

“This prospectus is made under the provisions of the Universities Act, the Postgraduate Institute of Medicine Ordinance, and the General By-Laws No. 1 of 2016 and By-Laws No. 2 of 2016 for Degree of Doctor of Medicine(MD) and Board Certification as a Specialist”



# POSTGRADUATE INSTITUTE OF MEDICINE UNIVERSITY OF COLOMBO, SRI LANKA

## Prospectus

### BOARD CERTIFICATION IN CLINICAL NEUROPHYSIOLOGY

*(To be effective from the year 2016)*

Specialty Board in Neurology  
The Board of Study in Medicine

Copyright © 2016 by Postgraduate Institute of Medicine, University of Colombo,  
160 Prof. Nandadasa Kodagoda Mawatha, Colombo 7, Sri Lanka.

All rights reserved. This course document is the intellectual property of the Postgraduate Institute of Medicine, University of Colombo. No part of this document may be copied, reproduced or transmitted in any form by any means without the prior written permission of the Postgraduate Institute of Medicine, University of Colombo.

Contents

|   |    |
|---|----|
| 1. Introduction.....  | 2  |
| 2. Entry criteria, selection process and intake .....         | 2  |
| 3. Training outcomes at the end of the programme.....         | 3  |
| 4. Training content and curriculum .....                      | 5  |
| 5. Training programme details and structure .....             | 6  |
| 6. Trainers and Training Centres .....                        | 12 |
| 7. Evaluation of progress.....                                | 12 |
| 8. Pre–Board Certification Assessment (PBCA).....             | 13 |
| 9. Board Certification .....                                  | 14 |
| 10. Recommended learning material.....                        | 15 |
| ANNEXURE 1: CURRICULUM .....                                  | 16 |
| ANNEXURE 2: FORMAT OF DETAILED PROJECT PROPOSAL.....          | 34 |
| ANNEXURE 3: REPORT OF THE RESEARCH PROJECT FOR REVIEWER ..... | 35 |
| ANNEXURE 4: INSTRUCTIONS TO SUPERVISORS .....                 | 38 |
| ANNEXURE 5: RESEARCH PROGRESS REPORT .....                    | 39 |
| ANNEXURE 6: RESEARCH REPORT FORMAT .....                      | 40 |
| ANNEXURE 7: RESEARCH REPORT MARKING SCHEME.....               | 41 |
| ANNEXURE 8: PORTFOLIO.....                                    | 42 |
| ANNEXURE 9: CASE-BASED DISCUSSION .....                       | 43 |
| ANNEXURE 10: DIRECTLY OBSERVED PROCEDURAL SKILLS.....         | 46 |
| ANNEXURE 11: RECOMMENDED MINIMIUM NUMBER OF PROCEDURES.....   | 48 |
| ANNEXURE 12: AUTHENTICATED ACTIVITY FORM .....                | 49 |
| ANNEXURE 13: PROGRESS REPORT ASSESSMENT FORM .....            | 50 |

## **1. Introduction**

The successful completion of post-MD (Medicine) training programme in Clinical Neurophysiology will entitle the trainee to be eligible for Board Certification by the Postgraduate Institute of Medicine as a Specialist in Clinical Neurophysiology.

Clinical Neurophysiology is a diagnostic specialty, which encompasses the use of electro-diagnostic techniques such as nerve conduction studies (NCS), needle electromyography (EMG), electroencephalography (EEG), and evoked potential studies (EP) to assess function of the brain, spinal cord, peripheral nerves and muscles to diagnose disorders of the central and peripheral nervous systems. The objective of the training programme is to ensure that the trainee gains adequate knowledge, skills and attitudes which will enable him/her to function as a Specialist in Clinical Neurophysiology providing the highest standards of care to patients who require clinical neurophysiological investigations. The trainee is expected to acquire the professional skills to be an effective leader and a manager in the provision of health information and care. The trainee is expected to acquire the necessary skills to design and conduct audit and research, critically appraise published research and be committed to the practice of evidence-based medicine and continuing professional development.

Clinical Neurophysiology is a specialty recognised by the Ministry of Health in Sri Lanka and the postgraduate training programme in Clinical Neurophysiology has been in effect since 1998.

## **2. Entry criteria, selection process and intake**

### **2.1 Entry criteria**

- Applicants should have passed the MD (Medicine) examination
- Applicants should not have already applied to be enrolled in the training programme in any other subspecialty or be already Board Certified as a Specialist in any medical field

### **2.2 Selection Process**

The candidates will be selected according to the merit-based rank in the results of the MD (Medicine) Examination.

### **2.3 Intake**

The candidates will be informed the number of positions available for post-MD appointments in Clinical Neurophysiology at the allocation meeting or before. The selected candidates would be provided with full and comprehensive details of the training programme. This would be available at the PGIM for perusal by prospective candidates prior to the allocation meeting.

### **3. Training outcomes at the end of the programme**

The broad outcomes of the entire training programme are as follows:

- a. Patient care
- b. Medical knowledge and appropriate application of knowledge
- c. Technical ability and strategic approach in carrying out tests
- d. Interpersonal and communication skills
- e. Professionalism
- f. Evidence-based approach
- g. Ability to work in a multidisciplinary team
- h. Teaching, Research and Audit
- i. Understanding Clinical Governance

By the end of the training period, the trainee should be able to undertake the following clinical activities as applied to patients with neurological disorders:

#### **History taking**

Take an appropriate, focused and comprehensive history, including where appropriate, information from others, and communicate this verbally or in writing and in summary form.

#### **Mental and physical examination**

Undertake an appropriate, focused and comprehensive examination of mental and physical state and communicate verbally or in writing and in summary form.

#### **Differential diagnosis**

Formulate an appropriately ordered differential diagnosis based on an appreciation of the patient, their past history and current problems and their likely causes.

#### **Investigation**

- Formulate and carry out a focused and relevant series of clinical neurophysiological investigations.
- Interpret these clinical neurophysiological investigations in relation to the clinical context, and correlate with those used by other disciplines, such as neuroradiology, neuroimmunology and neuropathology, to evaluate the structure and function of the nervous system. The information provided at the end of the investigation procedures should lead to identification of the anatomical site and the pathological nature of the lesion, its severity and extent, and guide to effective management.

#### **Management plan**

Liaise with the clinician or members of the multidisciplinary team to develop an overall plan for investigation, treatment and follow-up of the individual patient.

### **Multidisciplinary team involvement**

Liaise with and provide leadership where appropriate, with all members of the Multi-Disciplinary Team and allied professionals (technologists, medical engineers and other ancillary staff) in a constructive and professional manner in the interests of the patients and their carers.

### **Communication issues**

Provide comprehensive information about the procedures, their interpretation and implications in the form of a report or other acceptable mode of communication.

Communicate effectively with the patients, their family and carers and other staff in relation to the individual needs of the patient and with appropriate regard for confidentiality.

Obtain full and informed consent for investigations and treatment.

Explain the results of the procedures to the patient, family or carer where appropriate.

### **Risk Management including managing unexpected events and handling complaints**

#### **Clinical neuro-pharmacology**

Plan and administer pharmacological treatments (e.g. Botulinum toxin therapy) safely and effectively where appropriate.

Refer to local and international guidelines and sources for evidence and information about treatments (synapse and neurotransmitter physiology, principles of neuro-pharmacokinetics and pharmacodynamics, modes of actions of drugs used to treat neurological diseases).

Understand and apply principles of treatment, especially those requiring neurophysiological guidance.

Understand limitations: compliance, adverse effects, interactions, cost implications.

Understand information needs of patients and others.

#### ***Special patient groups***

##### **Children**

Apply the clinical neurophysiological procedures on children. Understand the variations of the techniques and the results of the tests in children.

Understand the effects of age and maturation on the nervous system.

##### **Women and pregnancy**

Understand the effect of pregnancy on existing neurological disorders and neurological disorders complicating pregnancy.

Understand the variations of the techniques and the results of the tests during pregnancy.

##### **The elderly**

Understand the effects of aging on the nervous system.

Understand the normal clinical and radiological findings in the elderly; special presentations of neurological disease in the elderly.

Understand the variations of the techniques and the results of the tests in the elderly.

**Critically ill**

Understand the limitations, interferences and the adaptations to the methods during evaluation of a critically ill patient and in a critical care giving environment.

