for congenital, trauma, tumour and vascular disorders, see relevant sections)

- Differential diagnosis of spinal cord compression and root dysfunction – investigation and management
- Biomechanics of the spine and principles of spinal stabilization/fusion; approaches to the spine
- Conservative management of spinal disorders
- Degenerative and inflammatory spinal disease - e.g. rheumatoid arthritis, cervical spondylotic myelopathy/radiculopathy, thoracic discs, lumbar disc disease, spinal stenosis and spondylolisthesis
- Syringomyelia; arachnoiditis
- Management of spasticity

Pain

- Pathophysiology of pain; differential diagnosis
- General and psychological factors in pain management
- Analgesics and pain relief
- Craniofacial pain syndromes
- Trigeminal and glossopharyngeal neuralgia - history, drug treatment, percutaneous and posterior fossa approaches
- Nerve blocks, electrical stimulation and RF lesions for pain relief; implants; cordotomy
- DREZ lesions; Dorsal rhizotomy

Peripheral nerves

- The diagnosis and treatment of common peripheral nerve problems
- including entrapment neuropathies, thoracic outlet and brachial plexus, causalgia and sympathetic dystrophy
- Theory and practice of nerve repair and cranial nerve reconstruction

Functional and Stereotactic Neurosurgery

- Principles and techniques of stereotactic and computer-assisted image-guided surgery
- Stereotactic radiosurgery
- Movement disorders and their surgical treatment
- Investigation, medical and surgical management of epilepsy and other functional disorders
- Classification, causes and presentations of dysphasias, speech dyspraxia and dyslexia
- Classification, causes and presentations of dysarthria
- Role of speech and language therapists in assessment and treatment
- Neurological causes of dysphagia
- Indications for laryngoscopy, videofluoroscopy, nasogastric and percutaneous gastric feeding
- Aetiology, differential diagnosis, investigation and initial management of patients presenting with sphincteric disorders
- Interpretation of urodynamic studies
- Aetiology, differential diagnosis, investigation and initial management of patients presenting with movement disorders
 - Parkinson's disease
 - Iatrogenic movement disorders
 - Dystonic syndromes
 - Choreiform syndromes
- Disorders of memory and cognition associated with head injury, subarachnoid haemorrhage, hydrocephalus, structural lesions of the frontal and temporal lobes and disorders of the limbic system

Neuro-ophthalmology / Neuro-otology

- Visual acuity and visual fields; fundal examination
- Patterns of visual loss in relation to common bulbar, retrobulbar, sellar, parasellar and optic pathway disorders
- Analysis of diplopia and nystagmus in relation to common cranial nerve and brainstem disorders
- Significance of abnormalities of the pupils, fundi, external ocular movements and the visual fields

- Significance of abnormalities of hearing and of the vestibular system
- Common causes of conductive and sensorineural hearing loss
- Principles of audiological assessment

Rehabilitation of the Neurosurgical Patient

- Distinction between, and relevance of, concepts of limitation, disability and handicap
- Methods of assessment
- Patterns of natural history of recovery after Neurosurgical treatment, outcome and confounding factors
- Use of components of rehabilitation provided by specific medical and paramedical disciplines and interdisciplinary approaches, including community and family reintegration

Evidence based Neurosurgery; Audit and Trial design

- To understand the provisional nature of knowledge
- To be able to acknowledge and identify failure of current treatments
- To cope with uncertainty and biological variability
- To be able to critically assess the neurosurgical literature
- To be aware of the relevant rational and quantitative methods to resolve uncertainty

Relevant topics

- Principles of audit and randomized controlled trials
- Outcome assessment
- Design and appraisal of clinical studies - evaluation of published reports
- Clinical trials: design, randomization, patient numbers, end points and power; statistical analysis, confidence intervals and clinical significance.
- Drug studies : phases 1 - 4
- Informed consent
- Issues of organization and delivery of neurosurgical care

2. Common Neurosurgical Presentations

- Impaired consciousness and non-traumatic coma due to:
 - Meningitis
 - Encephalitis
 - Intracranial haemorrhage
 - Acutely raised ICP
 - Hydrocephalus
 - Hypoxaemia and ischaemia
 - Cardiogenic shock
 - Hypoglycaemia
 - Epilepsy
 - Metabolic encephalopathies
 - Drugs and toxins
- Traumatic coma
- Weakness and paralysis
 - Ocular, cranial nerve, limb, trunk and respiratory muscle weakness

