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# **CURRICULUM/STATUTES & REGULATIONS**

## **FOR 5 YEARS DEGREE PROGRAMME IN NEUROLOGY (MD NEUROLOGY)**

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**UNIVERSITY OF HEALTH SCIENCES,  
LAHORE**

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## STATUTES

### **1. Nomenclature Of The Proposed Course**

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

### **2. Course Title:**

MD Neurology

### **3. Training Centers**

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

### **4. Duration of Course**

The duration of MD Neurology 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 1<sup>st</sup> calendar year. The candidate shall undertake didactic training in Basic Medical Sciences, Behavioural Sciences and Biostatistics & Research Methodology. At the end of first year the examination shall be held in Basic Medical Sciences. The clinical training in fundamental concepts of Internal Medicine shall start from the 1<sup>st</sup> day of enrollment.

**Part II** is structured for the 1<sup>st</sup> and 2<sup>nd</sup> calendar years. The candidate shall undertake clinical training in fundamental concepts of Internal Medicine. At the end of 2<sup>nd</sup> year, the examination shall be held in fundamental concepts of Internal Medicine. The clinical training in Neurology shall start from 3<sup>rd</sup> year onwards in the in recognized institutions.

**Part III** is structured for 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> calendar years in MD Neurology. The candidate shall undergo training to achieve educational objectives of MD

Neurology (knowledge & skills) along with rotation in relevant fields. The research component and thesis writing shall also be included in this part. 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 5<sup>th</sup> 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**

1. For admission in MD Neurology course, the candidate shall be required to have:
  - MBBS degree
  - Completed one year House Job
  - One year experience in Neurology/Internal Medicine/Allied medical 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.
  
2. Exemptions: A candidate holding FCPS/MRCP/Diplomate American Board/equivalent qualification in Internal Medicine 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 MD 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 MD courses.
- Candidates selected for the courses after their enrollment at the relevant institutions shall be registered with UHS as per prescribed Registration Regulations.

## **7. Accreditation Related Issues of the Institution**

### **1. Faculty**

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

### **2. Adequate Space**

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

### **3. Library**

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

- Accreditation of Neurology 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 MD programme in Neurology is to train residents to acquire the competency of a specialist in the field of Neurology so that they can become good teachers, researchers and clinicians in their specialty after completion of their training.

### **GENERAL OBJECTIVES**

MD Neurology training should enable a student to:

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
- Safely and effectively performs appropriate clinical skills & procedures:
  - Consistently demonstrate sound clinical 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
- 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 medical treatment
- 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.
- 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
- 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 patients

- Recognize the value of knowledge and research and its application to clinical practice:
  - Assume responsibility for self-directed learning
  - Critically appraise new trends in Neurology
  - Facilitate the learning of others
- Appreciate ethical issues associated with Neurology:
  - 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.
- Professionalism by:
  - Employing a critically reflective approach to Neurology
  - 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
- 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
- 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
- Health advocacy:
  - Promote health maintenance of patients
  - Advocate for appropriate health resource allocation

## SPECIFIC LEARNING OUTCOMES

Residents completing MD Neurology training will have formal instruction, clinical experience, and will be able to demonstrate competence in the evaluation and management of adult and paediatric patients and applying scientific principles for the identification, prevention, treatment and rehabilitation of following acute and chronic neurological disorders:

1. To provide a foundation of organized instruction in the basic neurosciences.
2. To provide an opportunity to develop and maintain an investigative career in the basic neurosciences and clinical neurology.
3. Demonstrate proficiency in the following areas:

**A.** The Neurologic Examination (as an integral component of the general medical examination).

1. How to perform a focused but thorough neurologic examination.
2. How to perform a neurologic examination on patients with an altered level of consciousness.
3. How to recognize and interpret abnormal findings on the neurologic examination.

**B.**Localization - general principles differentiating lesions at the following levels:

1. Cerebral hemisphere.
2. Posterior fossa.
3. Spinal cord.
4. Nerve root/Plexus.
5. Peripheral nerve (mononeuropathy, polyneuropathy, and mononeuropathy multiplex).
6. Neuromuscular junction.
7. Muscle.

**C.**Symptom Complexes - a systematic approach to the evaluation and differential diagnosis of patients who present with:

1. Focal weakness.
2. Diffuse weakness.
3. Clumsiness.
4. Involuntary movements.
5. Gait disturbance.
6. Urinary or fecal incontinence.

7. Dizziness.
8. Vision loss.
9. Diplopia.
10. Dysarthria.
11. Dysphagia.
12. Acute mental status changes.
13. Dementia.
14. Aphasia.
15. Headache.
16. Focal pain
  - a. Facial pain.
  - b. Neck pain.
  - c. Low back pain.
  - d. Neuropathic pain
17. Numbness or paresthesias.
18. Transient or episodic focal symptoms.
19. Transient or episodic alteration of consciousness.
20. Sleep disorders.
21. Developmental disorders.

**D. Approach to Specific Diseases - general principles for recognizing, evaluating and managing the following neurologic conditions (either because they are important prototypes, or because they are potentially life-threatening):**

**1. Potential emergencies:**

- a. Increased intracranial pressure.
- b. Toxic-metabolic encephalopathy.
- c. Subarachnoid hemorrhage.
- d. Meningitis/Encephalitis.
- e. Status epilepticus.
- f. Acute stroke (ischemic or hemorrhagic).
- g. Spinal cord or cauda equina compression.
- h. Head Trauma.

- i. Acute respiratory distress due to neuromuscular disease (e.g. myasthenic crisis or acute inflammatory demyelinating polyradiculoneuropathy).
- j. Temporal arteritis.

## **2. Movement disorders**

- a. Tremor
- b. Parkinson's disease
- c. Epilepsy/seizure
- d. Partial onset
- e. Generalized onset
- f. Status epilepticus

## **3. Disorders of vision**

- a. Patterns of visual loss
- b. Afferent pupillary defect and Horner's syndrome
- c. Motor neuron disease/ALS

## **4. Peripheral nerve**

- a. Guillain-Barre syndrome, Carpal tunnel syndrome, Bell's palsy, Length dependent neuropathy
- b. Myasthenia gravis
- c. Myopathy - Polymyositis, Muscular dystrophy

## **5. Dizziness**

- a. Vertigo
- b. Presyncope
- c. Dysequilibrium

## **6. Cerebrovascular disease**

Stroke - Embolic, Lacunar, Transient ischemic attack, Hemorrhagic

## **7. Multiple sclerosis**

- a. Relapsing-remitting
- b. Primary progressive

## **8. Head trauma**

- a. Concussion and post-concussive syndrome
- b. Subdural and epidural hematoma

## **9. Altered consciousness**

- a. Delirium

- b. Coma
- c. Brain death

### **10. Dementia**

Alzheimer's

### **11. Aphasia**

- a. Fluent (Wernicke's)
- b. Non-fluent (Broca's)

### **12. Headaches**

- a. Migraine
- b. Tension
- c. Cluster
- d. Subarachnoid hemorrhage
- e. Giant cell arteritis

