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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

### ***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.

### ***Course Title:***

MD Neurology

### ***Training Centers***

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

### ***Duration of Course***

The duration of MD Neurology course shall be five (5) years with structured training in a recognized department under the guidance of an approved supervisor.

After admission in MD Neurology Programme the resident will spend first 6 Months in the relevant Department of Neurology as **Induction period** during which resident will get orientation about the chosen discipline and will also participate in the **mandatory workshops** (Appendix E). The research project will be designed and the **synopsis** be prepared during this period.

On completion of Induction period the resident will start formal training in the Basic Principles of Internal Medicine for 18 Months. During this period the resident must get the research synopsis approved by AS&RB. At the end of 2<sup>nd</sup> years, the candidate will take up Intermediate Examination.

During the 3<sup>rd</sup>, 4<sup>th</sup>, & 5<sup>th</sup> years, of the Program, there will be two components of the training

- 1) Clinical training in Pulmonology
- 2) Research and Thesis Writing

The candidate shall undergo clinical training to achieve educational objectives of MD Neurology (knowledge & skills) along with rotations in the relevant fields. Which will be carried out during the 4<sup>th</sup> & 5<sup>th</sup> years of the Programm. The clinical training shall be competency based. There shall be generic specialty specific

competencies & shall be assessed by Continuous Internal Assessment (Appendix F&G)

Research Component and thesis writing shall be completed over the five years duration of the course. Candidates will spend total time equivalent one calendar year for research during the training. Research can be done as one block or it can be done in the form of regular periodic rotation over five years as long as total research time is equivalent to one calendar year.

### ***Admission Criteria***

Applications for admission to MD Training Programs of Neurology will be invited through advertisement in print and electronic media mentioning closing date of applications and date of Entry Examination.

Eligibility: The applicant on the last date of submission of applications for admission must possess the:

- i) Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.
- ii) Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council Is essential at the time of interview. The applicant is required to submit House Certificate from the concerned Medical Superintendent that the House Job shall be completed before the Interview.
- iii) Valid certificate of permanent or provisional registration with Pakistan Medical & Dental Council.

## ***Registration and Enrollment***

- As per policy of Pakistan Medical & Dental Council the number of PG Trainees/ Students per supervisor shall be maximum 05 per annum for all PG programmes including minor programmes (if any).
- 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.

## ***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. Delirium 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

# REGULATIONS

## *Scheme of the Course*

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

<b>Course Structure</b>	<b>Components</b>	<b>Examination</b>
<b>At the End of 2nd year MD Neurology Programme</b>	<ul style="list-style-type: none"> <li>• Principles of Internal Medicine</li> <li>• Relevant Basic Science (Physiology, Pharmacology, Pathology)</li> </ul>	<p><b><u>Intermediate Examination</u></b> at the end of 2<sup>nd</sup> Year of M.D. Neurology Programme</p> <p>Written MCQs = 300 Marks            Clinical, TOACS/OSCE &amp; ORAL = 200 Marks</p> <p style="text-align: right;">Total = 500 Marks</p>
<b>At the end of 5<sup>th</sup> year MD Neurology Programme</b>	<p style="text-align: center;"><b><u>Clinical Component</u></b></p> <p><b>Professional Education in Neurology</b></p> <p>Training in Neurology with compulsory/ optional rotations in the relevant fields.</p> <p style="text-align: center;"><b><u>Research component</u></b></p> <p>Research work / Thesis writing must be completed and thesis be submitted atleast 6 months before the end of final year of the programme.</p>	<p><b><u>Final Examination</u></b> at the end of 5<sup>th</sup> year of M.D. Neurology Programme.</p> <p>Written = 500 Marks            Clinical, TOACS/OSCE &amp; ORAL = 500 Marks            Contribution of CIS = 100 Marks            Thesis Evaluation = 400 Marks</p> <p style="text-align: right;"><b>Total = 1500 Marks</b></p> <p>Thesis evaluation and defence at the end of 5<sup>th</sup> year of M.D. Neurology Programme.</p>

***Intermediate Examination***  
***(at the end of 2<sup>nd</sup> year of M.D. Neurology Programme)***

All candidates admitted in M.D. Neurology courses shall appear in Intermediate examination at the end of second calendar year.

