



FORMAT FOR COURSE CURRICULUM

Course Title: Techniques in Neurosciences

Credit Units: 4

Course Level: PG

Course Code: NURO619

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
3	0	2	0	4

Course Objectives: The goal of this course is to teach students about the principles, methods and applications of methods used for Neuroscience research along with details of all basic research techniques

Pre-requisites: Students are expected to have basic understanding of biology and neuroscience.

Course Contents/Syllabus:

	Weightage (%)
<p>Module I- Sectioning and Microscopy techniques</p> <ul style="list-style-type: none"> •Principles and applications of microscopy •Numerical aperture, limit of resolution, types of objectives, ocular and stage micrometers •Types of microscope: Bright-field microscope, Dark-field microscope, Phase-contrast microscope, Differential interference contrast microscope, Fluorescence microscope, Confocal microscope, Atomic force microscopy, Transmission and scanning electron microscopes •Basic concepts of stereology and image analysis •Principles of fixation, sectioning and staining of brain tissue using various sectioning instruments (microtome, freezing microtome, cryostat). 	30%
<p>Module II- Analytical Techniques</p> <ul style="list-style-type: none"> •UV and Visible Spectroscopy •Chromatographic methods- TLC and Paper chromatography, Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography •HPLC and FPLC •Electrophoresis-Polyacrylamide and Agarose gel electrophoresis •Isoelectrofocussing •Principle and types of centrifuges and their applications •Mass spectrometry •NMR and X-ray crystallography 	30%
<p>Module III- Molecular Techniques</p>	20%

<ul style="list-style-type: none"> •Detailed methods for preparation of buffers and solutions with concepts of normality, molarity, etc. •DNA and RNA isolation from brain tissue •Preparation of recombinant DNA •Preparation of genomic and c-DNA libraries •Screening of gene libraries •Hybridization techniques-Southern, Northern, Western, dot and slot blots and in situ hybridization •DNA sequencing PCR types and applications 	
Module IV–Neurophysiology and neuroimaging Techniques	20%
<ul style="list-style-type: none"> •Tools in electrophysiological studies of the brain in animals •Animal activity monitoring, different types of mazes and their application in studies on behavior •Rotarod, grip strength meter •Pain sensitivity testing •Cell culture and in vitro models for neuroscience research. Detailed neuroimaging methods: MRI, fMRI, PET,CT,SPECT 	

Student Learning Outcomes:

After completion of this course students will be able to:

- Understand the principles behind experimental tools and techniques used for research.
- Identify the techniques to be used for particular research objectives
- Learn the structure and application of various types of microscopes, fixing and staining methods.
- Understand and learn principles of gene manipulation

Pedagogy for Course Delivery:

There will be lecture-based classes along with assignments. Course will be taught by digital as well as traditional methods. Progress of class will be monitored by oral/written examinations and group discussions.

Lecture Plan/Session Plan:

Lectures: 44

Tutorials/Assignments/Seminars:

Class Test: 1

Total: 45

Lab/ Practicals details, if applicable: 30

List of Experiments:

- Estimation and separation of protein by native PAGE and SDS-PAGE.
- Detection of housekeeping proteins (Actin, GAPDH) using Western Blotting.
- Density gradient centrifugation to separate different cell types from blood/brain.
- Sectioning of fixed brain tissue with freezing microtome and staining sections on slide with Nissl. Observing these sections under microscope to identify brain regions..

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
75	25	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Tem Exam	Project	Viva	Attendance	
Weightage (%)	10%	10%	5%	5 %	70

Practical Assessment

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Lab book	Lab work	Viva	Attendance	
Weightage (%)	10%	10%	5%	5 %	70

Text Reading:

- **Boyer: Modern Experimental Biochemistry and Molecular biology (2nd ed 1993, Benjamin/Cumin)**
- **Wilson and Walker “Principles and Techniques of Practical Biochemistry” 4 Edn., Cambridge Knew pros 1997**
- **Wadhwa &Dinda, Stereology, Image Processing and Quantitative Image Analysis in Biomedical Research**