### **13. Brain tumors**

- a. Primary
- b. Metastatic

### **14. Spinal disorders**

- a. Radiculopathy
- b. Cervical stenosis
- c. Lumbar stenosis
- d. Epidural abscess
- e. Cauda equina syndrome
- f. B12 subacute combined degeneration

### **15. Infections**

- a. Encephalitis
- b. Meningitis
- c. HIV related lesions

### **16. Alcohol related disorders**

- a. Delerium tremens
- b. Wernicke's encephalopathy
- c. Korsakoff's dementia

### **17. Sleep Medicine**

- a. Sleep apnea
- b. Restless leg syndrome

c. Narcolepsy

**18. Child neurology**

- a. Childhood specific epilepsy
- b. Enlarging head circumference
- c. Cerebral palsy

**19. Psychiatry**

- a. Depression
- b. Bipolar disorder
- c. Conversion disorder

- E.** Become more familiar with the purpose, utility, interpretation and procedural techniques of:
- a. Electro-encephalograms (EEG)
  - b. Nerve Conduction Studies and Electromyography (NCS/EMG)
  - c. Evoked Potential Studies (EP)
  - d. Lumbar Punctures
  - e. Botulinum Toxin injections
  - f. Neuro-imaging modalities (CT, MRI, Cerebral Angiograms, SPECT scans)
  - g. Inner ear repositioning techniques

Curriculum/Statutes & Regulations -MD Neurology  
**REGULATIONS**

**1. Scheme of the Course**

A summary of five years course in MD Neurology is presented as under:

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

## **2. Examinations**

### **Part-I Examination**

1. All candidates admitted in MD Neurology courses shall appear in Part-I examination at the end of 1<sup>st</sup> 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 Neurology (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 MD Neurology course shall appear in Part-II examination at the end of 2nd calendar year, and having passed part I examination.
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:  
Paper 1 & 2: Principles of Internal Medicine
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 Internal Medicine.
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 MD Neurology 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 / MRCP / Diplomate American Board/equivalent qualification in Internal Medicine 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	100

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 MD Neurology 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 3<sup>rd</sup> year of MD 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 MD course shall appear in Part-III thesis examination at the end of 5<sup>th</sup> 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 Internal Medicine and related fields 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 MD Neurology Degree***

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

## CONTENT OUTLINE

### Part I MD Neurology

#### **Basic Sciences:**

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

### **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
- Divisions of the nervous system
- Cerebral cortex
- Thalamus
- Basal ganglia
- Brainstem
- Cerebellum
- Spinal cord
- Mixed spinal nerve
- Motor units
- 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 maldevelopment
- 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 autoregulation and vasospasm
- Blood brain barrier and cerebral odema
- 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 (Alzheimers 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**

- Introduction to Bio-Statistics
- Introduction to Bio- Medical Research
- Why research is important?
- 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
- Ethics in Health Research
- Writing a Scientific Paper
- Making a Scientific Presentation
- Searching the Literature

## **7. Behavioural Sciences**

- Bio-Psycho-Social (BPS) Model of Health Care
- Use of Non-medicinal Interventions in Clinical Practice
  - Communication Skills
  - Counselling
  - 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 MD Neurology**

Internal Medicine training for first two years starting from first day of enrollment. Resident should get exposure in the following organ and system competencies (listed below) while considering and practicing each system in terms of: -

- Medical ethics
- Professional values, student teachers relationship
- Orientation of in-patient, out-patients and neurology labs
- Approach to the patient
- History taking
- General physical examination
- Systemic examination
- Routine investigations
- Special investigations
- Diagnostic and therapeutic procedures

**Course Contents:****1. Cardiovascular Medicine**

*Common and / or important Cardiac Problems:*

- Arrhythmias
- Ischaemic Heart Disease: acute coronary syndromes, stable angina, atherosclerosis
- Heart Failure
- Hypertension – including investigation and management of accelerated hypertension
- Valvular Heart Disease
- Endocarditis
- Aortic dissection
- Syncope
- Dyslipidaemia

*Clinical Science:*

- Physiological principles of cardiac cycle and cardiac conduction
- Pharmacology of major drug classes: beta blockers, alpha blockers, ACE inhibitors, Angiotensin receptor blockers (ARBs), anti-platelet agents, thrombolysis, inotropes, calcium channel antagonists, potassium channel activators, diuretics, anti-arrhythmics, anticoagulants, lipid modifying drugs, nitrates, centrally acting anti-hypertensives

**2. Dermatology;**

*Common and / or Important Problems:*

- Cellulitis
- Cutaneous drug reactions
- Psoriasis and eczema
- Skin failure: eg erythroderma, toxic epidermal necrolysis
- Urticaria and angio-oedema

- Cutaneous vasculitis
- Herpes zoster and Herpes Simplex infections
- Skin tumours
- Skin infestations
- Dermatomyositis
- Scleroderma
- Lymphoedema

*Clinical Science:*

- Pharmacology of major drug classes: topical steroids, immunosuppressants

### **3. Diabetes & Endocrine Medicine**

*Common and / or Important Diabetes Problems:*

- Diabetic ketoacidosis
- Non-acidotic hyperosmolar coma / severe hyperglycaemia
- Hypoglycaemia
- Care of the acutely ill diabetic
- Peri-operative diabetes care

*Common or Important Endocrine Problems:*

- Hyper/Hypocalcaemia
- Adrenocortical insufficiency
- Hyper/Hyponatraemia
- Thyroid dysfunction
- Dyslipidaemia
- Endocrine emergencies: myxoedemic coma, thyrotoxic crisis, Addisonian crisis, hypopituitary coma, pheochromocytoma crisis

*Clinical Science:*

- Outline the function, receptors, action, secondary messengers and feedback of hormones
- Pharmacology of major drug classes: insulin, oral anti-diabetics, thyroxine, anti-thyroid drugs, corticosteroids, sex hormones, drugs affecting bone metabolism

### **4. Gastroenterology and Hepatology**

*Common or Important Problems:*

- Peptic Ulceration and Gastritis
- Gastroenteritis
- GI malignancy (oesophagus, gastric, hepatic, pancreatic, colonic)
- Inflammatory bowel disease
- Iron Deficiency anaemia
- Acute GI bleeding
- Acute abdominal pathologies: pancreatitis, cholecystitis, appendicitis, leaking abdominal aortic aneurysm
- Functional disease: irritable bowel syndrome, non-ulcer dyspepsia
- Coeliac disease
- Alcoholic liver disease
- Alcohol withdrawal syndrome
- Acute liver dysfunction: jaundice, ascites, encephalopathy
- Liver cirrhosis
- Gastro-oesophageal reflux disease

- Nutrition: indications, contraindications and ethical dilemmas of nasogastric feeding and EG tubes, IV nutrition, re-feeding syndrome
- Gall stones
- Viral hepatitis
- Auto-immune liver disease
- Pancreatic cancer

