CURRICULUM FOR
5 YEARS DEGREE PROGRAMME
MD NEUROLOGY

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DURATION OF COURSE:

The duration of MD Neurology course will be five (5) years with structured training in a neurology department of Dr.Ziauddin hospital under the guidance of DR BASHIR A. SOOMRO, the supervisor of MD neurology approved by BASR.

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

On completion of the Induction period the resident will start formal training in the neurology department. During this period the resident must get the research synopsis approved by BASR. At the end of the 2nd year, the candidate will take up Intermediate Examination.

During the 3rd, 4th, & 5th years, of the Program, there will be two components of the training:

1. Clinical training in Neurology
2. Research and Thesis Writing

The candidate will undergo clinical training to achieve educational objectives of MD Neurology (knowledge & skills) along with rotations in the relevant fields. This will be carried out during the 4th & 5th years of the Programme. The clinical training will be competency based. There shall be generic specialty specific competencies & will be assessed by Continuous Internal Assessment.

Research Component and thesis writing shall be completed over the five years duration of the course. Candidates will spend a total time equivalent to 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:

ADMISSION PROCESS

1. Application for admission shall be made to the postgraduate office on the prescribed form.
2. Eligible candidates will be required to pass an entrance test and will be interviewed for suitability by a postgraduate committee.
3. Entrance exam will be conducted by the examination department of Ziauddin university.

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

1. Basic Medical Qualification of MBBS or equivalent medical qualification recognized by Pakistan Medical & Dental Council.
2. Certificate of one year's House Job experience in institutions recognized by Pakistan Medical & Dental Council Is essential at the time of interview.

ENROLLMENT:

Candidates will be enrolled after gaining admission to the course and payment of admission fees.

AIMS AND OBJECTIVES OF THE COURSE

AIM

The aim of the 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:

1. Access and apply relevant knowledge to clinical practice:
    - Maintain currency of knowledge
    - Apply scientific knowledge in practice
    - Appropriate to patient need and context
2. Critically evaluate new technology
3. Safely and effectively performs appropriate clinical skills & procedures
4. Critically analyze their own clinical performance for continuous improvement
5. Design and implement effective management plans.
6. Organize diagnostic testing, imaging and consultation as needed.
7. 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

8. Recognize the value of knowledge and research and its application to clinical practice
9. Appreciate ethical issues associated with Neurology
10. Professionalism by:
    - Employing a critically reflective approach to Neurology
    - Adhering with current regulations concerning workplace harassment
    - Regularly carrying out self and peer reviewed audit
11. Work in collaboration with members of an interdisciplinary team where appropriate
12. Management and Leadership
    - Manage and lead clinical teams
    - Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team
13. 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:

- To provide a foundation of organized instruction in the basic neurosciences.
- To provide an opportunity to develop and maintain an investigative career in the basic neurosciences and clinical neurology.
- 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 faecal 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 acute inflammatory demyelinating polyradiculoneuropathy
    j) Temporal arteritis.
2) **Movement disorder**
    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**
    a) Stroke - Embolic, Lacunar, Transient ischemic attack, Hemorrhagic
7) **Multiple sclerosis**
8) **Head trauma**
9) **Altered consciousness**
    a) Delerium
    b) Coma
    c) Brain death
10) **Dementia**
11) **Aphasia**

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

12) Headaches
a) Migraine
b) Tension
c) Cluster
d) Subarachnoid haemorrhage
e) Giant cell arteritis

13) Brain tumour
a) Primary
b) Metastatic

14) Spinal disorders
a) Radiculopathy
b) Cervical stenosis
c) Lumbar stenosis
d) Epidural abscess
e) Cauda equina syndrome
f) subacute combined degeneration

15) Infections

16) HIV related lesions

17) Alcohol related disorders
a) Delirium tremens
b) Wernicke's encephalopathy
c) Korsakoff's dementia

18) Sleep Medicine
a) Sleep apnea
b) Restless leg syndrome
c) Narcolepsy

19) Child neurology
a) Childhood specific epilepsy
b) Enlarging head circumference
c) Cerebral palsy

20) Psychiatry
a) Depression
b) Bipolar disorder
c) Conversion disorder

E. Become more familiar with the purpose, utility, interpretation and procedural techniques of:

1. Electro-encephalograms (EEG)
2. Nerve Conduction Studies and Electromyography (NCS/EMG)
3. Evoked Potential Studies (EP)
4. Lumbar Punctures