**4. Training content and curriculum**

| <b>Topics</b>                                     | <b>Teaching-learning activity/opportunity</b>                   |
|---|---|
| 1. Technology                                     | Clinical neurophysiology (local + overseas)                     |
| 2. Health and Safety                              | Clinical neurophysiology (local + overseas)                     |
| 3. Basic Neuroscience                             | Clinical neurology, clinical neurophysiology (local + overseas) |
| 4. Neurology                                      | Clinical neurology (local)                                      |
| 5. Basic Electroencephalography                   | Clinical neurophysiology (local + overseas)                     |
| 6. Basic Nerve conduction and Electromyography    | Clinical neurophysiology (local + overseas)                     |
| 7. Basic Evoked Potentials                        | Clinical neurophysiology (local + overseas)                     |
| 8. Advanced Electroencephalography                | Clinical neurophysiology (local + overseas)                     |
| 9. Advanced Nerve Conduction and Electromyography | Clinical neurophysiology (local + overseas)                     |
| 10. Advanced Evoked Potentials                    | Clinical neurophysiology (local + overseas)                     |
| 11. Research and audit methodology                | Clinical neurology, clinical neurophysiology (local + overseas) |
| 12. Teaching and Training                         | Clinical neurology, clinical neurophysiology (local + overseas) |

See detailed curriculum in **Annexure 1.**

- The Basic Techniques in electroencephalography, nerve conduction, electromyography and evoked potentials should be completed within the 2 years of clinical neurophysiology training.
- Advanced Techniques (items 8,9,10) are optional. However, the trainee is encouraged to become familiar with these techniques depending on the facilities available at the training centre.

## 5. Training programme details and structure

The total duration of training is three years.

|   |   |              |
|---|---|--------------|
| Local training in Clinical Neurology          | - | One (1) year |
| Local training in Clinical Neurophysiology    | - | One (1) year |
| Overseas training in Clinical Neurophysiology | - | One (1) year |

### 5.1 Structure of the Training Programme

| Stage and assessments          | Rotation                                      | Duration         |
|--------------------------------|---|------------------|
| <b>Year 1</b>                  | Clinical Neurology                            | <b>06 months</b> |
|                                | Clinical Neurophysiology                      | <b>06 months</b> |
| <b>ASSESSMENT at 12 months</b> |   |                  |
| <b>Year 2</b>                  | Clinical Neurology                            | <b>06 months</b> |
|                                | Clinical Neurophysiology                      | <b>06 months</b> |
| <b>Year 3</b>                  | Overseas training in Clinical Neurophysiology | <b>12 months</b> |
|                                | <b>PRE-BOARD CERTIFICATION ASSESSMENT</b>     |                  |

The training programme will have a Course Coordinator nominated by the Specialty Board in Neurology and named trainers who will undertake educational supervision. The Course Coordinator will coordinate rotations in liaison with the Director, PGIM.

The first 6 months of training in Year 1 and Year 2 will be in Clinical Neurology (total 12 months). The two periods of 6 months each will be under two different trainers in Clinical Neurology in two different training centres. The trainee is expected to perform all the duties of a Senior Registrar in Clinical Neurology during these 12 months of Clinical Neurology with emphasis on neurophysiological evaluation of patients.

The second 6 months of training in Year 1 and Year 2 will be in Clinical Neurophysiology (total 12 months). The two periods of 6 months each will be under two different trainers in Clinical Neurophysiology in two different training centres.

To commence overseas training specified in Year 3, a trainee should have completed a minimum of 12 months of the training programme and have successfully completed the Assessment at 12 months.

## 5.2 Method of delivery and learner support system

- a. Text book and journal-oriented theory knowledge
- b. Patient-oriented discussions and case-based learning on ward rounds and clinics
- c. Specialist clinics in epilepsy, peripheral neuropathy, myopathy, etc.
- d. Monthly Journal Clubs
- e. Monthly Clinical Forum of the Association of Sri Lankan Neurologists
- f. Monthly Neurology Lectures of the Association of Sri Lankan Neurologists
- g. Annual Scientific Sessions of the Association of Sri Lankan Neurologists, Ceylon College of Physicians, Sri Lanka Medical Association
- h. Updates in Neurology conducted by the Association of Sri Lankan Neurologists, the Ceylon College of Physicians and other professional associations.
- i. Workshops, fellowships and congresses in Clinical Neurophysiology, epilepsy and neuromuscular disorders.

## 5.3 Training requirements

### 5.3.1. On-call commitment

During the local training period in Clinical Neurology, the trainee will be expected to perform on-call duties at a frequency determined by the need of the centre of training.

### 5.3.2. Neurology and Neurophysiology referrals

The trainee could undertake to see neurology and neurophysiology referrals from other units under the supervision of the trainer.

### 5.3.3. Teaching

The trainee must gain experience in teaching undergraduates, postgraduates, nursing staff and ancillary medical staff, and must show evidence to that effect in the Portfolio.

### 5.3.4. Research project leading to a research paper

Successfully carrying out a research project is a *mandatory requirement* that needs to be fulfilled and be eligible to appear for the Pre-Board Certification Assessment (PBCA). The Research Project should be undertaken at the commencement of training. It should be a study which is either hospital or community-based and should include a clinical neurophysiological component. It may be observational or interventional in type.

All aspects of the study have to be assessed and deemed to be satisfactory by the Specialty Board in Neurology *before embarking on the proposed study*. Towards that end, a comprehensive project proposal has to be submitted to the Board within 3 months of entering the training programme and approval obtained, *prior to commencing the study*. The draft proposal (prepared according to **Annexure 2**) should be all-inclusive and detailed with all relevant particulars being included. The supervisor would be the Clinical

Neurophysiology Trainer. The submitted proposal will be evaluated by an evaluator and comments submitted to the Board (**Annexure 3**).

Once approved, it should be commenced without any delay and within a period of two months after approval. Instructions to the supervisor are given in **Annexure 4**. The supervisor should submit a progress report to the Specialty Board in Neurology every six months using the form in **Annexure 5**.

All projects would need approval from a relevant Ethics Review Committee while interventional studies have to be registered with the Clinical Trials Registry.

The trainee is expected to submit the study for publication in a peer-reviewed journal. Either the published article or evidence of the study being accepted for publication should be provided to the Specialty Board in Neurology. In the event that the trainee fails to get the study published, a comprehensive report on the completed study should be incorporated into the Portfolio according to the format in **Annexure 6**. Two examiners appointed by the Specialty Board in Neurology will assess the completed project report based on the marking scheme in **Annexure 7** as part of the evaluation of the Portfolio.

#### **5.3.5. Clinical Audit**

The trainee is required to do a comprehensive Clinical Audit and formally present it at the hospital where he or she is working during either the local or overseas training period. This is in addition to the prescribed Research Project (see 5.3.4). Documentary evidence of such an audit presentation must be included in the trainee's Portfolio.

#### **5.3.6. Portfolio**

The portfolio is a framework containing evidence of achievement of learning outcomes over time. This evidence is supplemented by the portfolio builders' reflections on their learning and can be used to provide feedback to the learner. The training portfolio should include evidence of all the Neurological and Clinical Neurophysiological procedures, specialized procedures, supervision of ventilated patients, assessment of brain death, outpatient clinic duties, subspecialty attendance, grand rounds, conferences, teaching courses, on-call commitments and teaching. The portfolio should be prepared and submitted according to the format indicated in **Annexure 8**. The portfolio must be built by the trainee and be up to date at all times during the training period including the overseas period. The portfolio will be regularly inspected and signed by the supervising consultant. The portfolio will have to be produced at the assessments.

The fundamental basis of Portfolio maintenance is Reflective Practice, which is an important tool in postgraduate training. Reflective practice consists of:

- a. focused self-assessment
- b. reflecting on experience

- c. reflecting on strengths, weaknesses and areas for development
- d. design of own strategies that leads to improvement in practice

Using such a process, there is improved training by self-identification of strengths and weaknesses, which is expected to promote deep learning, document what the trainee already knows, identify areas for improvement and help in planning further learning. This approach promotes self-directed learning and critical thinking skills.

The objectives of maintaining a Portfolio is

- a. to help the trainee to record his/her training in brief so that the experience acquired can be assessed and deficiencies identified and remedied
- b. to help supervisors and assessors to evaluate the overall training and provide guidance in areas where it is needed.

The Portfolio should consist of

- Documentation of all aspects of training and learning experienced by the trainee.
- It must include a case record book of a minimum of five case records. Each case record should not exceed 3000 words. A published case report in a refereed journal can be substituted for a case, if the supervisor certifies that the trainee's contribution for the publication justifies exemption.
- Details of Continuing Professional Development (CPD) activities: minimum of 30 CPD points.

CPD points will be allocated as follows:

- Participation in the Academic Sessions of the Association of Srilankan Neurologists (ASN) or any other Neurology congress: 3 points each
- Participation in the Academic Sessions of the Sri Lanka Medical Association (SLMA) or the Ceylon College of Physicians (CCP): 2 points each
- Oral or poster presentation related to Clinical Neurophysiology at ASN, CCP, SLMA, PGIM or Neurology congress: 6 points each
- Participation in ASN lecture, ASN clinical forum or workshop relevant to Clinical Neurophysiology : 1 point each
- Presentation at Young Physician forum, Young Neurologist forum or ASN clinical forum: 2 points each

Points will be allocated in only one category for one activity, i.e., a trainee presenting at a session can only claim points for presentation and not participation in that session. Documentary evidence such as a certificate or a letter is required in order to claim points.

