UNIVERSITI TEKNOLOGI MARA

BIO711: ADVANCED INSTRUMENTATION

Course Name (English)	ADVANCED INSTRUMENTATION APPROVED
Course Code	BIO711
MQF Credit	3
Course Description	Our understanding of various biological principles relies upon the ability of the scientist to learn new laboratory skills and technology, as well as to be able to plan experiments and solve problems. Thus, this course will provide the advanced practical background necessary for successful employment in the applied biology and biotechnology industry, as well as to equip students with the knowledge required to pursue advanced studies in this area. Students will take part in intensive laboratory exercises designed to introduce them to essential and advanced techniques in applied biology including the biological electron microscopes, plant transformation, cryobiology, advanced techniques in molecular biology and much more. In addition, most of the practical modules will have an associated lecture component. Also, at the end of this course students are expected to present a mini project using a selected techni
Transferable Skills	The subject provides opportunities for the students to advance their knowledge and acquire additional skills on handling, using and analysing selected equipment, protocols and procedures in various fields of research in biology.
Teaching Methodologies	Lectures, Lab Work, Field Trip, Web Based Learning, Discussion, Presentation, Supervision
CLO	CLO1 apply the concepts of the operational aspects of selected advanced techniques and instrumentations in Biology CLO2 display selected advanced techniques and instrumentations for obtaining specific measurement and data collection CLO3 present idea related to the importance and application of selected techniques and instrumentations in Biology
Pre-Requisite Courses	No course recommendations

Topics
1. Electron microscopy 1.1) 1.1 Electron microscopes-General principles and applications of TEM and SEM 1.2) 1.2 Techniques of sample preparation in TEM AND SEM 1.3) 1.3 Imaging technology in TEM AND SEM
2. Fluorescent and Confocal Microscopy 2.1) 2.1 Fluorescent Microscope-Concepts and operational 2.2) aspects of fluorescence microscope 2.3) 2.2 Applications of fluorescence microscopy technique on biological materials 2.4) 2.3 Confocal microscope- Concepts and operational aspects of confocal microscope 2.5) 2.4 Applications of confocal microscopy technique on biological materials
3. Animal Cell Culture Technology 3.1) 3.1 Principles and methods of culturing cells, tissues, and organs of animals 3.2) 3.2 Applications of animal cell culture technology
4. Plant Tissue Culture Technology 4.1) 4.1 Principles and methods of culturing cells, tissues, 4.2) and organs of plants 4.3) 4.2 Agrobacterium biology, including the construction of 4.4) Ti plasmid vectors used in plant transformation 4.5) 4.3 Modern methods of plant breeding especially with 4.6) respect to breeding for abiotic stress resistance

5. Plant and Animal Cryopreservation 5.1) 5.1 Cryopreservation- theory and practical 5.2) considerations 5.3) 5.2 New and retrospective insights in cryoprotection 5.4) 5.3 Cryopreservation protocols for working laboratories 5.5) 5.3.1 Selected plant cryopreservation 5.6) 5.3.2 Selected animal cryopreservation 5.7) 5.4 Viability assessments
6. Advanced Molecular Biology Techniques 6.1) 6.1 In vitro or recombinant DNA/cloning techniques 6.2) emphasizing the isolation, manipulation and 6.3) molecular characterization of DNA and RNA 6.4) 6.2 In vivo genetic analysis in selected prokaryotic and 6.5) eukaryotic organisms including mutagenesis and 6.6) genetic mapping in E.coli, as well as use of gene 6.7) fusions to assess gene expression in vivo 6.8) 6.3 Computer applications in molecular biology
7. Proteomics Technology 7.1) 7.1 Principles of proteomics 7.2) 7.2 Strategies for sample preparation 7.3) 7.3 Strategies for protein separation 7.4) 7.4 Protein identification by mass spectrometry: 7.5) 7.4.1 Ionization methods 7.6) 7.4.2 Ion fragmentation 7.7) 7.4.3 Types of mass spectrometer 7.8) 7.5 Informatics in proteomics 7.9) 7.6 Validation of proteomics data

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	1 Assignment (review article)	30%	CLO3
Lab Exercise	1 Lab Exercise	20%	CLO2
Presentation	1 Presentation	20%	CLO3
Test	1 Test	30%	CLO1

Reading List

Reference Book Resources

- **J.J. Bozzola and L.D. Russell 1999, *Electron Microscopy: Principles and Techniques for Biologists. 2nd ed.*, 2nd Ed., Jones and Bartlett Publishers [ISBN: 0763701920]**
- **Michael Richard Green,Joseph Sambrook, *Molecular Cloning*, 4 Ed. [ISBN: 1936113422]**
- **Rob DeSalle Gonzalo Giribet Ward Wheeler 2002, *Techniques in Molecular Systematics and Evolution*, 1 Ed., 17, Springer Basel AG USA [ISBN: 978-3-7643-62]**
- **John H Davis 2011, *Animal Cell Culture Essential Methods*, 1 Ed., 11, Wiley Blackwell UK [ISBN: 978-0-470-666]**
- **Richard Twyman 2013, *Principles of Proteomics*, 2nd Ed., CRC Press United Kingdom [ISBN: 978-081534472]**

Article/Paper List

This Course does not have any article/paper resources

Other References

- **n/a Beverly Clendening*An Advanced Molecular Techniques Laboratory Course Using Drosophila melanogaster* http://www.faculty.virginia.edu/evolutio nlabs/ClendeningBiosceneDrosophilav28-1p 3-19.pdf**