*Clinical Science:*

- Laboratory markers of liver, pancreas and gut dysfunction
- Pharmacology of major drug classes: acid suppressants, anti-spasmodics, laxatives, anti-diarrhoea drugs, aminosalicylates, corticosteroids, immunosuppressants, infliximab, pancreatic enzyme supplements

## **5. Renal Medicine**

*Common and / or Important Problems:*

- Acute renal failure
- Chronic renal failure
- Glomerulonephritis
- Nephrotic syndrome
- Urinary tract infections
- Urinary Calculus
- Renal replacement therapy
- Disturbances of potassium, acid/base, and fluid balance (and appropriate acute interventions)

*Clinical Science:*

- Measurement of renal function
- Metabolic perturbations of acute, chronic, and end-stage renal failure and associated treatments

## **6. Respiratory Medicine**

*Common and / or Important Respiratory Problems:*

- COPD
- Asthma
- Pneumonia
- Pleural disease: Pneumothorax, pleural effusion, mesothelioma
- Lung Cancer
- Respiratory failure and methods of respiratory support
- Pulmonary embolism and DVT
- Tuberculosis
- Interstitial lung disease
- Bronchiectasis
- Respiratory failure and cor-pulmonale
- Pulmonary hypertension

*Clinical Science:*

- Principles of lung function measurement
- Pharmacology of major drug classes: bronchodilators, inhaled corticosteroids, leukotriene receptor antagonists, immunosuppressants



## **7. Allergy**

### *Common or Important Allergy Problems*

- Anaphylaxis
- Recognition of common allergies; introducing occupation associated allergies
- Food, drug, latex, insect venom allergies
- Urticaria and angioedema

### *Clinical Science*

- Mechanisms of allergic sensitization: primary and secondary prophylaxis
- Natural history of allergic diseases
- Mechanisms of action of anti-allergic drugs and immunotherapy
- Principles and limitations of allergen avoidance

## **8. Haematology**

### *Common and / or Important Problems:*

- Bone marrow failure: causes and complications
- Bleeding disorders: DIC, haemophilia
- Thrombocytopaenia
- Anticoagulation treatment: indications, monitoring, management of over-treatment
- Transfusion reactions
- Anaemia: iron deficient, megaloblastic, haemolysis, sickle cell,
- Thrombophilia: classification; indications and implications of screening
- Haemolytic disease
- Myelodysplastic syndromes
- Leukaemia
- Lymphoma
- Myeloma
- Myeloproliferative disease
- Inherited disorders of haemoglobin (sickle cell disease, thalassaemias)
- Amyloid

### *Clinical Science:*

- Structure and function of blood, reticuloendothelial system, erythropoietic tissues

## **9. Immunology**

### *Common or Important Problems:*

- Anaphylaxis (see also 'Allergy')

### *Clinical Science:*

- Innate and adaptive immune responses
- Principles of Hypersensitivity and transplantation

## **10. Infectious Diseases**

### *Common and / or Important Problems:*

- Fever of Unknown origin
- Complications of sepsis: shock, DIC, ARDS
- Common community acquired infection: LRTI, UTI, skin and soft tissue infections, viral exanthema, gastroenteritis
- CNS infection: meningitis, encephalitis, brain abscess
- HIV and AIDS including ethical considerations of testing

- Infections in immuno-compromised host
- Tuberculosis
- Anti-microbial drug monitoring
- Endocarditis
- Common genito-urinary conditions: non-gonococcal urethritis, gonorrhoea, syphilis

*Clinical Science:*

- Principles of vaccination
- Pharmacology of major drug classes: penicillins, cephalosporins, tetracyclines, aminoglycosides, macrolides, sulphonamides, quinolones, metronidazole, anti-tuberculous drugs, anti-fungals, anti-malarials, anti-helminthics, anti-virals

## **11. Medicine in the Elderly**

*Common or Important Problems:*

- Deterioration in mobility
- Acute confusion
- Stroke and transient ischaemic attack
- Falls
- Age related pharmacology
- Hypothermia
- Continence problems
- Dementia
- Movement disorders including Parkinson's disease
- Depression in the elderly
- Osteoporosis
- Malnutrition
- Osteoarthritis

*Clinical Science:*

- Effects of ageing on the major organ systems
- Normal laboratory values in older people

## **12. Musculoskeletal System**

*Common or Important Problems:*

- Septic arthritis
- Rheumatoid arthritis
- Osteoarthritis
- Seronegative arthritides
- Crystal arthropathy
- Osteoporosis – risk factors, and primary and secondary prevention of complications of osteoporosis
- Polymyalgia and temporal arteritis
- Acute connective tissue disease: systemic lupus erythematosus, scleroderma, poly- and dermatomyositis, Sjogren's syndrome, vasculitides

*Clinical Science:*

- Pharmacology of major drug classes: NSAIDs, corticosteroids, immunosuppressants, colchicines, allopurinol, bisphosphonates

### **13. Psychiatry**

*Common and /or Important Problems:*

- Suicide and parasuicide
- Acute psychosis
- Substance dependence
- Depression

*Clinical Science:*

- Principles of substance addiction, and tolerance
- Pharmacology of major drug classes: anti-psychotics, lithium, tricyclic antidepressants, mono-amine oxidase inhibitors, SSRIs, venlafaxine, donepezil, drugs used in treatment of addiction (bupropion, disulpham, acamprosate, methadone)

### **14. Cancer and Palliative Care**

*Common or Important Oncology Problems:*

- Hypercalcaemia
- SVC obstruction
- Spinal cord compression
- Neutropenic sepsis
- Common cancers (presentation, diagnosis, staging, treatment principles): lung, bowel, breast, prostate, stomach, oesophagus, bladder)

*Common or Important Palliative Care Problems:*

- Pain: appropriate use, analgesic ladder, side effects, role of radiotherapy
- Constipation
- Breathlessness
- Nausea and vomiting
- Anxiety and depressed mood

*Clinical Science:*

- Principles of oncogenesis and metastatic spread
- Apoptosis
- Principles of staging
- Principles of screening
- Pharmacology of major drug classes in palliative care: anti-emetics, opioids, NSAIDS, agents for neuropathic pain, bisphosphonates, laxatives, anxiolytics

### **15. Clinical Genetics**

*Common and / or Important problems:*

- Down's syndrome
- Turner's syndrome
- Huntington's disease
- Haemochromatosis
- Marfan's syndrome
- Klinefelter's syndrome
- Familial cancer syndromes
- Familial cardiovascular disorders

*Clinical Science:*

- Structure and function of human cells, chromosomes, DNA, RNA and cellular proteins
- Principles of inheritance: Mendelian, sex-linked, mitochondrial

- Principles of pharmacogenetics
- Principles of mutation, polymorphism, trinucleotide repeat disorders
- Principles of genetic testing including metabolite assays, clinical examination and analysis of nucleic acid (e.g. PCR)

## **16. Clinical Pharmacology**

*Common and / or Important problems:*

- Corticosteroid treatment: short and long-term complications, bone protection, safe withdrawal of corticosteroids, patient counselling regarding avoid adrenal crises
- Specific treatment of poisoning with:
  - Aspirin,
  - Paracetamol
  - Tricyclic anti-depressants
  - Beta-blockers
  - Carbon monoxide
  - Opiates
    - Digoxin
    - Benzodiazepines