5. Botulinum Toxin injections
6. Neuro-imaging modalities (CT, MRI, Cerebral Angiograms, SPECT scans)
7. Inner ear repositioning techniques

REGULATIONS
Scheme of the Course

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

Course Structure	**Components**	**Examination**
At the End of 2nd year MD Neurology Programme	Principles of Neurology & medicine Relevant Basic Science (Physiology, Pharmacology, Pathology)	**Intermediate Examination** at the end of 2nd Year of M.D. Neurology Programme Written MCQs Clinical, TOACS/OSCE & ORAL
At the end of 5th year MD Neurology Programme	**Clinical Component** Professional Education in Neurology: Training in Neurology with compulsory/optional rotations in the relevant fields. **Research component**	**Final Examination** at the end of 5th year of M.D. Neurology Programme. Written

Course Structure	Components	Examination
	Research work / Thesis writing must be completed and thesis be submitted atleast 6 months before the end of final year of the programme.	Clinical, TOACS/OSCE & ORAL Contribution of CIS Thesis Evaluation Thesis evaluation and defence at the end of 5th year of M.D. Neurology Programme.

Intermediate Examination
(at the end of 2nd 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:

- To have submitted certificate of completion of mandatory workshops.
- To have submitted certificate of completion of first two years of training from the supervisor/ supervisors of rotations.
- To have submitted CIS assessment Performa from his/her own supervisor on 03 monthly basis and also from his/her supervisors during rotation, achieving a cumulative score of 75%.

- 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.
- To have submitted evidence of payment of examination fee.

Intermediate Examination Schedule and Fee

- Intermediate Examination at completion of two years training, will be held twice a year.
- There will be a minimum period of 30 days between submission of application for the examination and the conduction of examination.
- Examination fee will be determined periodically by the University.
- The examination fee once deposited cannot be refunded / carried over to the next examination under any circumstances.
- 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

Clinical, TOACS/OSCE & ORAL

Total

Written - MCQs / SEQs

Components of Theory Paper	**MCQs**	**SEQs**
Principles of Internal Medicine	MCQs	SEQs
Specialty specific	MCQs	SEQs
Basic Sciences	MCQs	SEQs

Clinical, TOACS/OSCE & ORAL

Clinical Components
Four Short Cases
One Long Case

Clinical Components
TOACS/OSCE & ORAL

Declaration of Results

The Candidate will have to score 60% marks in written, Clinical, TOACS/OSCE & ORAL component.

Final Examination M.D. Neurology
(At the end of 5th 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:

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

Final Examination Schedule and Fees

1. Selected candidate will pay Rs. 25,000 as admission fees to the university Accounts office.
2. The final examination fees will be Rs. 25,000
3. The Defence of Thesis examination fees will be Rs.50,000.
4. In service candidate will be given current stipend.
5. Fees may be revised by the university at its discretion.

Final examination will be held in 2 stages

STAGE ONE

1. Theory examination.
2. Clinical examination.

STAGE TWO

Defence of thesis.

a. The candidates have to satisfy eligibility criteria before permission is granted to take the examination.
b. Examination fee will be determined and varied at periodic intervals by the University.
c. 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
Clinical, TOACS/OSCE & ORAL
Contribution Internal Assessment
Thesis Examination

Written Papers

Paper	**Duration**
Paper 1	3 hours
Paper 2	3 hours

Clinical, TOACS/OSCE & ORAL

Clinical Structure
4 short cases

Clinical Structure
1 long case
Toacs/OSCE & oral

Declaration of Result

For the declaration of result:

1. The candidate must get his/her Thesis accepted.
2. The candidate must have passed the final written examination with 60% marks and the clinical & oral examination securing 60% marks. There is no need of aggregate marks.
3. The MD degree shall be awarded after acceptance of thesis and success in the final examination.

EXAMINATION RULES REGARDING NUMBER OF ATTEMPTS AFTER COMPLETION OF TRAINING, DURATION OF ATTEMPTS AND WEIGHTAGE OF INTERNAL EVALUATION IN FINAL EXAM.

The training of MD/MS candidates will end by 5 years and trainee has to give his 1st attempt within 2 yrs after completion of training. If failed to do so will not be eligible to sit in exam unless granted permission by BASR. 3 attempts of part A exam are allowed, if theory is clear then 3 attempts of clinical exam. The period between 2 attempts should be atleast 6 months and if candidate fails to attempt exam in that period ,it will be counted as exam attempt.

