NS3001: TECHNOLOGIES IN NEUROSCIENCE

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Technologies in Neuroscience

Subject Code
NS - Neuroscience
Course Number
3001

Academic Unit
Neuroscience (NS)

College/School
Jockey Club College of Veterinary Medicine and Life Sciences (VM)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
Students will learn in-depth knowledge of advanced technologies for brain research and conduct hands-on practices in approved facilities under the direction and supervision of laboratory educators. Students will understand the mechanistic

and analytical procedures of most recent neuroscience technologies and develop adequate technical skills to access required laboratory competencies. Toward the course end, students can apply the scientific concepts and principles to a wide range of recent methodologies used in today's brain research. In this regard, the course will introduce the most classical and advanced techniques and neuroscience equipment to identify various brain functions such as molecular and genetic tools for brain research, neurophysiological recordings, optical imaging, brain mapping, and brain stimulation methods. The most up-to-date neurotherapeutic methods for the alleviation of various brain diseases will also be discussed.

Course Intended Learning Outcomes (CILOs)

	CILOs	**Weighting (if app.)**	**DEC-A1**	**DEC-A2**	**DEC-A3**
1	Demonstrate competency in the processing and analysis of brain specimens in the brain research laboratory	20	x	x	
2	Learn the basic concepts and principles of recent methodologies used in today's brain research	30		x	
3	Use computerized instruments for analytical procedures of brain research properly, accurately, safely, and correctly	20	x	x	
4	Apply immense knowledge of advanced technologies to understand cognition and behavior	20		x	x
5	Critically discuss the most up-to-date neurotherapeutic methods for the alleviation of various brain diseases	10	x		x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	**Brief Description**	**CILO No.**	**Hours/week (if applicable)**
1	Lectures	Lectures deliver methodology-specific knowledge	2, 3, 4, 5	
2	Laboratory sessions	Laboratory sessions will allow the students todevelop practical skills	1, 3, 4, 5	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term exam	1, 2, 3, 4	30	
2	Practical lab assessments	1, 3, 4, 5	30	

Continuous Assessment (%)
60

Examination (%)
40

Examination Duration (Hours)
3

Additional Information for ATs
"Minimum Passing Requirement" for this course:
A minimum of 40% in practical lab assessment as well as in examination.

Assessment Rubrics (AR)

Assessment Task
Practical Lab Assessments

Criterion
Assess students' application of materials taught in class to hands-on experiences in practice, and evaluate their skills for handling research tools and animals.

Excellent (A+, A, A-)
Sufficiently demonstrates a high level of knowledge regarding neuroscience technologies and their related applications in practice. Confidently perform a safe, measurable experiments to achieve valuable outcomes and discussion.

Good (B+, B, B-)
Acceptably, demonstrates a high level of knowledge regarding neuroscience technologies and their related applications in practice. Acceptably perform a safe, measurable experiments to achieve valuable outcomes and discussion.

Fair (C+, C, C-)
Demonstrates a fair level of knowledge regarding neuroscience technologies and their related applications in practice. Fairly, perform a safe, measurable experiments to achieve valuable outcomes and discussion.

Marginal (D)
Demonstrates a minimal level of knowledge regarding neuroscience technologies and their related applications in practice. Minimally, perform a safe, measurable experiments to achieve valuable outcomes and discussion.

Failure (F)
Not even reaching marginal levels

Assessment Task
Mid-term Exam

Criterion
To test students' application of materials taught in the half of class and evaluate their performance on the exam

Excellent (A+, A, A-)

Demonstrates highly developed knowledge and understanding concerning neuroscience technologies and their related applications.

Good (B+, B, B-)

Demonstrates well-developed knowledge and understanding of neuroscience technologies and their related applications.

Fair (C+, C, C-)

Demonstrates basic knowledge and understanding of neuroscience technologies and their related applications.

Marginal (D)

Demonstrates minimal knowledge and understanding of neuroscience technologies and their related applications.

Failure (F)

Not even reaching the marginal level

Assessment Task

Final Exam

Criterion

To test students' application of materials taught in the last half class and evaluate their performance on the exam

Excellent (A+, A, A-)

Demonstrates highly developed knowledge and understanding concerning neuroscience technologies and their related applications.

Good (B+, B, B-)

Demonstrates well-developed knowledge and understanding of neuroscience technologies and their related applications.

Fair (C+, C, C-)

Demonstrates basic knowledge and understanding of neuroscience technologies and their related applications.

Marginal (D)

Demonstrates minimal knowledge and understanding of neuroscience technologies and their related applications.

Failure (F)

Not even reaching the marginal level

Part III Other Information

Keyword Syllabus

General brain structure and functions
Electrophysiology: in vitro and in vivo field unit recording
Electrophysiology: whole-cell recording
Genetic and molecular tools for identifying neural functions
Animal models for studying brain functions and disease
Anatomical and immunochemical techniques for brain research
Neural interface devices for investigating brain functions and diseases
Optical imaging techniques
Brain mapping techniques
Electroencephalography (EEG) and Magnetoencephalography (MEG)
Magnetic resonance imaging (MRI)

Optogenetics
Neurotherapeutic methods

Reading List

Compulsory Readings

	Title
1	Guide to Research techniques in Neuroscience, 3rd edition. Matt Carter, Rachel Essner, Nitsan Goldstein, Manasi Lyer, 2022
2	Neuroscience, sixth edition, Editor Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Anthony-Samuel LaMantia, Richard D. Mooney, Michael L. Platt, Leonard E. White.

Additional Readings

	Title
1	Nil