- Records of scientific presentations made.
- Case-based discussions (CBD) (**Annexure 9**): minimum of five.
- Direct Observation of Procedural Skills (DOPS) (**Annexure 10**): minimum of two in each of the main curricular area i.e. electroencephalography 2, nerve conduction & electromyography 2 and evoked potentials 2.

- Regular reflective entries on all aspects of patient care and professional training.
- A record of individual activity-based entries on the trainee's own experience. This should include a log of procedures performed during the training period. The recommended minimum number of procedures is given in **Annexure 11**.
- Published article or report of the research project undertaken during the training period (see 5.3.4).
- Report of clinical audit (see 5.3.5).

The contents of the portfolio should be divided into **7 sections**. The following list sets out the type of evidence that may be relevant to each section.

1. Subject expertise:
  - case record book
  - progress reports from supervisors (essential, should be according to prescribed format)
  - supervisor feedback on communication skills
  - log of procedures carried out
  - results of any work-place assessments conducted
2. Teaching
  - undergraduates
  - postgraduates
  - ancillary health staff
3. Research and Audit relevant to Clinical Neurophysiology
  - Dissertations / theses
  - Research papers published or accepted for publication
  - Abstracts of presentations
  - Clinical audit
4. Ethics and Medico-legal Issues
  - Completed Professionalism Observation Forms (from integrated learning component of Professionalism Strand)
  - Completed PTR forms during post-MD training
5. Information Technology
  - Participation in training programmes / workshops
  - Evidence of searching for information and application of findings in practice
6. Life-long learning
  - Participation in conferences and meetings
  - CPD points
7. Reflective practice
  - Narration of at least one learning event experienced by the trainee, in relation to each of the above outcomes, with reflection on what and how the trainee learned from this experience

Entries in the Portfolio should be made by the trainee at the time of acquiring the skill and *authenticated (signed)* by the trainer or supervisor (**Annexure 12**).

The trainee is expected to keep the portfolio updated regularly. The trainers and supervisors will use the portfolio to assess the progress of the trainee and to provide a feedback at regular intervals (e.g. every 6 months) during the training period. The trainers and supervisors are expected to assess the level of competencies in different areas of training and provide advice and assistance to the trainees to achieve the expected levels of skills empowerment.

It is the responsibility of the trainees, the trainers and the supervisors to ensure that the entries in the Portfolio are *authentic* and made *regularly*. It is essential to provide the trainee with accurate feedback on his or her views about his or her performance during the training period.

The Specialty Board in Neurology expects the Trainee and the Trainers to make the best use of the Portfolio in order to achieve the objectives of the training programme. The portfolio should be kept as a ring binder document which will allow easy insertions of documents by the Trainee.

When the trainee is eligible for Pre-Board Certification Assessment (PBCA), 3 copies of the completed portfolio should be submitted to the PGIM Examinations Branch. It will be assessed by a panel of two examiners appointed by the Specialty Board in Neurology as described later.

#### **5.3.7. Overseas training**

One year of training in Clinical Neurophysiology in an overseas centre of excellence for Clinical Neurophysiology is an essential pre-requisite for Board certification as a specialist in Clinical Neurophysiology. The overseas centre in which the trainee proposes to train must be approved by the Board of Study in Medicine prior to commencing overseas training. The BOS in Medicine will approve only overseas centres that have been recommended by the Specialty Board in Neurology. The trainee must submit details of the job description (weekly or monthly work schedule), training offer, and the facilities and training opportunities available at the proposed overseas training centre to the Specialty Board in Neurology in order to obtain approval.

## 6. Trainers and Training Centres

A panel of Board-approved Trainers who are Board-certified Specialists with employment in the Ministry of Health or the Universities would carry out the training locally. Overseas training would be carried out by Consultant Clinical Neurophysiologists in centres approved for training.

### a. Local training in Clinical Neurology

The training will be done in a centre recognized by the PGIM for training in Clinical Neurology. The Trainer should be a Board-certified Consultant Neurologist with a minimum of three years after Board certification. The training centre should possess the following minimum requirements: a Neurology ward, out-patient Neurology clinics, access to intensive care units and free access to CT scan, EEG and neurophysiology facilities in the same centre.

### b. Training in Clinical Neurophysiology

The centre should be recognized by the PGIM for training in Clinical Neurophysiology. The trainer should be a Board-certified Clinical Neurophysiologist with a minimum of three years after Board certification. Facilities outside the training centre (including the private sector) may be utilized by the trainer, with the approval of the Specialty Board in Neurology and the Board of Study in Medicine, solely for enhancing the training experience.

### c. Overseas training

The training centre, the trainer and the training programme should be approved by the Specialty Board in Neurology.

## 7. Evaluation of progress

### 7.1. Progress Reports

7.1.1. Each completed section of the training programme should be followed by the submission of a Progress Report by the Supervisor/Trainer using the form in **Annexure 13**. These reports should be received by the PGIM within one month of completing the relevant section of training. The onus of ensuring that these reports are sent in time to the PGIM is entirely on the trainee. He or she should liaise with the trainers and make sure that the reports are received by the PGIM in time. This includes local as well as overseas training. Satisfactory Progress Reports are a mandatory requirement to qualify for the Pre-Board Certification Assessment (PBCA).

Suitable and appropriate action will be taken by the Board of Study in Medicine with concurrence of the Specialty Board in Neurology, according to the General Regulations and

Disciplinary Code of the PGIM in the event of the receipt of an unsatisfactory or adverse progress report at any stage of training.

7.1.2. The trainee also should submit the completed Peer Team Rating (PTR) forms every six months (Annexure 14).

## **7.2. Assessments**

The trainees will undergo formal assessments at the end of 12 months (Assessment) and after the completion of training (Pre-Board Certification Assessment) prior to Board Certification.

### **7.2.1. The Assessment**

A barrier-assessment will be conducted at the end of 12 months of training with the objectives of evaluating whether the trainee is fit to proceed to the next stage of training. The Assessment will be conducted by one Board-certified Clinical Neurophysiologist and one Board-certified Neurologist. The Assessment will comprise two components:

- a. Assessment of observed history taking, examination, interpretation of physical signs, neurophysiological evaluation and management (40 minutes – 70 marks)
- b. Assessment of the training portfolio (20 minutes – 30 marks)

The trainee must score a total of 60% or above to pass. Trainees who do not pass the Assessment in their first attempt are allowed to re-sit the evaluation while proceeding to Year 2 of the training programme. *However, trainees will not be allowed to proceed to overseas training until successful completion of the Assessment.*

The Assessment will be held 3 times per year. If the trainee fails to successfully complete the Assessment within 3 years of entering the training programme or within a maximum of 6 attempts (whichever is sooner), the trainee will be referred to the Specialty Board in Neurology to decide on the continuation or discontinuation of the training.

## **8. Pre-Board Certification Assessment (PBCA)**

### **8.1 Eligibility to sit for the PBCA**

In order to be eligible to appear for the PBCA, the trainee must meet the following criteria:

- Completion of the training period.
- Provision of satisfactory Progress Reports and PTR Reports for all stages of training.
- A mark of 60% or more at the Assessment at the end of 12 months of training.
- Completion of the research project and publication / acceptance for publication of the research paper in a peer-reviewed journal or submission of the research report in the Portfolio using the prescribed format.
- Completion of the Portfolio in concurrence to the format specified in 5.3.6.

### **Details of PBCA**

The PBCA will comprise an oral examination (*viva voce*) of 60 minutes, during which the trainee will be questioned on the portfolio, recent advances in neurology and neurophysiology, evidence-based medicine and clinical reasoning in neurology and neurophysiology. The PBCA aims to evaluate knowledge, clinical competence and depth of experience. The trainee is required to start with a presentation of 10 – 15 minutes on the post-MD training.

The PBCA will be conducted by one Board-certified Neurologist and one Board-certified Clinical Neurophysiologist. The examiners will be appointed by the Specialty Board in Neurology according to the rules and regulations of the PGIM.

### **8.2. Pass mark**

The overall assessment will be based on each of the main sections in the portfolio (as specified in 5.3.6) and the performance at the *viva voce*, which will be assessed as satisfactory or not, on an overall basis.

