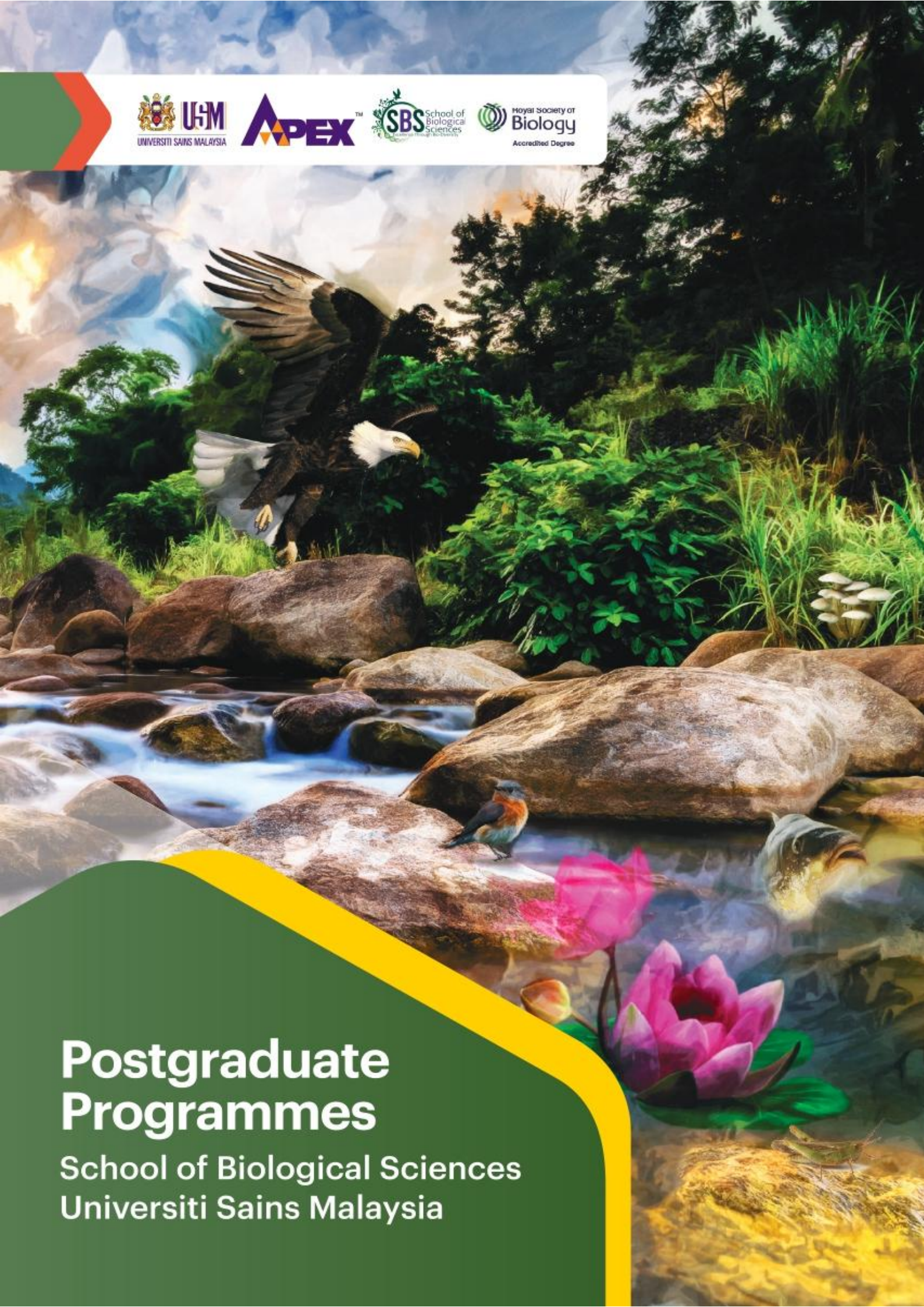


Postgraduate Programmes

School of Biological Sciences
Universiti Sains Malaysia

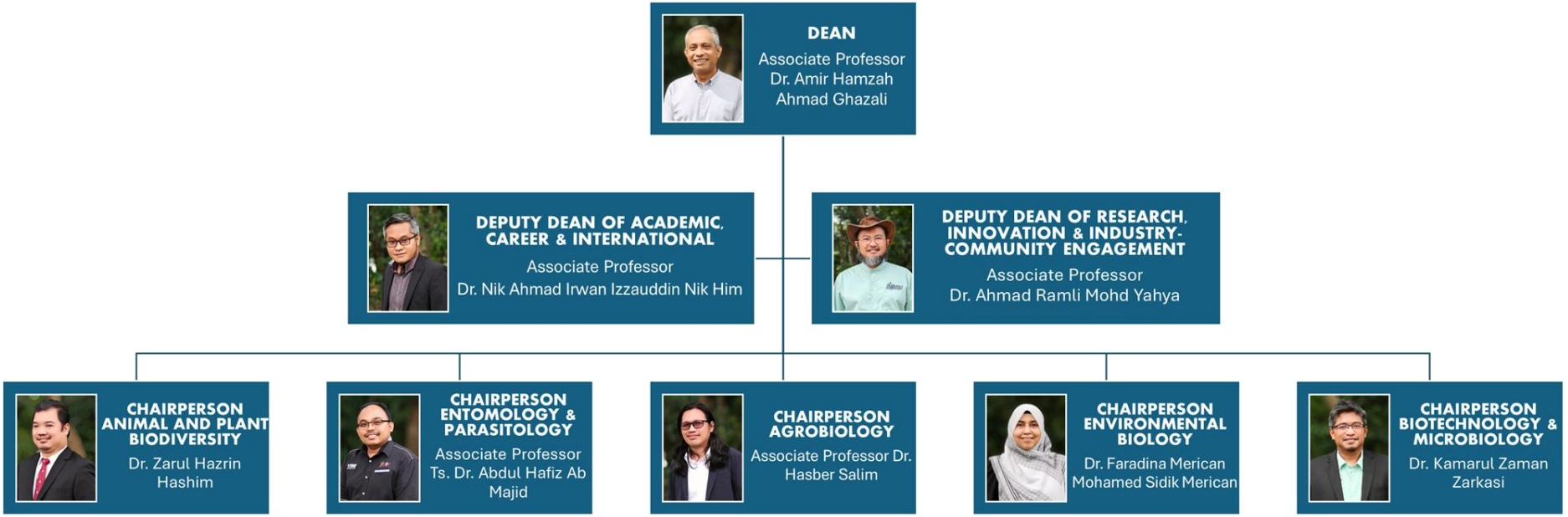
01. INTRODUCTION

THE SCHOOL OF BIOLOGICAL SCIENCES at Universiti Sains Malaysia is among the university's largest schools on the main campus. It comprises multi-disciplinary programmes that combine fundamental and applied biological sciences from botany, zoology, microbiology, ecology, genetics, biostatistics and biochemistry with other disciplines such as molecular biology and biotechnology. We have a vibrant multicultural academic staff that is dedicated to teaching and research excellence. Students benefit from our devoted academic community as well as our high-quality, comprehensive, and cutting-edge teaching and research facilities. Undergraduates are trained to develop their scientific skills through field works and their final year research projects. They will also have numerous opportunities to participate in a variety of co-curricular activities and enjoy the exciting university lifestyle.

The School of Biological Sciences collaborates with a number of international and local universities and research institutes on research and development activities. These collaborations are of primary importance as they can provide new ideas and awareness of emerging technologies for both the academic staff and postgraduate students. The school offers MSc and Ph.D. graduate research degrees. Students will gain research skills in the most relevant and current technologies through post-graduate training.

Our academic staff members are also active researchers, many of whom are well known in their respective fields and have received prestigious awards for their outstanding effort. Our strength in research is also reflected in the number of postgraduates we produced each year and the number of publications in highly reputable journals. Our overall achievement placed us among the top five high-performing schools at the university. Most importantly, our mission is to do our utmost to nurture our students to be highly versatile graduates in the field of life sciences

02. KEY ADMINISTRATORS



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03. OVERVIEW OF THE PROGRAM AGROBIOLOGY