After completion of training ,a trainee to successfully obtain a degree he /she will have to defend his/her thesis within a maximum period of 5 years and after which no further attempts will be allowed.

The 2nd yr (5%), 3rd yr (5%) and 4th yr (10%) evaluation exams will have a cumulative weightage of 20 % in final exam for theory and clinicals in MD/MS programme.

Submission / Evaluation of Synopsis

1. The candidates shall prepare their synopsis as per guidelines provided by the Advanced Studies & Research Board BASR , 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 & analyse the data.

3. Synopsis of research project shall be submitted by the end of the preferably by 1st year of MD program.

Submission of Thesis

1. Thesis shall be submitted by the candidate duly recommended by the Supervisor. Six months before the end of training a FINAL THESIS should be submitted to the postgraduate office for review.
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.

DEFENSE OF THESIS (Examination STAGE TWO)

a) The candidate will submit his/her thesis at least 06 months prior to completion of training.
b) The candidate will undergo a defense of thesis before a panel of examiners.
c) Eligible candidates are those whose thesis have been evaluated and reported as “accepted” by the review–examiners.
d) The BASR shall appoint a committee for the final examination which shall consist of 5 members.
e) Chairman of the examination committee is the Dean of the postgraduate.
f) The examiner shall report as to whether the candidate has adequate knowledge in the subject matter as well as whether he/she has defended his/her thesis successfully.
g) If candidate fails to defend the thesis ,will be allowed a period of a maximum of 2 years to successfully defend the thesis
h) The thesis will then be permanently bound with the name of author and title on the cover.

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 function
- 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

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 and 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 and 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

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 Principals 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
- 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, phaeochromocytoma 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
- gastroenteritis
- GI malignancy (oesophagus, gastric, hepatic, pancreatic, colonic)
- Inflammatory bowel disease
- Iron Deficiency anaemia
- 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:

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, disulpharam, acamprosate, methadone)

14. Cancer and Palliative Care

Common or Important Oncology Problems:

Problems
Hypercalcaemia
SVC obstruction
Spinal cord compression

Problems
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:

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

Investigations
Full lung function tests

More Advanced Competencies:

Procedures
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:

Procedures
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

No.	Program Content
1.	Specialized training in Neurology
2.	Compulsory rotations
3.	Research & Thesis writing
4.	Maintaining the Log-book

Specialized Training in Neurology
Head Injury

Competencies
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

Competencies
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

Competencies
Ability to assess the unresponsive patient and to formulate plan of investigation and management

Competencies
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

Competencies
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

Competencies
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 (in dementia and mood scales): evaluation of competency: community and support services

Epilepsy

Competencies
Ability to evaluate and manage people with epilepsy

Competencies
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

Cerebrovascular Disease

Competencies
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 Nervous System

Competencies
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 Nervous System (NS)

Competencies
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

CSF Disorders

Competencies
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

Competencies
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 Neurology

Competencies
Ability to evaluate & manage people with immunological disorder caused by disease or treatment
Principles of immune responses in relation to the Nervous system
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

Competencies
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

Competencies
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

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

Disorders of the Visual System

Competencies
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

Competencies
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

Competencies
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

Competencies
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

Competencies
Ability to evaluate and manage people with disorders of peripheral nerves (including plexus lesions)
Anatomy and pathology of peripheral nerves: clinical features & investigation of genetic and acquired axonal and demyelinating neuropathies, traumatic & entrapment neuropathies and plexopathies: management of Guillain-Barré syndrome and other severe paralysing neuropathies: general management of acute neuromuscular paralysis

Disorders of Autonomic System

Competencies
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 conditions e.g. multisystem atrophy: investigations including autonomic function tests: pharmacological and physical managements of urinary retention, erectile disorder, constipation, hypotension, autonomic dysreflexia

Disorders of Muscle

Competencies
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

Competencies
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

Subtopic	Competencies
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

Subtopic	Competencies
	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 intraventricular hemorrhage, 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, brain malformation, 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

Subtopic	Competencies
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

Subtopic	Competencies
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	EEG, EMG, evoked potentials, sleep and autonomic activity
Indications	Know the indications for and the interpretation of the various tests in the context of the clinical problem