### **8.3. Failed candidate**

If the examiners are of the view that the trainee's performance is unsatisfactory, and the trainee should not be given immediate Board Certification, the examiners will provide the trainee with written feedback on how the portfolio should be improved in order to reach the required standard. The trainee should then re-submit the portfolio within a specified period of time (up to 3 – 6 months), and face another oral examination (*viva voce*) based on the re-submitted portfolio. If the trainee is successful at this second oral examination, the date of Board Certification will be backdated as done routinely. If unsuccessful again, the date of Board Certification will be the date of passing the subsequent PBCA following further training for a minimum period of 6 months in a unit selected by the Board of Study.

Ineligibility to sit the PBCA due to unsatisfactory progress reports will be dealt with as stipulated in 7.1.1.

## **9. Board Certification**

A trainee, who has successfully completed the Pre-Board Certification Assessment is eligible for Board Certification as a Specialist in Neurophysiology, on the recommendation of the Speciality Board in Neurology and the Board of Study in Medicine.

## 10. Recommended learning material

### Text books

- a. Kimura, Jun. *Electrodiagnosis in Diseases of Nerve and Muscle - Principles and Practice* (4 ed). Oxford University Press, 2013.
- b. Daube JR, Rubin DI. *Clinical Neurophysiology* (3 ed). Oxford University Press, 2009.
- c. Preston DC, Shapiro BE. *Electromyography and Neuromuscular Disorders: Clinical-Electrophysiologic Correlations* (3 ed). Elsevier, 2012
- d. Donaghy, Michael. *Brain's diseases of the nervous system* (12 ed). Oxford University Press, 2009.
- e. Ropper, Allan, Samuels Martin. *Adam's and Victor's Principles of Neurology* (9 ed). McGraw-Hill, 2009.
- f. Darroff, Fenichel, Jankovic, Mazziotta. *Bradley's Neurology in Clinical Practice* (6 ed). Saunders, 2012.

### Journals

- a. *Muscle & Nerve*. Wiley Blackwell.
- b. *Clinical Neurophysiology*. Elsevier
- c. *Journal of Clinical Neurophysiology*. Wolters Kluwer Health/ Lippinkott Williams and Wilkins.
- d. *Journal of Neurology, Neurosurgery and Psychiatry*. BMJ Publishing Group.
- e. *Practical Neurology*. BMJ Publishing Group.
- f. *Lancet Neurology*. Lancet Publishing Group.
- g. *Neurology*. American Academy of Neurology.
- h. *Continuum*. American Academy of Neurology.
- i. *Brain*. Oxford University Press.
- j. *Sri Lanka Journal of Neurology*. Association of Sri Lankan Neurologists.
- k. *Journal of Neurological Sciences*. Elsevier.
- l. *The New England Journal of Medicine*. NEJM Group.
- m. *The Lancet*. Lancet Publishing Group.
- n. *Ceylon Medical Journal*. Sri Lanka Medical Association.
- o. *Current opinion in Neurology*. LWW journal.

### Websites:

- a. American Association of Electrodiagnostic and Neuromuscular Medicine: [www.aanem.org](http://www.aanem.org)
- b. International Federation of Clinical Neurophysiology: [www.ifcn.info](http://www.ifcn.info)
- c. International Society for Clinical Electrophysiology of Vision: [www.iscev.org](http://www.iscev.org)
- d. The British Society for Clinical Neurophysiology: [www.bscn.org.uk](http://www.bscn.org.uk)
- e. American Academy of Neurology: [www.aan.com](http://www.aan.com)
- f. Association of British Neurologists: [www.theabn.org](http://www.theabn.org)
- g. World Federation of Neurology: [www.wfneurology.org](http://www.wfneurology.org)

## **Annexures**

### **ANNEXURE 1: CURRICULUM**

#### **1. Technology**

To understand and utilise the technology which underpins practice of Clinical Neurophysiology

##### **Factual knowledge**

- Measurement techniques, electrodes and transducers
- Analogue-to-digital and digital-to-analogue conversion, effects of time and voltage resolution, aliasing
- Amplifiers and their characteristics
- Stimulators
- Signal processing including: averaging; trigger and delay techniques; Fourier and spectral analysis; brain mapping
- Component parts of recording systems
- Computer technology
- Information technology including general software used in departments, analysis and research tools
- Simple testing and repair of equipment
- Safety and legal issues surrounding equipment

##### **Skills**

- Makes rational purchasing decisions of recording and administrative systems
- Designs, implements and monitors safety standards
- Recognises artefacts
- Assesses and utilises new technologies
- Participates in supervision and training of non-medical and medical staff in basic technology
- Observes legal and professional requirements for safe use of technology

##### **Attitudes**

- Keeps knowledge current by continuing medical education
- Knows limits of own knowledge and when to seek assistance

## **2. Health and Safety**

To enable the trainee to be conversant with and implement measures that ensures the safe working of a Department of Clinical Neurophysiology for staff and patients

### **Factual knowledge**

- Hazards relating to the use of medical equipment (electrical and magnetic)
- Hygiene and sterilisation procedures, procedures for prevention of cross infection including MRSA, Hepatitis B, HIV, Prion diseases including CJD
- Control of substances hazardous to health
- Procedures relating to specific clinical situations: pacemakers, anti-coagulant therapy, theatre work, withdrawal of anti-epileptic medication
- Manual handling
- Needle stick injury - prevention and action on occurrence

### **Skills**

- Demonstrates safe practice of clinical procedures and when using equipment in a range of clinical settings

### **Attitudes**

- Makes patient and staff safety the top priority
- Assures quality by clinical governance and significant event reporting
- Follows local and national health and safety guidelines

## **3. Basic Neuroscience**

To acquire and reinforce knowledge of basic neuroanatomy, neurophysiology, neuropharmacology and neuropathology

### **Factual knowledge**

#### **3.1 Neuroanatomy**

- Knowledge of the major subdivisions of the central and peripheral nervous systems
- Fibre tracts and nuclei
- Cortical subdivision and function
- Visual, sensory, auditory and motor pathways
- Basal ganglia
- Cerebellum

- Autonomic nervous system
- Vascular supply to the brain
- Maturation of the nervous system
- Neurophysiology
- Basic knowledge of nerve conduction from ion channel function to the massed responses of nerve trunks, fibre tracts and nuclei.
- Synaptic function (inhibitory and excitatory) and the neuromuscular junction.
- Different motor unit types.
- Motor control and the cerebellum.
- Visual, auditory and somatosensory physiology from receptor to cortex.
- Biophysics of nerve stimulation (electrical and magnetic) and recording

### **3.2 Neuropharmacology**

- Central nervous system neurotransmitters and drugs which modulate them.
- Mode of action of drugs affecting the central and peripheral nervous systems

### **3.3 Neuropathology**

- Reactions of peripheral and central nervous systems to disease: tumours, infections, inflammation, infarction and immune mediated mechanisms.
- Demyelination and degeneration in the central nervous system; ephaptic transmission
- Pathophysiology of epilepsy; mechanisms of excessive or hypersynchronous neural activity and of the generalised cortico-reticular epilepsies.
- Pathophysiology of cerebral ischaemia, cerebral anoxia, cerebral injury, space occupying lesions and encephalopathy
- Demyelination, degeneration and regeneration in the peripheral nervous system.
- How nerve conduction can be affected by pathology, particularly axonal degeneration and demyelination; how these two basic types of neuropathic abnormalities may be differentiated, and how they may overlap and inter-relate.
- Changes in nerve conduction and needle EMG in neuropathic and myopathic conditions
- Temporal evolution of EMG and nerve conduction findings after complete and partial nerve injury.
- Different patterns of neuropathies and the ways in which peripheral neuropathies may present (diffuse sensori-motor predominantly sensory, predominantly motor (with conduction block), multifocal.
- Patterns and distribution of myopathic disorders.
- Pre- and post-synaptic defects of neuromuscular transmission

### **Skills**

- Interprets the findings of Clinical Neurophysiology investigations at their most basic level i.e. localisation in the nervous system and the mechanisms of pathogenesis

### **Attitudes**

- Maintains knowledge by continuing medical education
- Participates in basic neuroscience teaching sessions, at national, regional and local levels

## **4. Neurology**

### **Core Neurological Competencies**

#### **4.1 History Taking**

To enable the trainee to take a clinical history focusing on the patient's complaint

#### **Factual knowledge**

- Scope of the neurological history.
- Understanding of the differences between open and closed questioning
- Recognises the importance of social and cultural issues and practices that may have an impact on health

#### **Skills**

- Takes an appropriate, focused and comprehensive history, including where appropriate information from others, and communicates this verbally or in writing and in summary form.
- Communicates effectively with patients from diverse backgrounds and those with special communication needs, such as the need for interpreters
- Where values and perceptions of health and health promotion conflict, facilitates balanced and mutually respectful decision making

#### **Attitudes**

- Listens to and deals with complex patients (e.g. angry or distressed patient).
- Uses of an interpreter appropriately for patients & families when English is not their first language.