*Clinical Science:*

- Drug actions at receptor and intracellular level
- Principles of absorption, distribution, metabolism and excretion of drugs
- Effects of genetics on drug metabolism
- Pharmacological principles of drug interaction
- Outline the effects on drug metabolism of: pregnancy, age, renal and liver impairment

## **Investigation Competencies**

*Outline the Indications for, and Interpret the Following Investigations:*

- Basic blood biochemistry: urea and electrolytes, liver function tests, bone biochemistry, glucose, magnesium
- Cardiac biomarkers and cardiac-specific troponin
- Creatine kinase
- Thyroid function tests
- Inflammatory markers: CRP / ESR
- Arterial Blood Gas analysis
- Cortisol and short Synacthen test
- HbA1C
- Lipid profile
- Amylase
- Full blood count
- Coagulation studies
- Haemolysis studies
- D dimer
- Blood film report
- Blood / Sputum / urine culture
- Fluid analysis: pleural, cerebro-spinal fluid, ascitic
- Urinalysis and urine microscopy
- Auto-antibodies

- Chest radiograph
- Abdominal radiograph
- Joint radiographs (knee, hip, hands, shoulder, elbow, dorsal spine, ankle)
- ECG
- Peak flow tests
- Full lung function tests

*More Advanced Competencies;*

- Ultrasound
- Detailed imaging: CT Neuroangiography, high resolution CT, MRI
- Echocardiogram
- 24 hour ECG monitoring
- Ambulatory blood pressure monitoring
- Neurophysiological studies: EMG, nerve conduction studies, visual and auditory evoked potentials

**Procedural Competencies**

- The trainee is expected to be competent in performing the following procedures by the end of core training. The trainee must be able to outline the indications for these interventions. For invasive procedures, the trainee must recognize the indications for the procedure, the importance of valid consent, aseptic technique, safe use of local anaesthetics and minimization of patient discomfort.
- Venepuncture
- Cannula insertion, including large bore
- Arterial blood gas sampling
- Lumbar Puncture
- Pleural tap and aspiration
- Central venous cannulation
- Initial airway protection: chin lift, Guedel airway, nasal airway, laryngeal mask
- Basic and, subsequently, advanced cardiorespiratory resuscitation
- Cytology: pleural fluid, ascitic fluid, cerebro-spinal fluid, sputum
- Urethral catheterization
- Nasogastric tube placement and checking

## Part-III- Specialty training in Neurology

### Specific Program Content

1. Specialized training in Neurology
2. Compulsory rotations
3. Research & thesis writing
4. Maintaining of Log-book

### 1. Specialized Training in Neurology

#### Head Injury

- Ability to evaluate and manage people with acute head injury
- Perform immediate resuscitative measures; formulate a strategy for immediate and short term management: primary and secondary effects of head injury: symptoms and signs of head injury and its complications: indications for investigations: indications for medical interventions, ITU referral, urgent and delayed neurosurgery
- Ability to evaluate and manage post traumatic change in consciousness, behaviour and cognition, and other posttraumatic symptoms (including epilepsy)

#### Headache

- Ability to evaluate and manage people with headache & facial pains.
- Clinical features, differential diagnosis and specific pharmacological and general treatment of the causes of headache and facial pain:
- Investigations: role of brain scanning, urgent blood tests, lumbar puncture
- Disorders of consciousness
- Ability to assess the unresponsive patient and to formulate plan of investigation and management.
- Anatomy and physiology of consciousness, and the pathophysiology of disorders of consciousness: definitions, causes, pathophysiology, clinical features and prognosis of persistent vegetative state, locked in state and brainstem death: legal issues relating to disorders of consciousness: assessment of patient with disordered consciousness: use of tests for brainstem death: interpersonal skills for relating to management of the family of people with disorders of consciousness

#### Disorders of Sleep

- Ability to evaluate and manage people with sleep disorders
- Narcolepsy, daytime hypersomnolence, parasomnias, obstructive sleep apnoea, effects of neurological conditions on sleep: indications, scope and limitations of the sleep laboratory: effects of sleep on the EEG: principles of physical and pharmacological treatment: driving regulations: consequences and complications of sleep disorders
- Disorders of higher function & behaviour
- Ability to evaluate and manage people with disordered higher function & behaviour.

- Understanding of memory, language, visuospatial function & behaviour: definition and epidemiology of dementia; pathology and clinical features of individual dementias; relevant investigations; specific treatments; genetic aspects; risks and costs of investigations; role of neuropsychological evaluation (inc dementia and mood scales): evaluation of competency: community and support services

### **Epilepsy**

- Ability to evaluate and manage people with epilepsy.
- Differential diagnosis of paroxysmal and transient events: scope and limitations of investigations: use of anti-epileptic drugs: treatment of refractory seizures: serial seizures and status epilepticus: role of epilepsy surgery: awareness of issues related to women and pregnancy, driving, vocation: sudden death: psychological and social consequences of epilepsy especially teenagers

### **Cerebrovascular Disease**

- Ability to evaluate and manage people with stroke.
- Cerebral circulation and its determinants: pathophysiology of cerebral infarction, cerebral haemorrhage, subarachnoid haemorrhage, cerebral venous thrombosis & vascular dementia: epidemiology, risk factors and their management: features of stroke /TIA, intracranial haemorrhage and venous thrombosis: investigation and management of acute stroke and TIA, the role of medical and surgical interventions: role of evaluation scales: cerebral aneurysm and AVM; interventional, surgical and radiotherapy treatment: multidisciplinary stroke care, organization of stroke units, nutrition after stroke, rehabilitation techniques, community stroke care
- Tumours of the NS, neurological complications of systemic cancer, complications of treatment of cancer
- Ability to evaluate and manage people with tumours of the NS or effects of systemic tumours or their treatment.
- Neuropathological classification of brain tumours: clinical features of the common tumours of the nervous system including malignant meningitis: clinical features and immunology of paraneoplastic syndromes: benefits and risks of therapies including surgery and radiotherapy: neurological complications of chemotherapy and radiotherapy

### **Infections of NS**

- Ability to evaluate and manage people with infections of NS
- Principles of neurological infectious disease: clinical features of these diseases and their causes: diagnostic techniques and their appropriate use: anti-microbial therapies and their use: the importance of liaison with infectious disease physicians, microbiologists, public health and occupational health medicine in relation to neurological infections

### **CSF Disorders**

- Able to evaluate and manage people with disorders of CSF
- CSF composition and dynamics; anatomy and radiology of the ventricular system; genesis of hydrocephalus; biochemistry and immunology of CSF; blood brain barrier; indications, techniques, & contraindications of

CSF examination: methods of intracranial pressure monitoring: treatments of raised intracranial pressure, management of shunts