EEG

Competencies
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

Competencies
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

Competencies
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

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

Autonomic Function Tests

Competencies
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

Competencies
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

Competencies
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

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

Laboratory and Electrical Safety

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

Other Inter-related Subspecialties

Subspecialty	Competencies
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

Subspecialty	Competencies
	(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; understand the need to refer to and the role of the Clinical Neuropsychologist; interpret reports; Understanding of neuroanatomical and

Subspecialty	Competencies
	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; 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 neurorehabilitation; 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;

Subspecialty	Competencies
	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 Uroneurologist

Complete Neurological Examination

Competencies
Neurologic history taking
Signs and symptoms, syndromes, topical and etiological diagnosis
The principles of correlation of neurologic signs with neuroanatomic localization of the lesion
Conscious level assessment, Glasgow coma scale
Assessment of orientation
Assessment of the mental status: cognitive function; assessment of aphasia, apraxia, dyslexia, dysgraphia, dyscalculia, agnosia
Assessment of new learning ability, memory, concentration, reasoning and problem solving, emotional state
Physical examination technique
Cranial nerve examination, signs and symptoms of cranial nerve disorders, syndromes
Examination of the head and the neck, upper limbs, trunk, lower limbs, posture, gait
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
Examination of reflexes: tendon reflexes, cutaneous superficial reflexes, pathological reflexes
Types of paresis, characteristic features in upper motor neuron lesion, lower motor neuron lesion, mixed lesion, pseudoflaccid paresis

Competencies
The sensory examination: assessment of sense (all sensory modalities - pain, temperature, light touch, extinction phenomenon, vibration, position sense, discriminative sensations, stereognosis)
Examination of meningeal irritation, signs and symptoms
Detailed cerebellar examination; Vestibular examination
Examination of the vertebral column, signs and symptoms of radicular disorders
Record of a complete neurological assessment
Making a diagnosis, a plan of auxiliary examinations, treatment, rehabilitation

ELECTIVE ROTATIONS

Rotation	Duration & Description
Pediatric Neurology Rotation	Neurology residents are required to spend a total of three months during their 5th Neurology training on the Pediatric Neurology service (out of campus). 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.
Neuroradiology Rotation	Each neurology resident will be assigned three months of neuroradiology during their second 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).
EMG Rotation	Each resident will be assigned to the EMG for 3 months 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

Rotation	Duration & Description
	interpret each case by the end of the rotation. These cases will be discussed in detail with the neuromuscular faculty.
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). Residents should observe the process of applying electrodes to patients and then the recording phase itself of both EEG and EP studies. Residents must review and interpret individual EEGs and EPs on their own and have a preliminary report to present to the attending physician. Formal teaching will be done during review sessions. Residents are required to enhance their “hands on” experience with adequate reading of related topics. At the end of the rotation, residents 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).
Psychiatry Rotation	Residents will spend 2 months on the psychiatry consultation service during their 3rd year of neurology training. 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.
Neurosurgery Rotation	Residents will spend 3 months during their 4th year of neurology training on neurosurgery in patient and outpatient consultation service. During this rotation, the neurology resident will develop skills in the assessment of neurosurgery issues of patients. The resident will gain an understanding of the interaction of need, indications of surgery, outcomes and complications of neurosurgical interventions and patient’s prognosis after surgery.
Neuro-ophthalmology Rotation	Each neurology resident will be assigned 1 month of neuro-ophthalmology rotation during their 4th year of neurology training. It is crucial for a neurology resident to master this area early in his/her training. The resident will do the assessment of patients presenting to ophthalmology clinics including history and examinations, eye examination, fundoscopy, interpretation of imaging studies, and review the findings with the ophthalmologist.

MANDATORY WORKSHOPS

Workshop	Details
Communication Skills	Certificate from Dean postgraduate studies regarding satisfactory completion
Epidemiology, Biostatistics & Research Methodology	Mandatory courses either by Ziauddin University or from any other approved institution
Research/Thesis Writing	Synopsis should be submitted preferably within 1st year of training for approval by Clinical Review Committee and ERC. If candidate fails to do so by the end of 2nd year of training, they will be held liable and dropped from the program. Candidate will not be promoted to the 3rd year unless synopsis is submitted. A total of one year will be allocated for work on a research project with thesis writing. Project must be completed and thesis submitted before the end of training. Research can be done as one block in 5th year of training or stretched over five years with regular periodic rotations, as long as total research time equals one calendar year.