#### **4.2 Neurological Examination**

To enable the trainee to elicit the neurological signs relevant to the patient's complaint

### **Factual knowledge**

- The scope of neurological signs, particularly relating to the conditions regularly encountered by clinical neurophysiologists (diseases of the peripheral nervous system, disorders of consciousness and multiple sclerosis)

### **Skills**

- Undertakes an appropriate, focused and comprehensive examination of mental and physical state and communicates this verbally or in writing and in summary form.
- Comprehends constraints (including those that are cultural or social) to performing physical examination and strategies that may be used to overcome them

### **Attitudes**

- Uses a chaperone where appropriate
- Respects patient's personal dignity

### **4.3 Communication Skills**

To enable the trainee to communicate the clinical aspects of a patient's condition to the patient and other health care workers

### **Factual knowledge**

- Communication verbally and in writing.

### **Skills**

- Produces legible case notes.
- Negotiates with patients, relatives and fellow healthcare professionals
- Dictates reports and other clinical correspondence
- Shows consideration and patience to those with visual, auditory and other impairments.
- Responds to people in an ethical, honest and non-judgmental manner
- Adopt assessments and interventions that are inclusive, respectful of diversity and patient-centred
- Listens actively and question sensitively to guide the patient and to clarify information in particular with regard to matters that they may find it difficult to discuss, e.g. domestic violence or other abuse
- Identifies opportunities to promote changes in lifestyle and other actions which will positively improve health, e.g. discourage smoking, encourage weight reduction etc.

- Works collaboratively with other agencies, e.g. occupational health service, to improve the health of individual patients and communities, and help patients to remain at or return to work whenever appropriate
- Encourages patients to remain at or return to work whenever appropriate

#### **Attitudes**

- Communicates effectively with patients, their family and carers and other staff with appropriate regard for confidentiality.
- Considers cultural, religious & educational background of individuals
- Gives a prognosis, explains the patient's condition, breaks bad news, obtains full and informed consent for investigations and treatment in a way that can be understood by the patient.
- Summarises the clinical case in a coherent manner to clinical colleagues.

#### **4.4 Differential Diagnosis, Investigation and Initial Management**

To enable the trainee to appreciate clinical management decision making with particular relevance to the role of Clinical Neurophysiology

#### **Factual knowledge**

- The different presentations of common and less common neurological diseases.
- The roles and usefulness of investigations including neuro-imaging

#### **Skills**

- Formulates an appropriately ordered differential diagnosis based on an appreciation of the patient, the past history and current problems and their likely causes.
- Gives consideration for different racial, social & ethnic groups.
- Formulates a focused and relevant series of investigations.

#### **Attitudes**

- Plans and requests appropriate observations, liaises with members of the multidisciplinary team (MDT), determines and prescribes immediate treatment, seeks appropriate opinions and interventions and with others, develops an overall plan for the individual patient.
- Demonstrates leadership skills including mentorship of junior medical colleagues.

### **5. Basic Electroencephalography**

To provide the trainee with the knowledge and skills to be able to record and report on EEGs across all age groups and medical conditions

### **Factual knowledge**

- Use and limitations of EEG in a range of medical disorders
- EEG technology
- Physiological basis of EEG signals
- Requirements of specific recording environments e.g. intensive care unit

### **Skills**

- Recognizes normal components of the EEG and evolution of maturational changes
- Recognizes normal variants and abnormalities
- Recognizes changes during hyperventilation and photic stimulation
- Recognizes changes due to drowsiness and various stages of sleep
- Understands the use of activation procedures in Epilepsy
- Writes a factual report
- Interprets EEG in clinical setting
- Comments on EEG findings to referring clinician
- Cares for patient during recording, with particular reference to seizures during the recording and issues related driving and epilepsy

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **6. Basic Nerve conduction and Electromyography**

To enable the trainee to understand the indications for nerve conduction studies and electromyography (EMG); to perform these investigations; and to report on the findings

### **Factual knowledge**

- Physiology of nerve conduction, neuromuscular transmission and excitation - contraction mechanisms in muscle
- Clinical presentation and pathophysiology of diseases of the peripheral nerves, neuromuscular junction and muscles
- Anatomy of peripheral nerves and muscles with regard to electrode placement and needle insertion
- Techniques for study of peripheral nerves including sensory, motor, and F wave studies, H reflex, repetitive nerve stimulation and blink reflex.
- Adaptations necessary in particular patient groups or difficult recording situations
- Techniques of electromyography including recognition of neurogenic and myopathic disorders, and adaptations necessary in particular patient groups or difficult recording situations

- Single fibre EMG using voluntary activation and axonal stimulation
- Principles of jitter, blocking and fibre density measurement
- Normal values, including anatomical variants; effects of age, temperature, height and co-morbid conditions. Use and limitation of internal controls e.g. the opposite limb in contralateral conditions

### **Skills**

- Liaises with referring colleagues and advise on appropriate investigations
- Takes a history from and examines the patient to formulate the problem for investigation. Selects and performs the appropriate tests, with modification as required during neurophysiological examination
- Cares for the patient throughout the consultation by explaining the procedure, obtaining co-operation, and minimising discomfort. Provides appropriate information to the patient after the examination
- Describes and interprets findings of the investigation in the report
- Participates in the training and practice of Clinical Physiologists in performance of basic nerve conduction studies and reports on their findings

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **7. Basic Evoked Potentials**

To understand the technical basis and methods of recording visual, brainstem auditory and somatosensory evoked potentials, appreciate when these tests may be used, and the expected changes from normal in a variety of pathological conditions

### **Factual knowledge**

- Technical aspects of pattern reversal and flash visual stimulation
- Technical aspects of auditory stimulation
- Technical aspects of peripheral nerve stimulation for somatosensory evoked potentials
- Technical aspects of recording evoked potentials, including averaging methods
- Technical difficulties of recording from children and adults in a variety of circumstances, including the intensive care unit
- Anatomical generators of evoked potentials, and the basis for determining these generators
- Measurement of latency, amplitude and polarity in normal subjects, and the effect of altering stimulus parameters

- Physiological basis for alteration in evoked potential response amplitude and latency in demyelinating and degenerative pathological processes affecting the central and peripheral nervous system
- Sensitivity and specificity of evoked potential abnormalities for the diagnosis of multiple sclerosis, and changes expected in other demyelinating, degenerative, traumatic, vascular or other nervous system diseases

### **Skills**

- Sets up stimulus and recording apparatus to elicit reproducible visual, auditory and somatosensory evoked potentials
- Performs the test on adults and children
- Analyses main evoked potential components
- Recognizes of limits of normality and interpretation of alterations due to nervous system disease

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competencies

## **8. Advanced Electroencephalography**

### **8.1 Long-term EEG Monitoring**

To acquire competence to supervise and report on video EEG telemetry and Ambulatory EEG recordings

### **Factual knowledge**

- Semiology and classification of epileptic seizures and epilepsies
- EEG correlates of different seizure types
- Indications for long-term EEG monitoring and the limitations of these techniques
- Technology of video EEG telemetry and ambulatory monitoring, including the setting up and operation of equipment and fault finding
- Differential diagnosis of epileptic and non-epileptic seizures
- Common antiepileptic drugs, their uses, dosage, side effects and drug interactions
- Management of status epilepticus
- Role of EEG in pre-surgical assessment of epilepsy
- Role of EEG monitoring in the management of status epilepticus

### **Skills**

- Assesses seizure histories and proposing differential diagnosis
- Evaluates video recordings of seizures of epileptic and non-epileptic origins
- Reads ictal and inter-ictal EEGs in persons with epileptic and non-epileptic attacks
- Sets up video EEG telemetry and ambulatory monitoring, selection of montages, polygraphyetc; changing archiving media; identification of common faults
- Manages initial stages of status epilepticus
- Manages seizures and acute psychotic episodes in telemetry unit
- Explains procedures to patients and carers and obtaining their co-operation
- Participates in the multidisciplinary telemetry team

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence
- Provides leadership for the multidisciplinary telemetry team

## **8.2 Clinical Neurophysiology support for Epilepsy Surgery**

To acquire competence in one or more of the following:

- Supervision and reporting on sub-acute electrophysiological recordings with intracranial electrodes
- Supervision and reporting on acute electrocorticograms
- Participation in functional brain mapping
- Participation in carotid amygdala tests

### **Factual knowledge**

- Role of scalp and intracranial EEG techniques in pre-surgical assessment of epilepsy
- Strategies of epilepsy surgery and multidisciplinary pre-surgical assessment
- Intracranial EEG correlates of different seizure types
- The uses, interpretation and limitations of acute/intra-operative electrocorticography
- Use of functional brain mapping in pre-surgical assessment
- Procedure, uses and interpretation of carotid amygdala test and simultaneous EEG recording
- Risks and benefits of epilepsy surgery and its associated procedures