**Eligibility Criteria:**

The candidates appearing in Intermediate Examination of the M.D. Neurology Programme are required:

- a) To have submitted certificate of completion of mandatory workshops.
- b) To have submitted certificate of completion of first two years of training from the supervisor/ supervisors of rotations.
- c) To have submitted CIS assessment proforma from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.
- d) To have submitted certificate of approval of synopsis or undertaking / affidavit that if synopsis not approved with 30 days of submission of application for the Intermediate Examination, the candidate will not be allowed to take the examinations and shall be removed from the training programme.
- e) To have submitted evidence of payment of examination fee.

**Intermediate Examination Schedule and Fee**

- a) Intermediate Examination at completion of two years training, will be held twice a year.

- b) There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.
- c) Examination fee will be determined periodically by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue Roll Number Slips on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee.

### **Components of Intermediate Examination**

Written Examination	= 300 Marks
Clinical, TOACS/OSCE & ORAL	= 200 Marks
Total	= 500 Marks

### **Written:**

MCQs 100 (2 marks each MCQ)

SEQs 10 (10 Marks each SEQ)

**Total = 300 Marks**

### **Components of Theory Paper**

Principles of Internal Medicine	= 70 MCQs	7 SEQs
Specialty specific	= 10 MCQs	1 SEQs

Basic Sciences	= 20 MCQs	2 SEQs
• Physiology	= 8 MCQs	1 SEQs
• Pharmacology	= 4 MCQs	-----
• Pathology	= 8 MCQs	1 SEQ

### **Clinical, TOACS/OSCE & ORAL**

Four Short Cases	= 100 Marks
One Long Case	= 50 Marks
TOACS/OSCE & ORAL	= 50 Marks

**Total = 200 Marks**

### **Declaration of Results**

The Candidate will have to score 50% marks in written, Clinical, TOACS/OSCE & ORAL component and a cumulative score of 60% to be declared successful in the Intermediate Examination.

A maximum total of four consecutive attempts (availed or unavailed) will be allowed in the Intermediate Examination during which the candidate will be

allowed to continue his training program. If the candidate fails to pass his Intermediate Examination within the above mentioned limit of four attempts, the candidate shall be removed from the training program, and the seat would fall vacant, stipend/ scholarship if any would be stopped.

**Final Examination M.D. Neurology  
(At the end of 5<sup>th</sup> Calendar year of the Programme)**

All candidates admitted in MD Neurology course shall appear in Final examination at the end of structured training programme (end of 5th calendar year), and having passed the intermediate examination.

**Eligibility Criteria:**

To appear in the Final Examination the candidate shall be required:

- i) To have submitted the result of passing Intermediate Examination.
- ii) To have submitted the certificate of completion of training, issued by the Supervisor which will be mandatory.
- iii) To have achieved a cumulative score of 75% in Continuous Internal assessments of all training years.
- iv) To have got the thesis accepted and will then be eligible to appear in Final Examination.
- v) To have submitted no dues certificate from all relevant departments including library, hostel, cashier etc.
- vi) To have submitted evidence of submission of examination fee.

**Final Examination Schedule and Fee**

- a) Final examination will be held twice a year.
- b) The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
- c) Examination fee will be determined and varied at periodic intervals by the University.
- d) The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- e) The Controller of Examinations will issue an Admittance Card with a photograph of the candidate on receipt of prescribed application form, documents satisfying eligibility criteria and evidence of payment of examination fee. This card will also show the Roll Number, date / time and venue of examination.

All candidates admitted in M.D. Neurology course shall appear in Final examination at the end of structured training programme (end of 5th calendar year), and having passed the Intermediate examinations.