- Demyelination and vasculitis
- Ability to evaluate & manage people with demyelinating & vasculitic disorders
- Biology of demyelination & vasculitis: clinical features of multiple sclerosis, related demyelinating disorders and vasculitic and arteritic disorders: management of specific impairments and disabilities arising in MS: role of disease modifying drugs, symptomatic treatments and therapies

### **Immunological Disorder and NS**

- Ability to evaluate & manage people with immunological disorder caused by disease or treatment.
- Principles of immune responses in relation to the NS: immunological basis underlying auto-immune neurological disease: clinical features of these diseases: diagnostic techniques and their appropriate use: immuno-suppressive and immunomodulatory therapies: their actions, side effects and indications

### **Parkinsonism & Movement Disorders**

- Ability to evaluate & manage people with Parkinsonism & movement disorders
- Clinical features and differential diagnosis of parkinsonism, chorea/athetosis, dystonia, tics and tremor: role of investigations in diagnosis and treatment: treatment of movement disorders: role of neurosurgical interventions
- Motor neuron disease
- Ability to evaluate & manage people with motor neuron disease
- Clinical features and differential diagnosis of motor neuron syndromes: disease modifying and symptomatic treatments: special issues of breaking bad news and prognosis: palliative care aspects

### **Metabolic & Toxic States**

- Ability to evaluate and manage people with metabolic/toxic state
- Biochemistry and neuropathology of exposure to alcohol and other recreational drugs (cocaine, amphetamine, opiates), heavy metals, pesticides and therapeutic agents: clinical features of alcohol, cocaine, opiate, amphetamine neurotoxicity; of Pb, Hg, Mn, CO, NO and organophosphate poisoning; of therapeutic agents neurotoxicity (e.g. vincristine, lithium, radiation):
- Role & value of blood and urine toxicology, imaging and neurophysiology: assessment of other organ damage: psychiatric morbidity associated with substance abuse: clinical features and management of hyper and hypo-thermia, sodium, potassium, calcium and acid base disorders
- Disorders of the visual system
- Ability to evaluate and manage people with disorders of the visual system



- Applied anatomy and physiology of the visual and oculomotor systems: clinical evaluation of the eye and adnexae, vision (acuity, fields and high function): clinical features & conditions which may affect these systems: driving regulations

### **Disorders of Cranial Nerves**

- Ability to evaluate and manage people with disorders of cranial nerve function, anatomy of the skull base, particularly the orbit, cavernous sinus, pituitary fossa, foramen magnum and jugular foramen: pathological processes involving cranial nerves and their central connections: clinical features & clinical assessment of cranial nerve function: management of cranial nerve disorders including multidisciplinary approaches to visual, hearing & balance, speech & swallowing disorders

### **Disorders of Spine, Spinal Cord, Roots and Spinal Injury**

- Ability to evaluate and manage people with disorders of the spine, spinal cord and roots and the acute & chronic consequences of acute spinal cord injury including effects of paralysis, autonomic dysfunction and sensory loss
- Anatomy of the spine, spinal cord, roots: clinical features of spinal cord, root and cauda equina syndromes: indications for urgent investigation: potential and limitations of spinal CT, MRI, myelography and spinal angiography: emergency management of spinal cord or root compression, of spinal injury management of neck & low back pain and sciatica

### **Disorders of Peripheral Nerve**

- Ability to evaluate and manage people with disorders of peripheral nerves (including plexus lesions)
- Anatomy and pathology of peripheral nerves: clinical features & investigation of genetic and acquired axonal and demyelinating neuropathies, traumatic & entrapment neuropathies and plexopathies: management of Guillain-Barré syndrome and other severe paralysing neuropathies: general management of acute neuromuscular paralysis]
- Disorders of autonomic system
- Ability to evaluate and manage people with disorders of the autonomic nervous system (ANS)
- Anatomy and physiology of ANS. clinical features of ANS disorders alone and as part of other condition e.g. multisystem atrophy: investigations including autonomic function tests: pharmacological and physical managements of urinary retention, erectile disorder, constipation, postural hypotension, autonomic dysreflexia

### **Disorders of Muscle**

- Ability to evaluate and manage people with disorders of muscle
- Clinical features and investigation of genetic & acquired disorders of the neuromuscular junction and voluntary muscle including periodic disorders and disorders of energy metabolism (e.g. mitochondrial

disorders): management including cardiorespiratory & anaesthetic considerations

### **Pain**

- Ability to evaluate and manage people with neurological disorders causing pain and common non neurological causes of pain including musculoskeletal
- Theories of pain generation: pain patterns in neurological and systemic diseases: effective use of pharmacological agents and other measures for pain relief including nerve blocks, TNS, acupuncture, & neurosurgical interventions: role of Pain Clinic: psychological and social effects of chronic pain

### **Paediatric Neurology:**

#### Epilepsy

- List the common causes of seizures in the infant, child and adolescent
- Describe the management of status epilepticus
- Describe the evaluation and management of new onset and recurrent seizures, including febrile seizures
- Recognize epilepsy syndromes and their prognoses
- Distinguish seizures from nonseizure events, e.g. syncope, jitteriness, Breath-holding spells

#### Altered Level of Consciousness

- Describe the major disease categories that cause lethargy and coma
- Diagnose brain death in children and the persistent vegetative state

#### Headache

- Describe the features of headache in migraine, increased intracranial pressure, and tension
- Describe the evaluation and therapeutic approach

#### Psychomotor Retardation and Behavioral Problems

- Describe the approach to the child with learning disability, delayed speech, mental retardation, impaired attention, and behavioral problems

#### Neonatal Neurology

- Discuss the evaluation and treatment of common disorders in the term and preterm infant, including intracranial and intraventricular hemorrhage, neonatal encephalopathy, neonatal seizures, and periventricular leukomalacia.

#### Neurodegenerative Disorders

- Discuss the presentation, evaluation and therapeutic approach to lysosomal storage disease, peroxisomal disorders, mitochondrial disorders, amino acid disorders and other metabolic and genetic disorders

#### Motor Unit Disorders

- Describe the presentation and clinical course of disorders of the motor unit to include anterior horn cell (SMA), peripheral neuropathy (hereditary and non-hereditary, CMT), demyelinating (Guillain-Barre syndrome), neuromuscular junction and muscle disorders (Duchenne Muscular Dystrophy, Myotonic Dystrophy)

#### Upper Motor Neuron Syndromes

- List the major causes of stroke in childhood and describe evaluation and therapeutic options
- Describe causes, evaluation and therapy of cerebral palsy
- Discuss the etiology and complications of a child with spinal dysraphism, hydrocephalus
- Discuss the etiology and complications of a child with brain malformation
- Discuss the etiology and complications of a child with traumatic spine and brain injury
- Movement Disorders
- Discuss the differential diagnosis of tic (including Tourette Syndrome), chorea, ataxia, and dystonia
- Describe medications that can induce movement disorders

#### Neoplastic Disorders

- Discuss the most common tumors of the neural axis in childhood (particularly those of the posterior fossa) ; the presenting symptoms and diagnostic evaluation

#### Infectious and Inflammatory Disorders

- Discuss the most common infections of the neural axis in childhood (meningitis, encephalitis) and the evaluation and treatment
- Discuss ADEM (acute disseminated encephalomyelitis) and MS in children

#### Neurocutaneous Syndromes

- Discuss the common disorders and the clinical manifestations

#### Special Senses

- Describe disorders of the visual and hearing system, acquired and congenital

### **Clinical Neurophysiology:**

- Basic Neurophysiology: Membrane properties of nerve and muscle potentials (resting, action, synaptic, generator), ion channels, synaptic transmission, physiologic basis of EEG, EMG, evoked potentials, sleep mechanisms, autonomic disorders, epilepsy, neuromuscular diseases, and movement disorders
- Anatomic Substrates of EEG, EMG, evoked potentials, sleep and autonomic activity
- Indications : Know the indications for and the interpretation of the various CNP tests in the context of the clinical problem.