- Headache - acute and chronic- associated with
 - Benign headache syndromes
 - Migraine, cluster headache and related syndromes
 - Space occupying lesions
 - Meningitic disorders
 - Intracranial haemorrhage
 - Trigeminal neuralgia
 - Atypical craniofacial pain syndrome
- Dizziness, unsteadiness and falls
 - Cerebellar, vestibular, extrapyramidal and autonomic dysfunction
- Pain and sensory loss
 - Musculoskeletal, neurogenic and neuropathic pain and sensory loss
- Movement disorder associated with;
 - Parkinson's disease
 - Iatrogenic movement disorders
 - Dystonic syndromes
 - Choreiform syndromes
- Hearing disorder
 - Conductive and sensorineural hearing loss
- Visual disorder
 - Common bulbar, retrobulbar, sellar, parasellar and optic pathway disorders
 - Nystagmus and diplopia
- Language and speech disturbance presentations;
 - Dysphasias
 - Speech dyspraxia
 - Dyslexia
 - Dysarthria
- Swallowing disorders with neurological causes of dysphagia
- Disorders of the Sphincteric and sexual function
 - Neurological enuresis
 - Constipation
 - Diarrhea
 - Urgency of micturition/dribbling
- Memory and cognitive disorders associated with;
 - Head injury
 - Subarachnoid haemorrhage
 - Hydrocephalus
 - Structural lesions of the frontal and temporal lobes
 - Disorders of the limbic system
- Acute and chronic presentations of organic and psychiatric behavioural disorders relating to;
 - Alcohol and drug abuse
 - Encephalitis
 - Organic dementia
 - Psychosis
- Ill child with hydrocephalus, impaired consciousness and sepsis

3. Common Neurosurgical Skills and Procedures

- On completion of the initial training in Part I, the trainees will be competent in all aspects of the basic, operative and non operative care of surgical patients
- During Part II training, they will understand the importance of neurosurgical care and management with particular reference to common neurosurgical presentations recognizing and preventing secondary insults to the central nervous system. They will be capable of resuscitating, assessing and initiating the surgical management of patients deteriorating as a result of intracranial and systemic complications. They will demonstrate sound judgment when seeking more senior support, prioritizing medical interventions and escalating the level of medical care.

Neuro-Traumatology:

General Management of the Head Injured Patient:

- Medical management of acutely raised intracranial pressure
- Indications for operation intervention including the use of pressure monitoring
- Principles, diagnosis and confirmation of brain death
- Principles of intensive care of head injured patients
- Principles of spinal stabilization and radiological assessment in head injury patients
- Role of neurological rehabilitation
- Clinical assessment of the multiply-injured patient.
- Neurological assessment of the head-injured patient including:
 - Assessment and categorization of impaired consciousness
 - Recognition and interpretation of focal neurological deficits
- Prioritization of clinical risk
- Interpretation of CT scans and plain radiology
- Accurate documentation
- Indications for ICP monitoring
- Insertion of ICP monitor
- Insertion of frontal subdural and intraparenchymal ICP monitors using a standard frontal burr hole and/or twist drill craniostomy
- Calibration, zeroing and interpretation of ICP traces
- Potential complications of the procedure
- Burr hole evacuation of chronic subdural haematoma
- Management of anti-platelet and anti-coagulant medication
- Neurological assessment of patients with a CSDH
- Interpretation of CT scans
- Post-operative assessment and management
- Performance of single and multiple frontal and parietal burr hole
- Craniotomy for supratentorial traumatic haematoma, in particular:
 - Planning and siting of craniotomies for evacuation of extradural and subdural haematomas
 - Handling the "tight" brain
 - Achieving haemostasis in the coagulopathic patient

- Achieving haemostasis from the skull base and venous sinuses
- Elevation of compound depressed skull fracture with dural repair
- Delayed cranioplasty of skull vault
- Management of soft tissue trauma
- Indications for primary and secondary closure of wounds
- Indications for antibiotic prophylaxis
- Assessment of tissue perfusion and viability
- Wound exploration under local and general anaesthesia
- Wound debridement
- Arrest of scalp haemorrhage
- Layered closure of the scalp without tension
- Suturing technique
- Wound drainage and head bandaging
- Use of external mobilization including cervical collars and spinal boards
- Application of halo traction
- Application of a halo-body jacket
- The role of posttraumatic neurological rehabilitation

General Management of Hydrocephalus:

- The assessment and operative management of adult patients with communicating and non communicating hydrocephalus
- The assessment of children with hydrocephalus; emergency external ventricular drainage in children with acute hydrocephalus
- The insertion and revision of ventriculo-peritoneal, ventriculo-atrial and lumbo-peritoneal shunts; endoscopic third ventriculostomy
- Image-guided placement of ventricular catheters
- Management of neonatal post-haemorrhagic hydrocephalus

General Management of Subarachnoid Haemorrhage:

- Principles of resuscitation and timing of interventions.
- Indications for CT scanning, diagnostic lumbar puncture, CT angiography and digital subtraction angiography.
- Principles of management of post-haemorrhagic hydrocephalus
- Indications for endovascular and surgical intervention
- Interpretation of CT scans including assessment of intracranial blood load, haematomas and hydrocephalus
- Basic interpretation of cerebral angiography
- Diagnostic & therapeutic lumbar puncture
- To undertake an atraumatic lumbar puncture
- Interpretation of basic microscopy and biochemistry
- Principles of spectrophotometry
- Management of delayed secondary ischaemia
- Principles governing the augmentation of cerebral blood flow
- Assessment of a deteriorating patient
- Recognition and management of secondary insults
- Interpretation of CT scans
- Management of hypervolaemic hypertension
- Insertion of central venous catheter
- Insertion of lumbar drain

- Insertion of external ventricular drain
- Management of post-haemorrhagic hydrocephalus
- Indications for external ventricular drainage and lumbar subarachnoid drainage
- Assessment of the unconscious and deteriorating SAH patient
- Interpretation of CT scans
- The management of hydrocephalus complicating intracranial haemorrhage, head injury and intracranial space occupying lesions;
- Insertion and taping of CSF reservoirs; insertion and maintenance of lumbar and ventricular drains
- External ventricular drainage, ventriculoperitoneal shunting, lumbar CSF drainage and shunting, ventriculo-cisternostomy
- Insertion of ventricular drain/access device

Neuro-Oncology:

All trainees will be competent to manage patients with high grade intrinsic tumours, metastases and convexity meningiomas. Trainees with a special interest in neuro-oncology will participate fully in the multidisciplinary management of neuro-oncology patients and will be familiar with current developments in molecular neuro-oncology, emerging surgical techniques and the ethical, regulatory and practical considerations governing clinical trials in neuro-oncology

Assessment and Peri-Operative Management of Patients with Space-Occupying Intracranial Lesions:

- Craniotomy for superficial, lobar supratentorial intrinsic tumour. In particular:
 - Safe patient positioning
 - Planning and siting of craniotomy with and without image-guidance
 - Intra-operative management of raised ICP
 - Appropriate exposure of the tumour, using operating microscope as necessary
 - Safe use of fixed retractors
 - Precise use of suction, electro-coagulation and ultrasonic aspiration
 - Intracranial haemostasis
- Advanced surgical techniques including awake craniotomy; stereotactic craniotomy, intraoperative neurophysiological monitoring
- Advanced image guidance with integration of functional data; Intraoperative imaging techniques
- Use of intraoperative chemotherapy wafers
- Third ventriculostomy
- The management of low grade intrinsic tumours using advanced techniques
- The surgical approaches to tumours of the ventricular system and pineal gland including the transfrontal transventricular excision of intraventricular tumours and cysts
- Transcallosal transventricular excision of lesions of the third ventricle and foramen of Munro
- Indications for biopsy of intracranial tumours
- Risks of biopsy

- Principles of image-guided surgery
- Principles of radiosurgery and stereotactic radiotherapy and the indications for their use as adjunctive and/or primary treatment modalities.
- Indications for neuroimaging
- Image-guided frameless and/or frame-based stereotactic biopsy including Setting up a computer workstation and importing and interrogating image data
 - Positioning the patient and applying a cranial fixator
 - Obtaining and confirming accurate patient registration
 - Positioning and performing a suitable burr hole
 - Passage of biopsy probe and biopsy
 - Preparation of smear histology (when available)
- Management of raised intracranial pressure
- Principles of operative management
- Detection and management of post-operative complications e.g. cerebral swelling, intracranial haematomas and intracranial sepsis; the management of post-operative seizures
- Basic interpretation of CT and MRI scans
- Interpretation of CT and MRI scans and selection of biopsy targets

Assessment and Peri-Operative Management of Patients with Space-Occupying Intraspinal Lesions:

- Assessment and perioperative management of patients presenting with acute spinal disorders e.g. cauda equina and spinal root compression
- General and basic surgical management of patients with malignant spinal cord compression
- The surgical management of degenerative spinal disorders e.g. lumbar compressive radiculopathies by lumbar microdiscectomy and associated microsurgical decompressions
- The surgical management of compressive cervical myeloradiculopathies
- Including the multi-disciplinary management of patients with intracranial neoplasia
- Extradural spinal biopsy and decompression by laminectomy in selected patients without segmental instability
- Instrumented posterior spinal stabilization
- The management of spinal shock
- The ward management of patients with spinal instability
- The detection and initial management of postoperative complications including compressing haematomas, CSF fistula and spinal sepsis
- The operative management of supra-tentorial intrinsic tumours
- The operative management of convexity meningiomas e.g. use of duraplasty and cranioplasty

CNS Sepsis:

- General management of CNS infections e.g. ventriculitis, cerebral abscess, subdural empyema and spinal epidural abscess
- The operative management of cerebral abscess by burr hole aspiration

Paediatric Neurosurgery:

All trainees will undertake at least a six month placement in a paediatric neurosurgery service under the direct supervision of paediatric neurosurgeons with a full-time or major commitment to paediatric surgery. The service must provide a comprehensive range of paediatric neurosurgical care. On completion of general paediatric training trainees will be competent to assess and undertake the emergency neurosurgical management of the critically-ill child with raised intracranial pressure. On completion of a special interest fellowship in paediatric neurosurgery trainees will be competent in all aspects of the non-operative neurosurgical management of children presenting with disorders of the nervous system. They will have detailed knowledge of the statutory framework governing the care of children, paediatric neurointensive care, the principles of paediatric neuro-rehabilitation and of the management of non-accidental injury. They will be competent to undertake all aspects of the emergency neurosurgical operative care of children and to undertake a range of elective procedures in the following fields with appropriate supervision:

Paediatric Neuro-oncology:

- Stereotactic and image guided biopsy of paediatric tumours
- Endoscopic biopsy of third ventricular tumours
- Resection of supratentorial and infratentorial intrinsic tumours
- Approaches to suprasellar, third ventricular and pineal tumours
- Management of spinal cord tumours

Paediatric Head Injury:

- Decompressive craniectomy
- Cranioplasty
- Management of growing fractures
- Craniofacial reconstruction including the management of simple craniosynostosis, syndromic craniosynostosis, post-traumatic deformity
- Management of CSF fistulae

Paediatric Hydrocephalus:

- Assessment of the ill child with hydrocephalus, impaired consciousness and sepsis
- Differential diagnosis of shunt malfunction
- Interpretation of CT scans in shunted children
- Taping and draining from an Ommaya reservoir
- Taping a shunt
- External ventricular drainage

Spinal Dysraphism:

- Management of neonatal spina bifida, meningoceles and encephaloceles
- Spinal cord tethering syndromes
- Management of congenital and acquired spinal deformity e.g. syndromic spinal deformity and post-operative spinal deformity

Functional Neurosurgery:

Trainees with a special interest in functional neurosurgery will develop additional expertise as follows:

Surgical Management of Pain:

- Implantation of spinal cord stimulators
- Insertion of intrathecal drug delivery systems
- Ablative surgical treatment for pain including DREZ lesioning, cordotomy and myelotomy
- Neuromodulatory techniques including peripheral nerve, motor cortex and deep brain stimulation.
- Neurovascular compression syndromes: including microvascular decompression of the trigeminal nerve; microvascular decompression of the facial nerve; percutaneous trigeminal rhizotomy

Surgical Management of Spasticity:

- Medical and surgical treatments for spasticity
- Implantation of intrathecal drug delivery systems
- Other surgical treatments for spasticity including phenol blocks, neurectomies and rhizotomy.

Surgical Management of Epilepsy:

- Multidisciplinary assessment and preparation of patients for epilepsy surgery
- Stereotactic placement of depth electrodes and placement of subdural
- Electrode grids
- Temporal lobectomy
- Selective amygdalohippocampectomy
- Callosotomy
- Insertion of vagal nerve stimulators
- Hemispherectomy
- Multiple subpial transections

Surgical Management of Movement Disorders:

- Multidisciplinary assessment and management of patients with movement disorders e.g. Parkinson's disease and dystonia
- Selection, targeting and placement of deep brain stimulation electrodes
- Management of neuro-stimulators; radiofrequency lesioning

Neurovascular Surgery:

Special interest training will take place in units with extensive experience in the multi-disciplinary management of all common intracranial vascular disorders. Trainees with a special interest in neurovascular surgery will develop additional expertise in:

Intracranial Aneurysms:

- Surgical and endovascular strategies for the management of ruptured and un-ruptured intracranial aneurysms
- Surgical treatment of ruptured aneurysms of the anterior circulation

- Principles of microvascular reconstruction and bypass for complex aneurysms

Intracranial Vascular Malformations:

- Surgical, endovascular and radiosurgical strategies for the management of arteriovenous malformations
- Surgical treatment of superficial cortical arteriovenous malformations

Other Vascular Disorders:

- Surgical and endovascular treatment of dural arteriovenous fistulae
- Image-guided resection of cavernomas
- Management of primary intracerebral haematomas
- The management of venous occlusive disorders
- Medical, surgical and endovascular management of extracranial arterial occlusive disease

Skull-Base Surgery

Special interest training in skull base surgery will take place in units with extensive multi-disciplinary experience in the management of all common skull-base disorders. Trainees with a special interest in skull base surgery will develop additional expertise as follows:

Skull-Base and Craniofacial Surgical Access:

- Standard variations of fronto-basal, fronto-orbital, transzygomatic infratemporal, transtemporal, far-lateral, transphenoidal and transmaxillary approaches

Cranial Base Meningiomas:

- Resection of anterior fossa (olfactory groove and suprasellar) meningiomas; tentorial and petrous temporal meningiomas; petroclival meningiomas

Pituitary and Sellar Tumours:

- Microsurgical and endoscopic transphenoidal resection of pituitary tumours
- Pterional, subfrontal, interhemispheric and transventricular approaches to suprasellar tumours

Acoustic Neuromas:

- Retrosigmoid, translabyrinthine and middle fossa resection of acoustic neuromas

Other skull-base tumours:

- Management of other cranial nerve schwannomas, glomus tumours and malignant primary and secondary tumours of the skull-base

Management of cranio-facial trauma:

- Management of fronto-orbital disruption

Repair of CSF Fistulae:

- Management of postoperative CSF fistulae
- Indications for endoscopic repair of basal CSF fistula
- Techniques for open repair and skull-base reconstruction

Spinal Surgery:

On completion of a special interest fellowship in spinal surgery trainees will be competent in all aspects of the emergency and urgent operative

care of patients with spinal disorders. They will develop additional expertise as follows:

Spinal trauma:

- Reduction and internal stabilization of atlanto-axial, sub-axial and thoraco-lumbar fractures and dislocations

Metastatic Disease of the Spine:

- Posterior decompression and stabilization using pedicle screw, hook and sub-laminar wire constructs
- Corpectomy and instrumented reconstruction of the anterior column
- Primary tumours of the spine
- Techniques for local ablation of benign lesions and en bloc resections of malignant tumours
- Transpedicular and open vertebral and disc biopsy in vertebral osteomyelitis and discitis

Intradural Tumours:

- The radical resection of intradural, extra-medullary tumours; biopsy and optimal resection of intramedullary tumours

Syringomyelia and Hind Brain Anomalies:

- Foramen magnum decompression, syringostomy, syringopleural shunting, detethering and duroplasty

Advanced Surgery of the Ageing and Degenerative Spine:

- Management of osteoporotic collapse, vertebroplasty, kyphoplasty
- Stabilization of the osteoporotic spine
- Operative management degenerative spondylolisthesis and scoliosis
- The assessment, counseling and pre-operative preparation of patients with lumbar radiculopathies
- Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms
- Primary lumbar microdiscectomy
- Primary posterior decompression (laminotomy, hemilaminectomy etc): including
 - Identification of spinal level by pre and intra-operative fluoroscopy
 - Achieving safe access to the spinal canal by micro-surgical fenestration
 - Achieving full decompression of the spinal canal, lateral recess and foramen by appropriate bone and soft tissue resection
 - Protection and safe retraction of neural tissues
- The assessment, counseling and pre-operative preparation of patients with cervical myeloradiculopathies
- Interpretation of plain radiographs, CT scan, MRI scans and CT myelograms
- Single level anterior cervical discectomy with and without fusion
- Standard anterolateral approach to the cervical spine
- Use of fluoroscopy or plain radiographs to confirm spinal level
- Radical and subtotal excision of the cervical disc, PLL, central and unco-vertebral osteophytes
- Protection and full decompression of the spinal cord and spinal nerve roots
- Interbody fusion using autologous bone with or without interbody cages

The Rheumatoid and Ankylosed Spine:

- Management of atlanto-axial subluxation
- Cranial settling and odontoid migration
- Sub-axial degeneration; cervico-dorsal kyphosis

Spinal Deformity:

- Multidisciplinary management of patients with spinal dysraphism, diastematomyelia etc

**Part-III Thesis Component
(Fifth year of MS Neurosurgery Programme)**

RESEARCH/ THESIS WRITING

Total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis be submitted before the end of training. Research can be done as one block in 5th year of training or it can be stretched over five years of training in the form of regular periodic rotations during the course as long as total research time is equivalent to one calendar year.

Research Experience

The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining the essential clinical experience. Recent productivity by the program faculty and by the residents will be required, including publications in peer-reviewed journals. Residents must learn the design and interpretation of research studies, responsible use of informed consent, and research methodology and interpretation of data. The program must provide instruction in the critical assessment of new therapies and of the surgical literature. Residents should be advised and supervised by qualified staff members in the conduct of research.

Clinical Research

Each resident will participate in at least one clinical research study to become familiar with:

1. Research design
2. Research involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentation
3. Data collection and data analysis
4. Research ethics and honesty
5. Peer review process

This usually is done during the consultation and outpatient clinic rotations.

Case Studies or Literature Reviews

Each resident will write, and submit for publication in a peer-reviewed journal, a case study or literature review on a topic of his/her choice.