Written Part	= 500 Marks
Clinical, TOACS/OSCE & ORAL	= 500 Marks
Contribution Internal Assessment	= 100 Marks
Thesis Examination	= 400 Marks

**Total = 1500 Marks**

**Written Papers:**

Paper 1	= 100 MCQs	5 SEQs
Paper 2	= 100 MCQs	5 SEQs

**Clinical, TOACS/OSCE & ORAL:**

4 Short Cases	= 200 Marks
1 Long Case	= 100 Marks
Toacs/OSCE & Oral	= 200 Marks
<b>Total</b>	<b>= 500 Marks</b>

### **Declaration of Result**

For the declaration of result

- I. The candidate must get his/her Thesis accepted.
- II. The candidate must have passed the final written examination with 50% marks and the clinical & oral examination securing 50% marks. The cumulative passing score from the written and clinical/ oral examination shall be 60%.
- III. The MD degree shall be awarded after acceptance of thesis and success in the final examination.

IV. On completion of stipulated training period, irrespective of the result (pass or fail) the training slot of the candidate shall be declared vacant.

### ***Submission / Evaluation of Synopsis***

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board, available on university 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 2<sup>nd</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.

### **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.
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.

### **Thesis Examination**

- a) The candidate will submit his/her thesis at least 06 months prior to completion of training.
- b) The Thesis along with a certificate of approval from the supervisory will be submitted to the Registrar's office, who would record the date / time etc. and get received from the Controller of Examinations within 05 working days of receiving.
- c) The Controller of Examinations will submit a panel of eight examiners within 07 days for selection of four examiners by the Vice Chancellor. The Vice Chancellor shall return the final panel within 05 working days to the Controller of Examinations for processing and assessment. In case of any delay the Controller of Examinations would bring the case personally to the Vice Chancellor.
- d) The Supervisor shall not act as an examiner of the candidate and will not take part in evaluation of thesis.
- e) The Controller of Examinations will make sure that the Thesis is submitted to examiners in appropriate fashion and a reminder is sent after every ten days.
- f) The thesis will be evaluated by the examiners within a period of 06 weeks.
- g) In case the examiners fail to complete the task within 06 weeks with 02 fortnightly reminders by the Controller of Examinations, the Controller of Examinations will bring it to the notice of Vice Chancellor in person.

- h) In case of difficulty in find an internal examiner for thesis evaluation, the Vice Chancellor would, in consultation with the concerned Deans, appoint any relevant person as examiner in supersession of the relevant clause University Regulations.
- i) There will be two internal and two external examiners. In case of difficulty in finding examiners, the Vice Chancellor would, in consultation with the concerned Deans, appoint minimum of three, one internal and two external examiners.
- j) The total marks of thesis evaluation will be 400 and 60% marks will be required to pass the evaluation.
- k) The thesis will be considered accepted, if the cumulative score of all the examiners is 60%.
- l) The clinical training will end at completion of stipulated training period but the candidate will become eligible to appear in the Final Examination at completion of clinical training and after acceptance of thesis. In case clinical training ends earlier, the slot will fall vacant after stipulated training period.

### ***Award of MD Neurology Degree***

After successful completion of the structured courses of MD Neurology and qualifying Intermediate & Final examinations (Written, Clinical, TOACS/OSCE & ORAL and Thesis) the degree with title MD Neurology shall be awarded.



# CONTENT OUTLINE

## 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. 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
- 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

## **2. 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

### **3. 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

## **MD Neurology** **Principles of Internal Medicine**

After 6 months of Induction period the resident will start training in basic Principles of Internal Medicine for 18 months. 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

# Specialty training in Neurology

## Specific Program Content

1. Specialized training in Neurology
2. Compulsory rotations
3. Research & Thesis writing
4. Maintaining the 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 hypothermia, 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 paralyzing 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
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.