### **Skills**

- Sets up intracranial recordings, selection of montages, identification and correction of common faults
- Interprets intracranial recordings

- Assists surgeon and supervises technician in setting up and performing intra-operative electrocorticographic recordings and in identification correction of common artefacts and faults
- Assists at carotid amygdala tests
- Assists at functional brain mapping
- Explains these procedures accurately and comprehensibly to patients and carers

**Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

**8.3 Polysomnography and Multiple Sleep Latency Tests**

To acquire competence to supervise and report on polysomnography and/or Multiple Sleep Latency Tests

**Factual knowledge**

- Classification and semiology of sleep disorders
- Normal EEG and polygraphic findings in sleep
- Indications for polysomnography and MSLT and the limitations of these techniques
- Rechtschaffen & Kales' sleep staging criteria, American Academy of Sleep Medicine (AASM) for scoring sleep and associated events; manual and automated methods of staging
- Technology and procedures for polysomnography and Multiple Sleep Latency Tests

**Skills**

- Elicits and assesses histories of possible sleep disorders and proposes differential diagnosis
- Stages sleep and recognizes polygraphic features of common sleep disorders
- Sets up polygraphy both in the laboratory and using ambulatory recordings, selects of montages, transducers etc; changing media; identifies of common faults
- Explains procedures to patients and carers and obtaining their co-operation
- Participates in the multidisciplinary sleep studies team

**Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **9. Advanced Nerve Conduction And Electromyography**

### **9.1 Quantitative Electromyography (EMG)**

To acquire knowledge of and technical competence in quantitative motor unit potential analysis (macro EMG, EMG frequency analysis, turns/amplitude analysis, motor unit number estimate-MUNE) or single fibre EMG

#### **Factual knowledge**

- Basic principles of EMG quantification, including frequency analysis
- Indications for quantitative methods
- Technical aspects: needles, EMG filtering, statistical analysis on data generated
- Principles of quantification of recruitment patterns; turns/amplitude analysis; frequency analysis
- Principles of quantification of motor unit potentials; amplitude, duration and phase measurement

#### **Skills**

- Liaises with referring colleagues and advise on appropriate investigations
- Takes a history from and examines the patient to formulate the problem for investigation. Selects and performs the appropriate tests, with modification as required during neurophysiological examination
- Cares for the patient throughout the consultation by explaining the procedure, obtaining co-operation, and minimising discomfort. Provides appropriate information to the patient after the examination
- Describes and interprets findings of the investigation in the report

#### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

### **9.2 Quantitative sensory testing**

To acquire understanding of the pathophysiological concepts of sensory perception relating to the peripheral and central sensory nervous systems, and to obtain technical competence in different methods of quantitative sensory testing

#### **Factual knowledge**

- Anatomy, physiology and pathology of sensory receptors, and of peripheral and central sensory neural pathways

- Principles of different available methods and paradigms of quantitative sensory testing for warm and cold thresholds; heat pain and cold pain thresholds. Limitations of psychophysical techniques
- Principles of methods of quantitative sensory testing for touch thresholds
- Principles of other indirect methods of quantitative testing such as measurement of reflex vasodilatation using laser Doppler, and nicotine and acetylcholine induced sweating quantified by an evaporimeter
- Interaction between the autonomic nervous and sensory systems. Related diagnostic techniques in assessment of patients with neuropathic disorders

### **Skills**

- Liaises with referring colleagues and advise on appropriate investigations
- Takes a history from and examines the patient to formulate the problem for investigation.
- Selects and performs the appropriate tests, with modification as required during neurophysiological examination
- Cares for the patient throughout the consultation by explaining the procedure, obtaining co-operation, and minimising discomfort.
- Provides appropriate information to the patient after the examination
- Describes and interprets findings of the investigation in the report

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **9.3 Uroneurophysiology**

To enable the trainee to understand the indications for uroneurophysiological investigations, to perform some or all of these procedures, and to report on the findings

### **Factual knowledge**

- Anatomy and normal function and control of the urological system.
- Neural innervation and control of urethral and anal sphincters.
- Normal characteristics of motor neurons in Onuf's nucleus
- Consequences for urological and sexual function in neurological and general medical disorders, including endocrine disease such as polycystic ovary syndrome.
- Clinical presentation and underlying pathology of these conditions
- Technique of needle EMG examination of sphincters; normal and abnormal findings
- Use of EMG recording as part of urodynamic assessment

- Adaptations of technique necessary in particular patient groups or difficult recording situations
- Use and limitations of other techniques to assess bladder and sexual function, such as pudendal nerve conduction studies, sacral reflexes and cortical sensory/motor evoked responses

### **Skills**

- Liaises with referring colleagues and advises on appropriate investigations
- Takes a history from and examines the patient to formulate the problem for investigation.
- Selects and performs the appropriate tests, with modification as required during neurophysiological examination
- Cares for the patient throughout the consultation by explaining the procedure, obtaining co-operation, and minimising discomfort or anxiety.
- Provides appropriate information to the patient after the examination
- Describes and interprets findings of the investigation in the report

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **9.4 EMG guided botulinum toxin therapy**

To enable the trainee to understand the indications for botulinum toxin therapy, methods of administration and effects of therapy

### **Factual knowledge**

- Pharmacology of Botulinum toxin, including dosage and dilution schedules related to different strains of toxin and different manufacturers
- Clinical conditions where its use is indicated
- Role of EMG guided Botulinum toxin therapy
- Method of delivery using EMG guidance
- Anatomy of muscles with regard to site of needle insertion
- Complications of therapy

### **Skills**

- Liaises with doctor or team referring patient for treatment
- Takes a history and examines the patient with a view to setting out a treatment plan

- Explains the procedure to the patient in a manner which is understandable and gain patient's consent.
- Establishes patient co-operation to minimise discomfort during the procedure
- Performs EMG guided toxin therapy in a range of disorders, including focal limb and orofacial dystonias, diffuse dystonic disorders, spasmodic torticollis, spasticity.

#### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

### **10. Advanced Evoked Potentials**

#### **10.1 Multi-modal evoked potentials**

To understand the technical basis, methods of recording and clinical application of one or more of the specialised evoked potentials, acquire proficiency in performance of these studies, and expertise in the interpretation of clinical significance of findings

#### **Factual knowledge**

- Brain stem auditory evoked potentials audiometry
- Visual physiology, including electroretinography, electronystagmography, electrooculography: evaluation of function of rods and cones, retinal pigment, epithelium and ganglion cells

#### **Skills**

- Proficiency in performance and clinical interpretation of designated technique for each selected category

#### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

#### **10.2 Operative spinal monitoring**

To enable the trainee to participate in a multi-disciplinary team monitoring spinal cord &/or nerve root function during surgery

#### **Factual knowledge**

- Surgical procedures undertaken in spinal deformity correction and other spinal surgery requiring neurophysiological monitoring
- Risks & mechanisms of neurological injury associated with surgical procedures
- Somatosensory evoked potential techniques

- Motor evoked potential recording techniques
- Nerve root monitoring techniques
- Effects of anaesthetic agents and physiological variables on neurophysiological recordings
- Guidelines for performance of intra-operative neurophysiological monitoring techniques
- Guidelines on individual responsibilities of members of the monitoring team and advised action relating to adverse events

### **Skills**

- Assess pre-operative clinical and neurological status, decides the form of monitoring required, and consents the patients.
- Monitors somatosensory evoked responses and identifies adverse events perioperatively.
- Monitors Motor evoked responses and identifies adverse events perioperatively.
- Monitors nerve root EMG recordings and identifies adverse events perioperatively.
- Identifies effects of anaesthetic agents, physiological variables and surgical manoeuvres on recordings
- Works effectively within the monitoring team, and demonstrates leadership

### **Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## **10.3 Transcranial Magnetic Stimulation**

To enable the trainee to perform transcranial magnetic stimulation

### **Factual knowledge**

- Physical property of magnetic fields and the mechanism of neural excitation, including effect of coil design.
- Contraindications to the use of magnetic fields and other safety measures
- Differences between cortical and peripheral nerve stimulation
- Parameters of stimulation and recording and defined protocols of investigation.
- Physiological variables affecting measurements
- Normal values and changes expected due to disease process

### **Skills**

- Evaluates referral and decides the most appropriate test protocol.
- Explains technique to patient
- Assess patient for possible contraindications.

- Measures parameters of motor evoked potential, including threshold, latency, central conduction time, amplitude, amplitude ratio and silent period
- Reports results and interprets the findings in relation to disease processes.