#### EEG:

- Recognize normal EEG patterns of infants, children, and adults
- Recognize abnormal EEG patterns and their clinical significance, including epileptiform patterns, coma patterns, periodic patterns, and the EEG patterns seen with various focal and diffuse neurologic and systemic disorders.
- Know the EEG criteria for recording in suspected brain death

#### EMG:

- Know the normal parameters of nerve conduction studies and needle exam of infants, children, and adults

- Know the abnormal patterns of nerve conduction studies and needle exam and the clinical correlates with various diseases that affect the neuromuscular and peripheral nervous system

Evoked Potential Studies:

- Know the principles and recording of evoked potential studies, including pattern
- Reversal visual evoked responses, brainstem auditory evoked responses and somatosensory evoked potential studies.
- Know the generators and names of waveforms and normal values of evoked potential studies.
- Know the clinical significance of normal and abnormal findings of evoked potential studies.

Sleep recordings:

- Be familiar with the basic principles of tests, including polysomnography, and multiple sleep latency tests, and evaluation of various sleep disorders.

Autonomic Function Tests:

- Be familiar with the various tests used to evaluate disorders of the autonomic nervous system, including the quantitative sweat axonal reflex test (QSART), the thermoregulatory sweat test, heart rate, and blood pressure changes.

Special Recordings:

- Be familiar with the indications for doing prolonged EEG monitoring studies, recording EEG, EMG, evoked potential studies in the ICU, intraoperative intracranial and spinal cord recording, and recording various movement disorders.

Instrumentation:

- Be familiar with basic electronics, analog/digital recording, electrodes for recording EEG, EMG, and EPs, stimulators and stimulus parameters, amplifiers, and filters.

Principles and Techniques of Recording:

- Know the techniques for localization, polarity, stimulus parameters, and montages for the various CNP Studies.

Laboratory and Electrical Safety:

- Know the principles and guidelines for electrical safety of doing recordings in the lab, ICU, and operating room.

### **Other Inter-related Subspecialties:**

#### **Neuroendocrinology**

- Understand the principles of the NS in endocrine function and neurological features of endocrine disorder and need for referral
- Clinical features and investigations in endocrine disorders: emergency management of disorders: relationships with neurological disorders: steroid therapy

#### **Neurogenetics**

- Understand the principles of genetics as applied to neurological disorder: ability to interpret a genetics report
- Basic genetic principles and common diagnostic methods: roles of a detailed family history, of DNA based diagnostic tests, of liaison with

Clinical Genetics: genetic contribution to multifactorial neurological disease (e.g. stroke, multiple sclerosis, subarachnoid haemorrhage, epilepsy): clinical features of common genetic conditions (hereditary ataxias, Huntington's disease, hereditary neuropathies, muscle diseases, and neurocutaneous syndromes): bioinformatic databases of human disease]

### **Neurointensive care**

- Ability to evaluate and manage (with others) people in ICU
- Clinical features, causes, investigation and management of coma (including epilepsy and raised intracranial pressure), failure to regain consciousness and paralysis: diagnosis of and ability to define the vegetative state: ICU neurological complications of major surgery, sepsis, drugs & medical disorders
- Management of status epilepticus: the principles of cardiovascular and respiratory support: indications for and methods of artificial nutrition: clinical, legal and ethical issues in brain death, coma and vegetative state: communication issues with patients, relatives & staff in ICU

### **Neuro-otology**

- Ability to evaluate the deaf and / or dizzy person and interpret reports
- Applied anatomy and physiology of hearing and balance: history and examination techniques: conditions affecting the vestibulocochlear system: appropriate referral pathways

### **Neuropathology**

- Ability to appropriately request pathological investigations and interpret pathology reports
- The pathological and biochemical basis of neurological disorders; anatomy of brain sections, brain preparation, histological, histochemical, immunocytochemical and E.M. techniques; biochemical, immunological & microbiological techniques; and understand and interpret reports issued: role of and consent process for necropsy examination]

### **Neuropsychiatry**

- Ability to evaluate and interpret psychiatric symptoms in and as presentations of neurological disorders, psychiatric consequences of neurological disease and neurological features in people with psychiatric disorders
- Understanding of common psychiatric disorders (including learning disability), neurological features which may have psychiatric causes (including medically unexplained symptoms): the mental health act and when it can be used: ability to evaluate and manage acute organic brain syndromes: ability to liaise effectively and appropriately with Psychiatry services

### **Neuropsychology**

- Ability to utilize basic clinical tests of cognitive function, to understand the need to refer to and the role of the Clinical Neuropsychologist and to interpret reports.
- Understanding of neuroanatomical and neurophysiological basis of memory, attention, language and perception: understand the value and limitations of Neuropsychological interventions such as Cognitive Behavioural Therapy: understand mini-mental state examination, , basic

neuropsychological tests employed by Clinical Psychologists, e.g. NART, WAIS]

### **Neuroradiology**

- Ability to request and evaluate neuroradiological investigations and reports and liaise effectively with the neuroradiologist: understand the role, risks & limitations of common techniques
- Request, interpret and utilise neuro-radiological investigations appropriately: explain the nature, risks and benefits of neuroradiological investigations (CT scan cranial / angiography; MR scan cranial/spinal/angiography; catheter angiography diagnostic/interventional; myelography; ultrasound carotid/ trans-cranial/cardiac; other special investigations e.g. PET, SPECT) to patients]

### **Neurorehabilitation**

- Ability to evaluate the requirement for rehabilitation in people with neurological disorders in the context of a multidisciplinary team and make appropriate referrals
- Understand the difference between pathology, impairment, activity & participation: understanding the potential and limitations of neuro-rehabilitation; ability to perform and utilize a functional assessment; contribute to and, if appropriate, lead an MDT meeting being aware of the different roles, skills, approach and agenda of rehabilitation teams: understand the social perspective, relevant social work legislation and availability of care in the community]

