PH8006: ADVANCED MOLECULAR DIAGNOSTICS AND IMAGING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Advanced Molecular Diagnostics and Imaging

Subject Code
PH - Infectious Diseases and Public Health
Course Number
8006

Academic Unit
Infectious Diseases and Public Health (PH)

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

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course introduces students to state-of-the-art molecular diagnostics and imaging techniques through a combination of principle instruction and practical training. Students will gain hands-on experience with advanced technologies, including but not limited to, bacterial identification using MALDI-TOF, confocal fluorescence microscopy, SEM, flow cytometry, micro-CT imaging, and 3D printing. Emphasis will be placed on the application of these technologies to real-world research projects, with students encouraged to bring their own samples related to their research project for lab practice. The course aims to equip students with the skills and knowledge needed to apply cutting-edge molecular biological tools effectively in research and diagnostics settings.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the principles and applications of advanced molecular diagnostic and imaging tools.	30%	x	x	
2	Apply hands-on skills to operate and troubleshoot advanced biological platforms.	40%		x	x
3	Propose innovative research applications for the technologies learned in the course.	30%	x	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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Lectures introducing the principles and applications of molecular diagnostics and imaging.	1, 3	1.5 h/wk
2	Laboratory-based practical sessions	The laboratory sessions providing hands-on training in confocal microscopy, flow cytometry, and other platforms.	1, 2, 3	4 h/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Laboratory worksheets	1, 2	40	-	No

2	Assignment	1, 2, 3	60	Small group case write-up and presentation	No

Continuous Assessment (%)

100

Assessment Rubrics (AR)

Assessment Task

1. Lab reports

Criterion

Students will apply their knowledge of each topic to the hands-on practice and synthesize the information learned in the practical sections.

Excellent

Demonstrates a comprehensive understanding of laboratory concepts; submits a well-structured, grammatically correct report with insightful conclusions

Good

Demonstrates a solid understanding of laboratory concepts; Submits a structured report with minor errors and reasonable conclusions.

Fair

Demonstrates a basic understanding of laboratory concepts but requires assistance to apply knowledge effectively; submits a poorly structured report with frequent grammatical or logical errors and unclear conclusions.

Marginal

Demonstrates minimal understanding of laboratory concepts; report shows poor structure with frequent grammatical or logical errors; conclusions are vague or weakly supported.

Failure

Fails to demonstrate understanding of laboratory concepts; report lacks structure, contains numerous errors, and fails to present logical conclusions.

Assessment Task

2. Assignment

Criterion

Students will apply the techniques in this course to generate a case study in a research or clinic setting and present the results to the class.

Excellent

Effectively applies the techniques from the course to create an innovative case study, demonstrating exceptional understanding of the contents; delivers a well-organized, engaging, and professional presentation.

Good

Successfully applies techniques from the course to create a case study, demonstrating solid understanding and integration; delivers a clear and organized presentation, with good explanations of results.

Fair

Applies the techniques in the study but demonstrates limited understanding and integration; presentation is somewhat organized but lacks clarity, with insufficient explanations.

Marginal

Applies some techniques from the course but with limited relevance or accuracy; presentation lacks clarity and is inconsistently organized, with weak or partially developed explanations.

Failure

Fails to apply techniques from the course into the case study; presentation is poorly organized and unclear.

Part III Other Information

Keyword Syllabus

Molecular diagnostics, Imaging techniques, Confocal microscopy, Flow cytometry, 3D printing applications, Micro-CT imaging

Reading List

Compulsory Readings

	Title
1	Lab protocols and user manuals for diagnostic and imaging platforms (to be provided during the course).

Additional Readings

	Title
1	Albrecht, C., 2008. Joseph R. Lakowicz: Principles of fluorescence spectroscopy.
2	Lay Jr, J.O., 2001. MALDI‐TOF mass spectrometry of bacteria. Mass spectrometry reviews, 20(4), pp.172-19
3	Adan, A., Alizada, G., Kiraz, Y., Baran, Y. and Nalbant, A., 2017. Flow cytometry: basic principles and applications. Critical reviews in biotechnology, 37(2), pp.163-176.
4	Kannan, M., 2018. Scanning electron microscopy: Principle, components and applications. A textbook on fundamentals and applications of nanotechnology, pp.81-92.
5	Schambach, S.J., Bag, S., Schilling, L., Groden, C. and Brockmann, M.A., 2010. Application of micro-CT in small animal imaging. Methods, 50(1), pp.2-13.
6	Morgan, C.A., Herman, N., White, P.A. and Vesey, G., 2006. Preservation of micro-organisms by drying; a review. Journal of microbiological methods, 66(2), pp.183-193.