### **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.

<b>Sr.#</b>	<b>Date</b>	<b>Method of Evaluation (Oral, Practical, Theory)</b>	<b>Rating</b>	<b>Supervisor's Signature</b>
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 EXAMINATIONS**  
**Intermediate Examination MD Neurology**  
**Total Marks: 500**

All candidates admitted in MD Neurology course shall appear in Intermediate examination at the end of 2<sup>nd</sup> calendar year.

**Components of Intermediate Examination**

Written Examination	= 300 Marks
Clinical, TOACS/OSCE & ORAL	= 200 Marks
Total	= 500 Marks

**Written:**

MCQs 100 (2 marks each MCQ)

SEQs 10 (10 Marks each SEQ)

**Total = 300 Marks**

**Components of Theory Paper**

Principles of Internal Medicine	= 70 MCQs	7 SEQs
Specialty specific	= 10 MCQs	1 SEQs
Basic Sciences	= 20 MCQs	2 SEQs
• Physiology	= 8 MCQs	1 SEQs
• Pharmacology	= 4 MCQs	-----
• Pathology	= 8 MCQs	1 SEQ

**Clinical, TOACS/OSCE & ORAL**

Four Short Cases	= 100 Marks
One Long Case	= 50 Marks
Toacs/OSCE & Oral	= 50 Marks

**Total = 200 Marks**

## **Final Examination MD Neurology** **Total Marks: 1500**

All candidates admitted in MD course shall appear in Final examination at the end of structured training programme (end of 5th calendar year) and after clearing Intermediate examination.

There shall be two written papers of 250 marks each, Clinical, TOACS/OSCE & ORAL of 500 marks, Internal assessment of 100 marks and thesis examination of 400 marks.

### **Topics included in paper 1**

- |   |           |
|---|-----------|
| 1. Cerebrovascular Disease                | (15 MCQs) |
| 2. Disorders of Cranial Nerves            | (15 MCQs) |
| 3. Disorders of Spinal Cord and CSF       | (10 MCQs) |
| 4. Disorders of Muscle & Peripheral Nerve | (15 MCQs) |
| 5. Clinical Neurophysiology               | (20 MCQs) |
| 6. Paediatric Neurology                   | (25 MCQs) |

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

- |   |           |
|---|-----------|
| 1. Parkinsonism & Movement Disorders        | (15 MCQs) |
| 2. Epilepsy                                 | (15 MCQs) |
| 3. Sleep & Pain Medicine                    | (10 MCQs) |
| 4. Immunological and Infectious NS Disorder | (15 MCQs) |
| 5. Metabolic & Toxic States                 | (15 MCQs) |
| 6. Inter-related Subspecialties             | (30 MCQs) |

### **Components of Final Examination**

#### **Theory**

**Paper I**

**250 Marks**

**3 Hours**

5 SEQs  
100 MCQs

50 Marks  
200 Marks

**Paper II**

5 SEQs  
100 MCQs

**250 Marks**

**3 Hours**

50 Marks  
200 Marks

The candidates who pass in theory papers, will be eligible to appear in the Clinical, TOACS/OSCE & ORAL.

**Clinical and Toacs/OSCE & Oral**

**500 Marks**

Four short cases  
One long case:  
Toacs/OSCE & Oral

200 Marks  
100 Marks  
200 Marks

**Continuous Internal Assessment**

**100 Marks**

**Thesis Examination**

**400 Marks**

All candidates admitted in MD courses shall appear in Thesis examination at the end of 5<sup>th</sup> calendar year of the MD programme. The examination shall include thesis evaluation with defense.

## RECOMMENDED BOOKS

### **BASIC SCIENCES:**

1. Grays Anatomy. 39th Ed. 2005. Standing 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.

**APPENDIX "E"**  
**(See Regulation 9-iii)**

**MANDATORY WORKSHOPS**

1. Each candidate of MD/MS/MDS program would attend the 04 mandatory workshops and any other workshop as required by the university.
2. The four mandatory workshops will include the following

**d. Synopsis Writing**

**c. Communication Skills**

**d. Introduction to Computer / Information Technology and Software programs**

1. The workshops will be held on 03 monthly basis.
4. An appropriate fee for each workshop will be charged.
5. Each workshop will be of 02 - 05 days duration.
6. Certificates of attendance will be issued upon satisfactory completion of workshops.