**Attitudes**

- Applies and demonstrates clinical behaviours as in core neurological competence

## 11. Research and audit methodology

### Factual knowledge

- Study designs and levels of evidence
- Research methods
- Statistical tests including tests of significance, regression analysis and risk (relative/attributable risk, odds ratio and NNT) calculations
- Writing a research proposal and ethics committee submission
- Principles of meta-analysis, systematic review and clinical audit
- Methods of clinical audit and the audit cycle
- Critical appraisal of a scientific paper

### Skills

- Able to frame the clinical questions
- Able to locate the best evidence (Medline, Cochrane databases)
- Able to critically appraise scientific literature including applicability, validity and impact of individual studies and levels of evidence
- Able to interpret statistics
- Able to design a research project to answer a clinical question and write a research proposal including ethics committee submission
- Able to present research and audit results to a medical audience

### Attitudes

- Awareness of the importance of the evidence based medicine
- Appreciation of the ethics of research
- Awareness of the importance of clinical audit

## 12. Teaching and Training

### Factual knowledge

- Understand the meaning of problem based learning, student based learning, appraisal, assessment types, CPD, revalidation
- Understand that good teaching sessions require careful planning

### Clinical skills

- Able to facilitate learning in different circumstances

### Attitudes

- Being a role model
- Keen on life-long learning and self-criticism

## **ANNEXURE 2: FORMAT OF DETAILED PROJECT PROPOSAL**

### **Section 1**

1. Name of trainee
2. Name(s) of supervisor(s)
3. Training centre

### **Section 2**

1. Project title
2. Background and justification
3. Objectives of study
4. Research plan
  - a. Design
  - b. Setting
  - c. Method
  - d. Sample size and sampling techniques
  - e. Outcome measures
  - f. Statistical analyses and plan of presentation of results
  - g. Ethical considerations
  - h. Work plan and time lines
5. References
6. Funding for study
7. Signature of trainee

### **Section 3**

Recommendation of supervisor(s)

Signature of Supervisor 1

Date

Signature of Supervisor 2

Date

### **Section 4**

Date of submission to PGIM

Date of approval by BOS

Signature of Secretary BOS

**ANNEXURE 3: REPORT OF THE RESEARCH PROJECT FOR REVIEWER**

**1. Name of Trainee:**

**2. Training Centre:**

**3. Supervisor:**

**4. Reviewer:**

Name:

Designation:

Address Official:

Tel//Fax:

Email:

**5. Title of Project:**

**6. Please comment on each of the following headings.**

**6.1 Introduction** : Rationale(Justification) – problem identified and quantified.  
Hypothesis and expected outcome, impact and relevance of the study.

Comment : .....

**6.2 Literature Review:** Adequacy ( evidence of a systematic search for related. similar, relevant studies)

Comment : .....

**6.3 Objectives** : Clearly defined, relevant and stated in measurable terms .

Comment : .....

**6.4 Method:** Appropriate study design to address the objectives with clear detailed description of subjects, sampling technique and sample size, interventions, data collection and management. The study should be, internally valid and reproducible. Where specific details are available in the literature, reference should be made to the original papers, and comments kept to a minimum. If modifications have been

made to the published techniques, these should be described in full. Appropriate statistical tests planned should be mentioned and ethical issues addressed

Comment : .....

**6.5 Results:** Order of presentation and appropriate presentation of tables, figures, graphs. Appropriate statistical analyses and interpretations

Comment : .....

**6.6 Discussion:** The findings of the study should be discussed taking into consideration findings of relevant studies, within and outside the country. The discussion should not be a repetition of the results only. Limitations should be included.

Comment : .....

**6.7 Conclusion and recommendation:** Based of the results of the study and to address the objectives

Comment : .....

**6.8 Limitations:** Any inherent and / or inadvertent biases and how they were dealt with.

Comment : .....

**6.9 References:** According to the Vancouver system and relevant to the study. Properly documented in the Bibliography and appropriately cited in the text

Comment : .....

**6.10 Institution(s) where work would be carried out:**

**6.11 Ethical considerations/institution from where ethical approval will be /has been obtained:**

Comment : .....

**6.12 Overall presentation:** Overall presentation of the proposal (grammar, spelling, typographical mistakes etc).

Comment : .....

**7. Recommendation of reviewer:**

Comment : .....

- Is the project report acceptable?      Yes / No
- If No, What corrections are required? ( Attach a separate sheet of paper if necessary)

**Signature:**

**Date:**

**8. Recommendation of the Specialty Board in Neurology:**

**Signature of Chairperson/Secretary:**

**Date:**

#### **ANNEXURE 4: INSTRUCTIONS TO SUPERVISORS**

- The objective of the research project is to prove the trainee's capability to plan, carry out and present his / her own research. The purpose of this training is to ensure maturity, discipline and scholarship in research.
- The supervisor should guide the student in planning and designing, carrying out the research and in presentation of the work.
- The research project must be original and must comprise the trainee's own work.
- It must contribute to existing knowledge relevant to Sri Lanka and afford evidence of originality as shown by independent, critical assessment and / or discovery of new facts in the area under study.
- It should be satisfactory with regard to literary presentation.
- The research project should be certified by the supervisor as suitable for submission.
- General Comments on the contents: The objectives should be clearly stated and should be feasible to achieve within the time frame. Other published work relevant to the problem (both international and local) should be comprehensively and critically evaluated. An appropriate study design and method should be used to achieve the objectives stated. The results should be appropriately analysed, interpreted and presented effectively. The discussion should include comments on the significance of results, how they agree or differ from published work. If they differ, the probable reasons for these differences need to be discussed. Theoretical / practical applications of the results, if any should be given. The conclusions should be valid and be based on the results obtained on the study.
- Ethics: Approval should be obtained by a recognized Ethics Review Committee prior to commencement of the research project.
- If at any time the supervisor is not satisfied with the work progress of the trainee, the trainee should be made aware of the deficiencies and corrective measures suggested. This should be conveyed in writing to the trainee with a copy to the Specialty Board in Neurology. In such instances, a follow-up report should be forwarded within three months or earlier.

## **ANNEXURE 5: RESEARCH PROGRESS REPORT**

To be forwarded by the supervisor to the Specialty Board in Neurology at least once in SIX months

- 1. Name of trainee:**
- 2. Training Centre:**
- 3. Supervisor:**
- 4. Title of project:**
- 5. Description of work carried out to date:**

To be filled in by trainee: briefly describe progress in lab / field work and report writing

Supervisor's comments

- 6. Is the work on schedule?**      Yes / No
- 7. Progress in writing:**      satisfactory / unsatisfactory
- 8. Constraints (if any)**
- 9. Recommendation of supervisor:**

Signature:

Date:

- 10. Recommendation of the Specialty Board in Neurology:**

Signature of Secretary:

Date:

## **ANNEXURE 6: RESEARCH REPORT FORMAT**

### **General instructions**

The past tense should be used . The metric system and the International System (SI) of units should be used whenever possible.

### **Length**

The text should *not* exceed 4000 words, which equals to approximately 10 pages. With figures, references, etc., the total length is likely to be in the region of 15 - 20 pages.

### **Submission**

The research report should be included in the Portfolio only if the trainee does not succeed in publishing the study in a peer-reviewed journal. If published, only the published article should be included in the Portfolio.

### **Layout**

As presented in research papers in the journal *Lancet Neurology*.

## **ANNEXURE 7: RESEARCH REPORT MARKING SCHEME**

1. Title (05)
2. Author's name and address
3. Abstract (05)
4. Table of contents
5. List of tables
6. List of figures
7. Introduction (10)
8. Objectives (10)
9. Review of literature (10)
10. Materials and methods (15)
11. Results (15)
12. Discussion (including limitations) (20)
13. Conclusion and recommendations
14. Acknowledgements
15. References (05)
14. The overall presentation (05)

To pass the trainee should score 50 % or more. This mark will be part of the overall evaluation of the Portfolio.

## **ANNEXURE 8: PORTFOLIO**

### **Objectives**

To be appointed as a Specialist in Neurology to practice independently in Sri Lanka, on completion of the in-service training after the MD (Medicine) Examination and three years training in neurology, the Trainee should:

- a) have administrative and organizational skills
- b) be able to clearly document and prioritize problems
- c) have skills appropriate to a specialist (diagnostic, operative, counselling, risk management, management of medico-legal issues)
- d) have appropriate attitudes
- e) be able to carry out and also supervise research and clinical audits
- f) be committed to Continuous Professional Development
- g) be able to disseminate knowledge effectively
- h) be able to communicate effectively
- i) have adequate knowledge and skills in Information Technology

### **Learning outcomes**

1. Subject expertise
2. Teaching
3. Research and audit
4. Ethics and medico-legal issues
5. Information technology
6. Life-long learning
7. Reflective practice

The contents of the portfolio should encompass all of the above learning outcomes and contain evidence of achievement of these outcomes by the trainee. Although some of these may have been evaluated before the MD examination, the portfolio assessed at the PBCA should mainly contain evidence of achievements during post-MD training, either locally or overseas. All sections need not be of equal weight – for example, the section on Subject Expertise may be much more detailed than the others.

