



University of Calcutta

Six week Certificate course on “Electrophysiological & Neuroimaging Studies including Mathematical Modelling offered by The Centre with Potential for Excellence in a Particular Area (CPEPA), University of Calcutta

Submission of Application: in a white page with 2 copies of resume and attested copy of relevant documents addressing

Coordinator, CPEPA, in the following address.

Coordinator, CPEPA, University of Calcutta
Development and Planning Officer, office
Darbhanga Building
Asutosh Siksha Prangan (College Street Campus)
Kolkata 700073
West Bengal, India

Last DATE o Submission of application : 20th of July, 2016.

Candidates will be selected through an interview process.

Date of commencement of course: 16 th August, 2016.

Duration of course: 6 weeks programme

The course content:

Certificate Course on Electrophysiological & Neuroimaging Studies including Mathematical Modelling

Theoretical Papers

6Wk; 6 hrs/wk = 36 hrs

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Total Duration: 108 hours

Demonstration classes

6Wk; 2 hrs/wk = 12 hrs

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6Wk; 2 hrs/wk = 12 hrs

Total Duration: 36 hours

Module 1: PHYSIOLOGY

Theory

(A) Brain structure and function

Brain regions and functional networking; Brain cell types and cellular dynamics, Brain biochemistry including neurotransmitters; Brain immunology, Neuronal growth factors, Brain stem cells, Cognition and its Physiology; Neurodegenerative diseases.

(B) Brain Imaging for research and disease diagnosis

Invasive techniques for cellular and molecular imaging including Histology/Histochemistry, Immunohistochemistry, microscopy, Western Blot, ELISA, PCR/real-time PCR, Noninvasive techniques for brain structural and functional imaging including CT, MRI/f-MRI/MRS, f-NIRS, EEG, Brainomics, Brain mapping, Physiome project, artificial intelligence.

(C) Gene expression analysis

1. a) Basics of gene and genome b) Prokaryotic and eukaryotic and gene expression pattern, c) gene expression assays d) Principles of Gene expression, immune blot, PCR, Real time PCR

(D) In vivo imaging:

- a) Basics of in vivo imaging,
- b) Principles, Applications,
- c) Contemporary methods of imaging,
- d) Suitability of application in case to case situation.

(E) Structure and functions of heart

Myocardial ischemia, associated mechanisms, Role of oxidative stress in the development of myocardial ischemia, myocardial electrophysiological, haemodynamic changes during oxidative stress

(F) Antioxidants in protection / prevention of myocardial ischemia

Demonstration

(A)

1. Myocardial ischaemia: Genesis and aftermath

2. Reactive Oxygen Species and Oxidative Stress; exploring the biochemical link
3. (i) Role of oxidative stress in the development of myocardial ischaemia and its associated electrophysiological and haemodynamic changes.

(ii) Assessment of alterations in biomarkers of oxidative stress
4. Role of antioxidants in the protection / prevention of myocardial ischaemia and its mechanisms
5. Cardio-protective efficiency of melatonin as an antioxidant

(B)

1. In vivo imaging basics: Demonstration
2. Probes for in vivo imaging
3. Case to case analysis of images
4. Imaging softwares
5. Gene expression methods and techniques: PCR, Real Time PCR and Immune Blot: Demonstration

(C)

1. Demonstration of *in vivo* imaging of brain e.g. f-NIRS study
2. Demonstration of *in vitro* imaging of brain tissues e.g. histo-morphometric procedures and microscopy.

Module 2: PSYCHOLOGY

Theory

(A)

1. Working Memory,
2. Executive function,
3. Memory,
4. Emotion & Cognition,
5. Decision Making,
6. Problem Solving & Reasoning

(B) Theory of Psychological Assessment

Biofeedback, Cognitive Retraining

(C) Selected Neuro-degenerative disorders

Selected Psychiatric disorders, Autism

Demonstration

Psychological Assessment

1. Psychophysiological Assessment
 2. Electrophysiological Assessment.
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Module 3: APPLIED MATHEMATICS

Theory

(A) ELEMENTARY MATLAB COURSE

Data plotting in two dimension and three dimension, Plotting multiple data set in a single figure, curve fitting (from a data set), Histogram and Bar plot from data, mean, standard deviation, correlation coefficient, PDF and CDF plotting.

(B) Input and Output. Arithmetic. Algebra. Managing Variables. Functions. Array Mathematics and Manipulation. For Loops. While Loops. If-Else-End Construction. Switch-Case Construction. MATLAB Graphics.

(C) Preliminary Concepts of Mathematical Modelling. Fundamentals of time series analysis with applications in signal analysis

(D) Generation of prime numbers. Finding roots of polynomial equation. Solving system of equations. Interpolation. Integration and differentiation. Least squares curve fitting. Function optimisation. Inverse of a matrix. Eigenpairs of a matrix. Numerical solution of IVP, Numerical solution of BVP, 2-D graphics, 3-D graphics.

Demonstration

(A) Matlab

(B) Mathematical Modelling

(C) 2-D graphics, 3-D graphics.

| <i>Day</i> | <i>Tuesday</i> | <i>Wednesday</i> | <i>Thursday</i> | <i>Friday</i> | <i>Monday</i> |
|---------------|--|---|--|--|---|
| <i>Week 1</i> | Psychology Working Memory, Executive function | Physiology Brain structure and | App. Maths (PRELIMINARY CONCEPTS OF | <i>Demonstration</i> (Elementary MatLab) | <i>Demonstration</i> Module A(Physiology) |

Schedule of the certificate course on Electrophysiological & Neuroimaging Studies including Mathematical Modelling at CPEPA

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| | | function | MATHEMATICAL MODELLING) | | |
| Week 2 | Psychology Memory Emotion & Cognition | Physiology Brain Imaging for research and disease diagnosis | App. Maths (MATLAB LOOP STRUCTURE) | <i><u>Demonstration Psychological Assessment</u></i> | <i><u>Demonstration Module A cont. (Physiology)</u></i> |
| Week 3 | Psychology Decision Making, Problem Solving & Reasoning | Physiology Gene expression analysis | App. Maths (ELEMENTARY MATLAB COURSE) | <i><u>Demonstration Psychological Assessment</u></i> | <i><u>Demonstration Module B (Physiology)</u></i> |
| Week 4 | Psychology Psychophysiological & Electrophysiological assessment: some relevant issues; | Physiology In vivo imaging | App. Maths (ADVANCED COMPUTATION) | <i><u>Demonstration Psychophysiological</u></i> | <i><u>Demonstration Module C (Physiology)</u></i> |
| Week 5 | Psychology Biofeedback | Physiology Structure and functions of heart | App. Maths (ADVANCED COMPUTATION) | <i><u>(Demonstration of Advanced Computation)</u></i> | <i><u>Demonstration Electrophysiological</u></i> |
| Week 6 | Psychology Cognitive Retraining | Physiology Antioxidants in protection / prevention of myocardial ischemia | App. Maths (ADVANCED COMPUTATION) | <i><u>Presentation of the Assigned Task</u></i> | <i><u>Presentation of the Assigned Task</u></i> |