**APPENDIX "F"**  
(See Regulation 9xxiii, 13, 14 & 16)

**CONTINUOUS INTERNAL ASSESSMENTS**

**a) Workplace Based Assessments**

Workplace based assessments will consist of Generic as well as Specialty Specific competency Assessments and Multisource Feedback Evaluation.

**Generic Competency Training & Assessments**

The Candidates of all MD / MS / MDS programs will be trained and assessed in the following five generic competencies.

**i. Patient Care.**

- a. Patient care competency will include skills of history taking, examination, diagnosis, plan of investigation, clinical judgment, plan of treatment, consent, counseling, plan of follow up, communication with patient / relatives and staff.
- b. The candidate shall learn patient care through ward teaching, departmental conferences, morbidity and mortality meetings, core curriculum lectures and training in procedures and operations.
- c. The candidate will be assessed by the supervisor during presentation of cases on clinical ward rounds, scenario based discussions on patient management, multisource feedback evaluation, Direct Observation of Procedures (DOPS) and operating room assessments.
- d. These methods of assessments will have equal weightage.

**ii. Medical Knowledge and Research**

- a. The candidate will learn basic factual knowledge of illnesses relevant to the specialty through lectures/discussions on topics selected from the syllabus, small group tutorials and bed side rounds.
- b. The medical knowledge/skill will be assessed by the teacher during case based discussions and presentations to the supervisor.
- c. The candidate will be trained in designing research project, data collection, data analysis and presentation of results by the supervisor.

- d. The acquisition of research skill will be assessed as per regulations governing thesis evaluation and its acceptance.

iii. **Practice and System Based Learning**

- a. This competency will be learnt from journal clubs, review of literature, policies and guidelines, audit projects, medical error investigation, root cause analysis and awareness of healthcare facilities.
- b. The assessment methods will include case studies, presentation in morbidity and mortality review meetings and presentation of audit projects if any.
- c. These methods of assessment shall have equal weight-age.

iv. **Communication Skills**

- a. These will be learnt from role models, supervisor and workshops.
- b. They will be assessed by direct observation of the candidate whilst interacting with the patients, relatives, colleagues and with multisource feedback evaluation.

v. **Professionalism as per Hippocratic Oath**

- a. This competency is learnt from supervisor acting as a role model, ethical case conferences and lectures on ethical issues such as confidentiality, informed consent, end of life decisions, conflict of interest, harassment and use of human subjects in research.
- b. The assessment of residents will be through multisource feedback evaluation according to proformas of evaluation and its' scoring method.

**Specialty Specific Competencies**

- i. The candidates will be trained in operative and procedural skills according to a quarterly based schedule.
- ii. The level of procedural competency will be according to a competency table to be developed by each specialty.

iii. The following key will be used for assessing operative and procedural competencies:

a. **Level 1 Observer status**

The candidate physically present and observing the supervisor and senior colleagues

b. **Level 2 Assistant status**

The candidate assisting procedures and operations

c. **Level 3 Performed under supervision**

The candidate operating or performing a procedure under direct supervision

d. **Level 4 Performed independently**

The candidate operating or performing a procedure without any supervision

iv. **Procedure Based Assessments (PBA)**

a. Procedural competency will assess the skill of consent taking, preoperative preparation and planning, intraoperative general and specific tasks and postoperative management

b. Procedure Based assessments will be carried out during teaching and training of each procedure.

c. The assessors may be supervisors, consultant colleagues and senior residents.

d. The standardized forms will be filled in by the assessor after direct observation.

e. The resident's evaluation will be graded as satisfactory, deficient requiring further training and not assessed at all.

f. Assessment report will be sub

g. A satisfactory score will be required to be eligible for taking final examination.