**ANNEXURE 9: CASE-BASED DISCUSSION**

**Study Programme:**

**Date of Assessment:**

**Trainee’s Name:**

**Training Year:**

**PGIM**

**Reg. No:**

**Assessor’s Name:**

**Designation:**

**Brief summary of Case:**

**Setting:**     In-Patient         Out-Patient     Emergency         Other (please specify)

**1. Medical Record Keeping(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**2. History taking(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**3. Clinical and Electrodiagnostic findings and Interpretation(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**4. Treatment/management Plan(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**5. Follow-up and Future Planning(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**6. Professionalism(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**7. Overall Clinical Judgement(  Not Observed)**

|                |   |   |   |              |   |   |   |          |   |   |
|----------------|---|---|---|--------------|---|---|---|----------|---|---|
| 1              | 2 | 3 | / | 4            | 5 | 6 | / | 7        | 8 | 9 |
| UNSATISFACTORY |   |   |   | SATISFACTORY |   |   |   | SUPERIOR |   |   |

---

**Rating Scale:** Nine point rating scale is used. Rating of 4 is defined as ‘marginal’ and conveys the expectation that with remediation that the trainee will meet the expected standards.

**DESCRIPTORS OF COMPETENCIES DEMONSTRATED DURING CbD**

**Medical Record Keeping:** Understood the need for an accurate and appropriate clinical record

**History taking:** : facilitates patient’s telling of story, effectively uses questions directions to obtain accurate information needed, responds appropriately to affect, non-verbal cues

**Clinical and Electrodiagnostic Findings and Interpretation:** Was able to describe the key issues and their clinical relevance

**Treatment/Management Plan:** Reviewed and understood the significance of appropriate investigations, requested additional information and was able to formulate a treatment/management plan

**Follow-up and Future Planning:** Was able to formulate a plan for future care based on knowledge of potential problems and their severity.

**Professionalism:** Where relevant, knew and followed appropriate standards, guidelines and protocols. Selectively orders/performs diagnostic studies, considers risks/benefits

**Overall Clinical Judgement and Clinical care:** Demonstrates an appropriate, systematic and co-ordinated approach to clinical care.

**Strengths**

.....  
.....  
.....

**Suggestions for development**

.....  
.....  
.....

**Agreed action:**

.....  
.....  
.....

|                                       |   |                       |   |   |   |   |   |   |   |  |                                  |  |             |
|---------------------------------------|---|-----------------------|---|---|---|---|---|---|---|--|----------------------------------|--|-------------|
| <b>Time taken for discussion</b>      |   | <b>mins</b>           |   |   |   |   |   |   |   |  | <b>Time taken for discussion</b> |  | <b>mins</b> |
| <b>Assessor Satisfaction with CBD</b> |   | <input type="radio"/> |   |   |   |   |   |   |   |  | <input type="radio"/>            |  |             |
| LOW                                   | 1 | 2                     | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  | HIGH                             |  |             |
| <b>Trainee Satisfaction with CBD</b>  |   |                       |   |   |   |   |   |   |   |  |                                  |  |             |
| LOW                                   | 1 | 2                     | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  | HIGH                             |  |             |

Comments:.....  
.....  
.....

Assessors Signature: .....

Trainee’s Signature:.....

- The Case-based Discussion encounter takes approximately 30 minutes, including a 10 minute feedback session.
- The trainee discusses the case(s) with their assessor, including their approach, the results, and reflection on what went well and what they would change in similar situations in the future.
- The assessor may prompt for further information when required.
- The assessor makes notes and rates the trainee's performance on the PGIM Case-based Discussion rating form throughout the session. The assessor provides an overall 'competence' rating based on the outcome of the encounter.
- If a trainee receives a rating which is unsatisfactory, the assessor must complete the 'Suggestions for development' section. The form cannot be submitted if this section is left blank.
- Discussion of the case(s) is immediately followed by feedback from the assessor.
- Feedback should focus on the trainee's clinical decision making skills and include comments on what the trainee did well and areas for improvement.
- If any significant areas for development are identified during the session, the assessor and the trainee should devise a remediation plan.

**ANNEXURE 10: DIRECTLY OBSERVED PROCEDURAL SKILLS**

Date of Assessment (DD/MM/YY)  /  /       Trainee's Surname

/  /       Trainee's Forename

Trainee's Year       Trainee's GMC Number

Assessor's Email

Consultant       SAS       SpR       SHO       GP       Nurse       Other

Clinical Setting (e.g. A&E, ICU, In-Patient):

Procedure:

Please score the trainee on the scale shown. Please note that your scoring should reflect the performance of the trainee against that which you would reasonably expect at their stage/year of training and level of experience. Please mark 'Unable to Comment' if you feel you have not observed the behaviour.

| <i>Well below expectation for stage of training</i>                                  | <i>Below expectation for stage of training</i> | <i>Borderline for stage of training</i> | <i>Meets expectation for stage of training</i> | <i>Above expectation for stage of training</i> | <i>Well above expectation for stage of training</i> | <i>Unable to Comment</i> |
|--|--|---|--|--|---|--------------------------|
| Demonstrates understanding of indications, relevant anatomy, technique of procedure: |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Obtains informed consent:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Demonstrates appropriate preparation pre-procedure:                                  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Appropriate analgesia or self-sedation:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Technical ability:   |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Aseptic technique:   |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Seeks help where appropriate:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Post procedure management:   |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Communication skills:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Consideration of patient/professionalism:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |
| Overall ability to perform procedure:  |  |   |  |  |   |                          |
| <input type="checkbox"/>   | <input type="checkbox"/>                       | <input type="checkbox"/>                | <input type="checkbox"/>                       | <input type="checkbox"/>                       | <input type="checkbox"/>                            | <input type="checkbox"/> |

Based on this observation please now rate the level of independent practice the trainee has shown for this procedure:

| Level of Independent Practice   |                          |
|---|--------------------------|
| Rating  |                          |
| Unable to perform the procedure   | <input type="checkbox"/> |
| Able to perform the procedure under direct supervision/assistance           | <input type="checkbox"/> |
| Able to perform the procedure with limited supervision/assistance           | <input type="checkbox"/> |
| Competent to perform the procedure unsupervised and deal with complications | <input type="checkbox"/> |

Which aspects of the encounter were done well?

Any suggested areas for improvement?

Agreed Action:

Trainee's Signature..... Assessor's Signature.....

**ANNEXURE 11: RECOMMENDED MINIMUM NUMBER OF PROCEDURES**

| <b>Syllabus area</b>   | <b>No.</b> |
|--|------------|
| <b>Basic Electroencephalography</b>                            |            |
| Record EEG Adult   | 10         |
| Report EEG Adult   | 500        |
| Record EEG Paediatric/Neonatal                                 | 10         |
| Report EEG Paediatric/Neonatal                                 | 100        |
| <b>Basic Nerve Conduction and EMG</b>                          |            |
| NCS (Common Nerve Entrapments)                                 | 300        |
| NCS for less common nerve lesions                              | 50         |
| NCS for Generalized Neuropathy                                 | 100        |
| EMG for neurogenic disorders                                   | 100        |
| EMG in myopathy  | 10         |
| Repetitive Nerve Stimulation                                   | 10         |
| NCS and/or EMG in paediatrics                                  | 25         |
| Perform & interpret single fibre EMG                           | 5          |
| <b>Basic Evoked Potentials</b>                                 |            |
| Record VEPs  | 10         |
| Interpret VEPs   | 50         |
| Record BSER or BSER audiograms                                 | 10         |
| Interpret BSER or BSER audiograms (minimum 10 BSER audiograms) | 50         |
| Record SSEPs   | 5          |
| Interpret SSEPs  | 5          |

**ANNEXURE 12: AUTHENTICATED ACTIVITY FORM**

**Date:** .....

**Setting:** .....

**Activity:**

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

**Signature of Supervisor**

**Date**





***General / Specific comments***

.....  
.....

Signature of Trainer :-

Date :-

Designation :-



**Comments about the trainee (BLOCK CAPITALS PLEASE) – Write in English/ Sinhala/ Tamil**

Your

(You can remain Anonymous)

Signature:

**Please place form in the attached self addressed envelope and return to the PGIM (PTMU) named on the envelope. DO NOT return to the Registrar or Senior Registrar.**

**We are very grateful for your independent and honest rating our all trainees.**

---