Research Experience

Competencies
The active research component program must ensure meaningful, supervised research experience with appropriate protected time for each resident while maintaining essential clinical experience
Recent productivity by program faculty and 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, research methodology and data interpretation
The program must provide instruction in critical assessment of new therapies and surgical literature
Residents should be advised and supervised by qualified staff members in the conduct of research

Clinical Research

Competencies
Each resident will participate in at least one clinical research study to become familiar with: Research designResearch involving human subjects including informed consent and operations of the Institutional Review Board and ethics of human experimentationData collection and data analysisResearch ethics and honestyPeer review process
This usually is done during the consultation and outpatient clinic rotations

Case Studies or Literature Reviews

Competencies
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

METHODS OF INSTRUCTION / COURSE CONDUCTION

Method	Details
Active Participation	As a policy, active participation of students at all levels will be encouraged
Teaching Modalities	Lectures, Seminar Presentation and Journal Club Presentations, Group Discussions, Grand Rounds, Clinico-pathological Conferences, SEQ as assignments on content areas
Skill Teaching	Skill teaching in ICU, emergency and ward settings; attend genetic clinics and rounds for at least one month; attend sessions of genetic counseling; self-study, assignments and use of internet; bedside teaching rounds in ward; OPD & follow-up clinics; long and short case presentations
Interactive Strategies	Conferences to improve communication and clinical skills in upcoming consultants; must be conducted regularly and attended by all available faculty and residents; residents must actively request autopsies and participate in formal review of pathological material

Clinical Case Conference

Competencies
Each resident will be responsible for at least one clinical case conference each month. Cases discussed may be from consultation, clinic service, or specialty rotations. Residents, with advice of Attending Physician, will prepare and present cases and review relevant literature

Monthly Student Meetings

Meeting	**Description**
Journal Club Meeting	A resident will present in-depth a research article or topic of choice. Two hours per month should be allocated to discussion. Faculty or outside researchers may present current research results. Articles should be critically evaluated and applicable results highlighted and recorded.
Core Curriculum Meetings	All core topics of Neurology should be thoroughly discussed. Duration at least 2 hours once a month. Chaired by chief resident. Residents will brainstorm topics and generate ideas for course improvement.
Skill Development	Two hours twice a month for learning and practicing clinical skills. Residents must develop understanding of indications, contraindications, limitations, complications, techniques, and interpretation of results of technical procedures integral to the discipline. Residents must acquire skill in educating patients, obtaining informed consent, and documentation. Instruction in evaluation of medical literature, clinical epidemiology, study design, statistics, and medical decision-making is included.

Professionalism & Social Responsibilities

Competencies
Training must include cultural, social, family, behavioral and economic issues, such as confidentiality, indications for life support, and allocation of limited resources
Residents must learn the social and economic impact of decisions on patients, primary care physicians, and society; through bioethics lectures and Project Professionalism Manual (e.g., American Board of Internal Medicine)
Residents should receive instruction and experience with patient counseling skills and community education

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:

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			

Evaluation Record

(Excellent, Good, Adequate, Inadequate, Poor)

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

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

EVALUATION & ASSESSMENT STRATEGIES
Assessment

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

Six monthly evaluation will include:

1. Resident evaluation form
2. Mini clinical examination

The examination shall cover formal syllabus material as well as reading and discussion of medical literature. At the end of 6 months, if the progress of the candidate is unsatisfactory, the candidate will be informed in writing to improve. If the candidate fails to improve by the end of first year despite warning, the BASR will recommend termination of admission.

Feedback will be given for any unsatisfactory periodic internal evaluation.

- The candidate should be informed in writing and counselled if performance is unsatisfactory in consecutive periodic evaluations; liable to be withdrawn from the program
- Self Assessment by the student
- Peer Assessment
- Informal Internal Assessment by the Faculty

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:

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

Formative Assessment:

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

RECOMMENDED BOOKS
BASIC SCIENCES

- Gray's Anatomy, 39th Ed. 2005, Standring S.
- Textbook of Medical Physiology, 11th Ed. 2006, Guyton
- Harper's Biochemistry, 25th Ed.
- Katzung's Basic and Clinical Pharmacology, 9th Ed. 2004

- Pathologic Basis of Disease, Robbins & Cotran, 7th Ed. 2005
- Medical Embryology, Langman's, 9th Ed. 2004
- Behavioural Sciences by M. H. Rana
- Textbook of Preventive and Social Medicine by Park's

INTERNAL MEDICINE

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

NEUROLOGY

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