### **Neurosurgery**

- Ability to evaluate the requirement for neurosurgical interventions in people with neurological disorders and to liaise effectively with the neurosurgeon
- Understand the role of neurosurgery in the management of head injury, raised intracranial pressure, intracranial haemorrhage and ischaemic stroke, aneurysm, vascular malformation and tumours, spinal cord and root disorder and peripheral nerve lesions; understand the purpose, limitations, process and complications of biopsy procedures (brain, muscle, nerve); understanding of the principles of general and specific risks and complications of neurosurgical interventions

### **Uro-neurology**

- Ability to evaluate, manage and or refer people with disordered micturition and sexual function due to neurological disorder
- Understand normal control of micturition and sexual function: differential diagnosis of causes of disordered micturition and erectile dysfunction: understand hypo- and hyper-sexuality: understand treatment strategies for disorders of micturition and sexual function: ability to refer appropriately to Urology, Genitourinary Medicine or Uro-neurologist

## Complete Neurological Examination

1. Neurologic history taking.
2. Signs and symptoms, syndromes, topical and etiological diagnosis. The principles of correlation of neurologic signs with neuroanatomic localization of the lesion.
3. Conscious level assessment, Glasgow coma scale. Assessment of orientation.
4. Assessment of the mental status: cognitive function: assessment of aphasia, apraxia, dyslexia, dysgraphia, dyscalculia, agnosia.
5. Assessment of new learning ability, memory, concentration, reasoning and problem solving, emotional state.

### Physical examination technique

6. Cranial nerve examination, signs and symptoms of cranial nerve disorders, syndromes.
7. Examination of the head and the neck, upper limbs, trunk, lower limbs, posture, gait.
8. Examination of motor functions: inspection: posture, habitus, involuntary movements, appearance (atrophy, fasciculations), assessment of passive stretch - muscle tone (rigidity, spasticity, clonus), active and passive movements, assessment of muscle strength.
9. Examination of reflexes, tendon reflexes, cutaneous superficial reflexes, pathological reflexes.
10. Types of paresis, characteristic features in upper motor neuron lesion, lower motor neuron lesion, mixed lesion, pseudoflaccid paresis.
11. The sensory examination: assessment of sense (of all sensory modalities - pain, temperature, light touch, extinction phenomenon, vibration, position sense, discriminative sensations, stereognosis).
12. Examination of meningeal irritation, signs and symptoms.
13. Detailed cerebellar examination. Vestibular examination.
14. Examination of the vertebral column, signs and symptoms of radicular disorders.
15. Record of a complete neurological assessment.
16. Making a diagnosis, a plan of auxiliary examinations, treatment, rehabilitation.

## 2. ELECTIVE ROTATIONS

### 1. Pediatric Neurology Rotation

Neurology residents are required to spend a total of three months during their Neurology training on the Pediatric Neurology service. During the rotation, residents will be expected to participate daily in the outpatient clinic settings as well as the inpatient consult service. Upon completion of this rotation, the neurology resident will be proficient in history-taking and physical examination of the pediatric patient ranging in age from premature neonates to adolescents. Formulation of differential diagnoses, recommended work-ups, and potential treatments will be stressed through case by case teaching.

## **2. Neuroradiology Rotation**

Each neurology resident will be assigned two weeks of neuroradiology during their first year of neurology training. It is crucial for a neurology resident to master this area early in his/her training. The resident will perform preliminary interpretations of imaging studies and review the findings with the neuroradiologist. The resident will become proficient in the interpretation of the different neuroimaging tests (CT, MRI, MRA, angiography, myelography).

## **3. EMG rotation**

Each resident will be assigned to the EMG for a month during their second year of neurology training. Residents may also spend additional time in the EMG lab during their elective months. During the rotation, each resident will be provided with a series of cases with electrophysiologic data. The resident will be expected to interpret each case by the end of the rotation. These cases will be discussed in detail with the neuromuscular faculty.

## **4. EEG rotation**

Each neurology resident will rotate in the EEG lab for one month during their second year of neurology training. Additional training may be taken during elective months. During this rotation, the primary objective for each resident is to learn the basics of electroencephalography (EEG) and evoked potentials (EP). To accomplish this, residents must concentrate in several areas. First, residents should observe the process of applying electrodes to patients and then the recording phase itself of both EEG and EP studies. Secondly, residents must review and interpret individual EEGs and EPs on their own and have a preliminary report to present to the attending physician that is reviewing studies that day. The resident should be available each day for formal review of EEG and EP studies by the attending. At this time, the resident must be prepared to present their interpretation of that day's studies. Formal teaching will be done at this time. Finally, each resident is required to enhance their "hands on" experience with adequate reading of related topics. At the end of the rotation, the resident should feel relatively comfortable performing a rough interpretation of EEG and EP studies. The neurology resident on the EEG rotation will also cover the Epilepsy Monitoring Unit (EMU).

## **5. Neuropathology rotation**

During the four week neuropathology rotation, the neurology resident is required to use the provided microscope and desk space in the Department of Pathology as frequently as possible. The rotation period is divided into two segments with specific requirements and objectives. FIRST SEGMENT (Normal gross and histology and basic neuropathologic alterations). SECOND SEGMENT (More advanced study of neuropathology and familiarity with special neuropathologic and neuromuscular pathologic techniques).

## **6. Neurorehabilitation Rotation**

During the neurological rehabilitation rotation, residents will learn major principles of neurological rehabilitation, with emphasis on cognitive assessment and stroke rehabilitation. Consults from the medical rehabilitation service on patients with traumatic brain injury will be an opportunity for residents to learn



general treatment recommendations for optimal recovery in this population. Residents are expected to manage neurological rehabilitation patients relatively independently with respect to patient assessment, general medical care of patients, and medication management.

### **7. Psychiatry Rotation**

Residents will spend a month on the psychiatry consultation service. During this rotation, the neurology resident will develop skills in the assessment of psychiatric problems in a medical setting. The resident will gain an understanding of the interaction of medical and neurological conditions with psychiatric disorders.

### **8. Outpatient Clinic Rotation**

This one-month rotation is designed to increase exposure to various subspecialties of neurology. The resident will be assigned a schedule as to which clinic he/she must attend at a given time. The clinics that the resident will be exposed to are the following:

- Epilepsy Clinic
- Neuromuscular Clinic
- Neuro-ophthalmology Clinic
- Movement disorder clinic
- Multiple sclerosis clinic
- Headache clinic
- Neuropsychology
- Pain management clinic
- Sleep disorders clinic

### **9. Epilepsy Clinic**

A resident may be assigned to Epilepsy clinic during the outpatient rotation. This will take place under the supervision of one of the epilepsy faculty. Residents will be required to perform the initial evaluation of patients referred to the epilepsy clinic. This includes a complete history and neurologic/physical examination. Following this, the resident will be asked to formulate a differential diagnosis and propose a treatment plan for the patient. At the end of the rotation, residents should be familiar with different seizure and epilepsy types and their appropriate treatment.

### **10. Pain management clinic**

The resident will be exposed to a broad range of pain management problems during this rotation. They will be responsible for inpatient and outpatient consultations, developing a treatment plan, and implementation of the plan. During the rotation, the resident will work closely with the attending pain management specialist, pain medicine fellows, and nurse practitioner.