Laboratory Research

Bench Research

Participation in laboratory research is at the option of the resident and may be arranged through any faculty member of the Division. When appropriate, the research may be done at other institutions.

Research involving animals

Each resident participating in research involving animals is required to:

1. Become familiar with the pertinent Rules and Regulations of the University of Health Sciences Lahore i.e. those relating to "Health and Medical Surveillance Program for Laboratory Animal Care Personnel" and "Care and Use of Vertebrate Animals as Subjects in Research and Teaching"
2. Read the "Guide for the Care and Use of Laboratory Animals"
3. View the videotape of the symposium on Humane Animal Care

Research involving Radioactivity

Each resident participating in research involving radioactive materials is required to

1. Attend a Radiation Review session
2. Work with an Authorized User and receive appropriate instruction from him/her.

METHODS OF INSTRUCTION/COURSE CONDUCTION

As a policy, active participation of students at all levels will be encouraged.

Following teaching modalities will be employed:

1. Lectures
2. Seminar Presentation and Journal Club Presentations
3. Group Discussions
4. Grand Rounds
5. Clinico-pathological Conferences
6. SEQ as assignments on the content areas
7. Skill teaching in ICU, Operation theatres, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Self study, assignments and use of internet
10. Bedside teaching rounds in ward
11. OPD & Follow up clinics
12. Long and short case presentations

In addition to the conventional teaching methodologies interactive strategies like conferences will also be introduced to improve both communication and clinical skills in the upcoming consultants. Conferences must be conducted regularly as scheduled and attended by all available faculty and residents. Residents must actively request autopsies and participate in formal review of gross and microscopic pathological material from patients who have been under their care. It is essential that residents participate in planning and in conducting conferences.

1. Clinical Case Conference

Each resident will be responsible for at least one clinical case conference each month. The cases discussed may be those seen on either the consultation or clinic service or during rotations in specialty areas. The resident, with the advice of the Attending Surgeon on the Consultation Service, will prepare and present the case(s) and review the relevant literature.

2. Monthly Student Meetings

Each affiliated medical college approved to conduct training for MS Neurosurgery will provide a room for student meetings/discussions such as:

- a. Journal Club Meeting
- b. Core Curriculum Meetings
- c. Skill Development

a. Journal Club Meeting

A resident will be assigned to present, in depth, a research article or topic of his/her choice of actual or potential broad interest and/or application. Two hours per month should be allocated to discussion of any current articles or topics introduced by any participant. Faculty or outside researchers will be invited to present outlines or results of current research activities. The article should be critically evaluated and its applicable results should be highlighted, which can be incorporated in clinical practice. Record of all such articles should be maintained in the relevant department.

b. Core Curriculum Meetings

All the core topics of Neurosurgery should be thoroughly discussed during these sessions. The duration of each session should be at least two hours once a month. It should be chaired by the chief resident (elected by the residents of the relevant discipline). Each resident should be given an opportunity to brainstorm all topics included in the course and to generate new ideas regarding the improvement of the course structure

c. Skill Development

Two hours twice a month should be assigned for learning and practicing clinical skills.

List of skills to be learnt during these sessions is as follows:

1. Residents must develop a comprehensive understanding of the indications, contraindications, limitations, complications, techniques, and interpretation of results of those technical procedures integral to the discipline
2. Residents must acquire knowledge of and skill in educating patients about the technique, rationale and ramifications of procedures and in obtaining procedure-specific informed consent. Faculty supervision of residents in their performance is required, and each resident's experience in such procedures must be documented by the program director.
3. Residents must have instruction in the evaluation of medical literature, clinical epidemiology, clinical study design, relative and absolute risks of disease, medical statistics and medical decision-making.
4. Training must include cultural, social, family, behavioral and economic issues, such as confidentiality of information, indications for life support systems, and allocation of limited resources.
5. Residents must be taught the social and economic impact of their decisions on patients, the primary care physician and society. This can be achieved by attending the bioethics lectures
6. Residents should have instruction and experience with patient counseling skills and community education.

7. This training should emphasize effective communication techniques for diverse populations, as well as organizational resources useful for patient and community education.
8. Residents should have experience in the performance of neurosurgery related clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards
9. Each resident will manage at least the following essential neurosurgical cases and observe and participate in each of the following procedures, preferably done on patients under supervision initially and then independently;

Essential Neurosurgical Conditions:

- Cranial trauma
- Spontaneous intracranial haemorrhage
- Hydrocephalus
- Intracranial tumours
- CNS infections
- Spinal trauma
- Benign intradural tumours
- Malignant spinal cord compression
- Degenerative spinal disorders
- Emergency paediatric care

Essential Operative Competencies:

Initial Surgical Approaches

- Burr hole
- Craniotomy - convexity
- Craniotomy - pterional
- Craniotomy - midline supratentorial
- Craniotomy - midline posterior fossa
- Lateral posterior fossa
- Lumbar fenestration
- Laminectomy

General Procedures

- Insertion of lumbar drain
- Tapping/draining of CSF reservoir
- Application of skull traction
- Image Guidance/Stereotaxy set up

Management of Cranial Trauma

- Insertion of Intracranial (ICP) monitor
- Burr hole evacuation of CSDH
- Elevation of depressed skull fracture
- Craniotomy for traumatic haematoma (ICH)

Management of Spontaneous Intracranial Haemorrhage

- Craniotomy for spontaneous intracerebral
- Haematoma (ICH supratentorial)
- Craniotomy for spontaneous intracerebellar
- Haematoma (ICH infratentorial)

Management of Hydrocephalus

- Insertion of ventricular drain/access device
- Insertion of VP shunt
- Revision of VP shunt

Management of Intracranial Tumours

- Supratentorial tumour biopsy
- Craniotomy for supratentorial intrinsic tumour & metastasis
- Craniotomy for posterior fossa intrinsic tumour & metastasis
- Craniotomy for convexity meningioma

Management of Intradural Spinal Tumours

- Excision of intradural extramedullary tumour
- Management of degenerative spinal disorders
- Lumbar microdiscectomy
- Anterior cervical discectomy

Emergency Paediatric Care

- Insertion of EVD
- Evacuation of intracranial haematoma (ICH)

3. Annual Grand Meeting

Once a year all residents enrolled for MS Neurosurgery should be invited to the annual meeting at UHS Lahore.

One full day will be allocated to this event. All the chief residents from affiliated institutes will present their annual reports. Issues and concerns related to their relevant courses will be discussed. Feedback should be collected and suggestions should be sought in order to involve residents in decision making.

The research work done by residents and their literary work may be displayed.

In the evening an informal gathering and dinner can be arranged. This will help in creating a sense of belonging and ownership among students and the faculty.

LOG BOOK

The residents must maintain a log book and get it signed regularly by the supervisor. A complete and duly certified log book should be part of the requirement to sit for MS examination. Log book should include adequate number of diagnostic and therapeutic procedures observed and performed, the indications for the procedure, any complications and the interpretation of the results, routine and emergency management of patients, case presentations in CPCs, journal club meetings and literature review.

Proposed Format of Log Book is as follows:

Candidate's Name: _____

Roll No. _____

The above mentioned procedures shall be entered in the log book as per format:

Procedures Performed

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure Performed	Supervisor's Signature
1					
2					
3					
4					

Emergencies Handled

Sr. #	Date	Name of Patient, Age, Sex & Admission No.	Diagnosis	Procedure/ Management	Supervisor's Signature
1					
2					
3					
4					

Case Presented

Sr.#	Date	Name of Patient, Age, Sex & Admission No.	Case Presented	Supervisor's Signature
1				
2				
3				
4				

Seminar/Journal Club Presentation

Sr.#	Date	Topic	Supervisor's signature
1			
2			
3			
4			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

At the end of the rotation, each faculty member will provide an evaluation of the clinical performance of the fellow.

Sr.#	Date	Method of Evaluation (Oral, Practical, Theory)	Rating	Supervisor's Signature
1				
2				
3				
4				

EVALUATION & ASSESSMENT STRATEGIES

Assessment

It will consist of action and professional growth oriented ***student-centered integrated assessment*** with an additional component of ***informal internal assessment, formative assessment*** and measurement-based ***summative assessment***.

Student-Centered Integrated Assessment

It views students as decision-makers in need of information about their own performance. Integrated Assessment is meant to give students responsibility for deciding what to evaluate, as well as how to evaluate it, encourages students to '**own**' the evaluation and to use it as a basis for self-improvement. Therefore, it tends to be growth-oriented, student-controlled, collaborative, dynamic, contextualized, informal, flexible and action-oriented.

In the proposed curriculum, it will be based on:

- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

Self Assessment by the Student

Each student will be provided with a pre-designed self-assessment form to evaluate his/her level of comfort and competency in dealing with different relevant clinical situations. It will be the responsibility of the student to correctly identify his/her areas of weakness and to take appropriate measures to address those weaknesses.

Peer Assessment

The students will also be expected to evaluate their peers after the monthly small group meeting. These should be followed by a constructive feedback according to the prescribed guidelines and should be non-judgmental in nature. This will enable students to become good mentors in future.

Informal Internal Assessment by the Faculty

There will be no formal allocation of marks for the component of Internal Assessment so that students are willing to confront their weaknesses rather than hiding them from their instructors.