## Multisource Feedback Evaluation

- i. The supervisor would ensure a multisource feedback to collect peer assessments in medical knowledge, clinical skills, communication skills, professionalism, integrity, and responsibility.
- ii. Satisfactory annual reports will be required to become eligible for the final examination

### **b) Completion Of Candidate's Training Portfolio**

- i. The Candidate's Training Portfolio (CTP) will be published (or computer based portfolio downloadable) by the university.
- ii. The candidates would either purchase the CTP or download it from the KEMU web site.
- iii. The portfolio will consist of the following components
  - a) Enrollment details.
  - b) Candidate's credentials as submitted on the application for admission form.
  - c) Timeline of scheduled activities e.g dates of commencement and completion of training, submission of synopsis and thesis, assessments and examination dates etc ( **Appendix H**)
  - d) Log Book of case presentations, operations and procedures recorded in an appropriate format and validated by the supervisor.
  - e) Record of participation and presentations in academic activities e.g lectures, workshops, journal clubs, clinical audit projects, morbidity & mortality review meetings, presentation in house as well as national and international meetings.
  - f) Record of Publications if any.
  - g) Record of results of assessments and examinations if any
  - h) Synopsis submission proforma and IRB proforma and AS&RB approval Letter
  - i) Copy of Synopsis as approved by AS&RB
- iv. Candidates Training Portfolio shall be assessed as per proforma given in "**Appendix-G**".

## Supervisor's Annual Review Report.

This report will consist of the following components:-

- i. Verification and validation of Log Book of operations & procedures according to the expected number of operations and procedures performed (as per levels of competence) determined by relevant board of studies.
- ii. A 90 % attendance in academic activities is expected. The academic activities will include: Lectures, Workshops other than mandatory workshops, Journal Clubs, Morbidity & Mortality Review Meetings and Other presentations.
- iii. Assessment report of presentations and lectures
- iv. Compliance Report to meet timeline for completion of research project.
- v. Compliance Report on Personal Development Plan.
- vi. Multisource Feedback Report, on relationship with colleagues, patients.
- vii. Supervisor will produce an annual report based on assessments as per proforma in appendix-G and submit it to the Examination Department.
- viii. 75 % score will be required to pass the Continuous Internal Assessment on annual review.

**APPENDIX " G "**

(See Regulation 9ix, 9xxiii-d, 10, 11, 14 & 16)

**Supervisor's Evaluation**

**PROFORMA FOR CONTINUOUS INTERNAL ASSESSMENTS**

<b>1. Generic Competencies</b>		
(Please score from 1 – 100. 75% shall be the pass marks)		<b>Component Score</b>
i. Patient Care		20
ii. Medical Knowledge and Research		20
iii. Practice and System Based Learning		
• Journal Clubs		04
• Audit Projects		04
• Medical Error Investigation and Root Cause Analysis		04
• Morbidity / Mortality / Review meetings		04
• Awareness of Health Care Facilities		04
iv. Communication Skills		
• Informed Consent		10
• End of life decisions		10
v. Professionalism		
• Punctuality and time keeping		04
• Patient doctor relationship		04
• Relationship with colleagues		04
• Awareness of ethical issues		04
• Honesty and integrity		04
<b>2. Specialty specific competencies</b>		
Please score from 1 – 100. 75% shall be the pass marks		<b>Score achieved</b>
Operative Skills / Procedural Skills		
<b>3. Multisource Feedback Evaluation (Please score from 1 – 100. 75% shall be the pass marks)</b>		
<b>4. Candidates Training Portfolio (Please score from 1 – 100.75% shall be the pass marks)</b>		
(Please score from 1 – 100. 75% shall be the pass marks)		<b>Component Score</b>
i. Log book of operations and procedures		25
ii. Record of participation and presentation in academic activities		25
iii. Record of publications		25
iv. Record of results of assessments and examinations		25