### **11. Lumbar Puncture Clinic**

Each resident will be assigned to LP clinic during the year. All patients must sign informed consent. The goal is to provide each neurology resident with ample opportunity to become proficient in performing a lumbar puncture.

### 3. RESEARCH/ THESIS WRITING

#### 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 5<sup>th</sup> 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, emergency and ward settings
8. Attend genetic clinics and rounds for at least one month.
9. Attend sessions of genetic counseling
10. Self study, assignments and use of internet
11. Bedside teaching rounds in ward
12. OPD & Follow up clinics
13. 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 Physician 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 MD Neurology 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 Neurology 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 (mentioned in pg. 42-43).
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 and becoming familiar with Project Professionalism Manual such as that of the American Board of Internal Medicine.
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 may attend the series of lectures on Nuclear Medicine procedures (radionuclide scanning and localization tests and therapy) presented to the Radiology residents.
10. Residents should have experience in the performance of clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance and proficiency standards.
11. Each resident will observe and participate in each of the following procedures, preferably done on patients firstly under supervision and then independently (pg.42-43)

### **3. Annual Grand Meeting**

Once a year all residents enrolled for MD Neurology 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 MD 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: -----

Supervisor -----

Roll No. -----

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

Residents should become proficient in performing the related procedures. After observing the technique, they will be observed while performing the procedure and, when deemed competent by the supervising physician, will perform it independently. They will be responsible for obtaining informed consent, performing the procedure, reviewing the results with the pathologist and the attending physician and informing the patient and, where appropriate, the referring physician of the results.

### **Procedures Performed**

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

### **Neurologic 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				



## **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 degrees for successful completion of courses.

## **MD NEUROLOGY EXAMINATION**

### **Part I MD Neurology**

**Total Marks: 200**

All candidates admitted in MD Neurology 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 paper:**

<b>Topics included in paper:</b>	<b>Paper-I</b>	<b>Paper-II</b>
1. Anatomy	(20 MCQs)	(2 SEQs)
2. Physiology	(20 MCQs)	(2 SEQs)
3. Pathology	(20 MCQs)	(2 SEQs)
4. Biochemistry	(15 MCQs)	(1 SEQ)
5. Pharmacology	(10 MCQs)	(1 SEQ)
6. Behavioural Sciences	(10 MCQs)	(1 SEQ)
7. Biostatistics & Research Methodology	(05 MCQs)	(1 SEQ)

### **Part II MD Neurology**

**Total Marks: 430**

All candidates admitted in MD Neurology course shall appear in Part II examination at the end of 2<sup>nd</sup> 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 paper 1**

Principles of internal medicine including;

1. Pulmonary Medicine	(10 MCQs)
2. Allergy and Immunology	(10 MCQs)
3. Cardiovascular Illness	(10 MCQs)
4. Endocrinology and Metabolism	(10 MCQs)
5. Ophthalmology & Otolaryngology	(05 MCQs)
6. Infectious Disease	(05 MCQs)

#### **Topics included in paper 2**

Principles of internal medicine including;

1. Nephrology	(10 MCQs)
2. Psychiatry	(10 MCQs)
3. Gastroenterology & Hepatology	(10 MCQs)
4. Hematology & Oncology	(10 MCQs)
5. Dermatology	(05 MCQs)
6. Rheumatology	(05 MCQs)

## Components of Part II Examination

### Theory:

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

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

The candidates, who pass in theory papers, will be eligible to appear in the structured viva voce.

Oral & practical/clinical examination shall be held in basic clinical techniques relevant to internal medicine.

### **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 (15 marks each)	60 Marks
One long case:	40 Marks

### **Log Book** **80 Marks**

**Part III MD Neurology****Total Marks: 920**

All candidates admitted in MD 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, practical/ clinical examination of 300 marks, log book assessment of 120 marks and thesis examination of 200 marks.

**Topics included in paper 1**

- |   |           |
|---|-----------|
| 1. Cerebrovascular Disease                | (10 MCQs) |
| 2. Disorders of Cranial Nerves            | (10 MCQs) |
| 3. Disorders of Spinal Cord and CSF       | (10 MCQs) |
| 4. Disorders of Muscle & Peripheral Nerve | (10 MCQs) |
| 5. Clinical Neurophysiology               | (15 MCQs) |
| 6. Paediatric Neurology                   | (20 MCQs) |

**Topics included in paper 2**

- |   |           |
|---|-----------|
| 1. Parkinsonism & Movement Disorders        | (10 MCQs) |
| 2. Epilepsy                                 | (10 MCQs) |
| 3. Sleep & Pain Medicine                    | (10 MCQs) |
| 4. Immunological and Infectious NS Disorder | (10 MCQs) |
| 5. Metabolic & Toxic States                 | (10 MCQs) |
| 6. Inter-related Subspecialties             | (25 MCQs) |

**Components of Part III Examination****Theory**

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

The candidates who pass in theory papers, will be eligible to appear in the clinical & viva voce.

**OSCE/ Viva****100 Marks**

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

**Clinical**

Four short cases (each 25 marks)

One long case:

**200 Marks**

100 Marks

100 Marks

**Log Book**

**120 Marks**

**Thesis Examination**

**200 Marks**

All candidates admitted in MD courses shall appear in Part-III thesis examination at the end of 5<sup>th</sup> calendar year of the MD programme and not later than 8th calendar year of enrolment. The examination shall include thesis evaluation with defense.

## RECOMMENDED BOOKS

### **BASIC SCIENCES:**

1. Grays Anatomy. 39th Ed. 2005. Standring S.
2. Textbook of Medical Physiology 11th Ed. 2006 Guyton
3. Harper's Biochemistry 25th Ed.
4. Katzung's Basic and Clinical Pharmacology 9th Ed 2004
5. Pathologic Basis of Disease. Robbins & Cotran. 7th Ed 2005
6. Medical Embryology Langman's 9th Ed. 2004
7. Behavioural Sciences by M. H. Rana
8. Textbook of Preventive and Social Medicine by Park's

### **INTERNAL MEDICINE:**

1. Clinical Medicine: Textbook for Medical Students & Doctors. Kumar & Clark (editors). 6<sup>th</sup> edition (2006). Elsevier Saunders, Edinburgh.
2. Harrison's Principles of Internal Medicine by Eugene Braunwald. 16<sup>th</sup> Ed. McGraw-Hill
3. Davidson's Principles and Practice of Medicine by Nicholas A. Boon 20<sup>th</sup> edition. Churchill Livingstone
4. Hutchison's Clinical Methods in Medicine by Michael Swash. 21<sup>st</sup> edition. A. Saunders Ltd.

### **NEUROLOGY:**

1. Principles of Neurology - Adams and Victor.
2. Merritt's Textbook of Neurology - Lewis Roland.
3. Memorix Neurology Peter Berlit. Chapman & Hall Medical.
4. Localization in Clinical Neurology - Brazis, Masdeu, Biller.
5. Neurology in Clinical Practice - Bradley, Daroff, Fenichel, Masdeu.