It will include:

- a. Punctuality
- b. Ward work
- c. Monthly assessment (written tests to indicate particular areas of weaknesses)
- d. Participation in interactive sessions

Formative Assessment

Will help to improve the existing instructional methods and the curriculum in use

Feedback to the faculty by the students:

After every three months students will be providing a written feedback regarding their course components and teaching methods. This will help to identify strengths and weaknesses of the relevant course, faculty members and to ascertain areas for further improvement.

Summative Assessment

It will be carried out at the end of the programme to empirically evaluate cognitive, psychomotor and affective domains in order to award diplomas for successful completion of courses.

MS Neurosurgery Examinations

Part I MS Neurosurgery

Total Marks: 200

All candidates admitted in MS Neurosurgery course shall appear in Part I examination at the end of first calendar year.

Components of Part-I Examination:

Paper-I, 100 MCQs (single best, having one mark each)	100 Marks
Paper-II, 10 SEQs (having 10 marks each)	100 Marks

Topics included in papers:

	Paper-I	Paper-II
1. Anatomy	(20 MCQs)	(2 SEQs)
2. Physiology	(20 MCQs)	(2 SEQs)
3. Pathology	(20 MCQs)	(2 SEQs)
4. Biochemistry	(15 MCQs)	(1 SEQs)
5. Pharmacology	(15 MCQs)	(1 SEQ)
6. Behavioural Sciences	(05 MCQs)	(1 SEQ)
7. Biostatistics & Research Methodology	(05 MCQs)	(1 SEQ)

Part II - MS Neurosurgery

Total Marks: 430

All candidates admitted in MS Neurosurgery course shall appear in Part II examination at the end of second calendar year.

There shall be two written papers of 100 marks each, Oral & practical/clinical examination of 150 marks and log book assessment of 80 marks.

Topics included in papers 1 & 2:

Basic Principles of Surgery

Components of Part II Examination

Theory:

Paper 1:	<u>100 Marks</u>	3 Hours
10 SEQs (No Choice; 05 marks each)	50 Marks	
50 MCQs	50 Marks	
Paper 2:	<u>100 Marks</u>	3 Hours
10 SEQs (No Choice; 05 marks each)	50 Marks	

50 MCQs

Only those candidates who pass in theory papers, will be eligible to appear in the Oral & Practical/Clinical Examination.

Oral & Practical/ Clinical Examination shall be held in clinical techniques relevant to General Surgery.

OSCE

50 Marks

10 stations each carrying 05 marks of 10 minutes duration; each evaluating performance based assessment with five of them interactive

Clinical

100 Marks

Four short cases (each 15 marks)

60 Marks

One long case:

40 Marks

Log Book

80 Marks

Part III MS Neurosurgery**Total Marks: 920**

All candidates admitted in MS Neurosurgery course shall appear in Part-III examination at the end of structured training programme (end of 5th calendar year and after clearing Part I & II examinations).

There shall be two written papers of 150 marks each, Oral & Practical/ Clinical examination of 300 marks, log book assessment of 120 marks and thesis examination of 200 marks.

Part III MS Neurosurgery**Clinical Examination****Total Marks: 720****Topics included in paper 1**

- | | |
|---------------------------------|-----------|
| 1. Neurotraumatology | (20 MCQs) |
| 2. Cerebrovascular Neurosurgery | (20 MCQs) |
| 3. Paediatric Neurosurgery | (20 MCQs) |
| 4. Infections of Nervous System | (15 MCQs) |

Topics included in paper 2

- | | |
|---|-----------|
| 1. Neuro-oncology | (20 MCQs) |
| 2. Functional and Stereotactic Neurosurgery | (15 MCQs) |
| 3. Neuro-ophthalmology / Neuro-otology | (15 MCQs) |
| 4. Skull-Base Surgery | (15 MCQs) |
| 5. Spinal Surgery | (10 MCQs) |

Components of Part III Clinical Examination**Theory**

Paper I	<u>150 Marks</u>	3 Hours
15 SEQs (No Choice)	75 Marks	
75 MCQs	75 Marks	
Paper II	<u>150 Marks</u>	3 Hours
15 SEQs (No Choice)	75 Marks	
75 MCQs	75 Marks	

Only those candidates, who pass in theory papers, will be eligible to appear in the Oral & Practical/ Clinical Examination.

OSCE

100 Marks

10 stations each carrying 10 marks of 10 minutes duration; each evaluating performance based assessment with five of them interactive

Clinical

200 Marks

Four short cases (each 25 marks)

100 Marks

One long case:

100 Marks

Log Book

120 Marks

Part III MS Neurosurgery

Thesis Examination

Total Marks: 200

All candidates admitted in MS Neurosurgery courses shall appear in Part-III (thesis examination) at the end of 5th year of the MS programme and not later than 8th calendar year of enrolment. The examination shall include thesis evaluation with defense.