The Agrobiology program is designed to provide students with a solid foundation in agricultural science, emphasizing sustainable crop production and plant health management. This multidisciplinary program integrates biological sciences with practical agricultural applications to address both current and emerging challenges in food production systems. A key strength of the program is its focus on applied research and hands-on learning. In plant pathology, students study the biology, diagnosis, and control of plant diseases caused by fungi, bacteria, and viruses. In the area of agronomy and soil fertility, students explore crop management, nutrient cycling, and sustainable soil practices. The use of vermicompost, an organic fertilizer derived from earthworm activity, is emphasized for its ability to improve soil structure, enhance microbial activity and boost crop yields. This is complemented by research on mycorrhizae, beneficial soil fungi that form symbiotic relationships with plant roots to enhance nutrient uptake, stress tolerance, and overall soil health. Plant tissue culture is another core area, providing students with hands-on training in micropropagation and ***in vitro*** techniques for plant improvement, conservation, and large-scale propagation. A notable expertise within the program is the micropropagation of strawberries, producing high-quality, disease-free plantlets for commercial cultivation.

Mycology and mushroom cultivation is also a key component where students study fungi as both plant pathogens and beneficial organisms. In applied mycology, students are trained in cultivating edible and medicinal mushrooms such as Pleurotus and Ganoderma, covering spawn production, substrate preparation, and post-harvest handling. Pest management covers both insect and vertebrate pests, emphasizing Integrated Pest Management (IPM) strategies that combine biological, cultural, and chemical controls. A

distinctive feature is the use of Barn Owls (Tyto alba javanica) as a natural predator to manage rat populations in agricultural settings—reflecting the program's commitment to eco-friendly pest control and biodiversity conservation. Overall, the Agrobiology program at USM prepares graduates to become skilled professionals and researchers who are capable of advancing sustainable agriculture and ensuring food security through innovative science-based approaches.

Plant Pathology

Plant pathology is a branch of study that focuses on interaction between pathogens and plants. It is challenging, fascinating, important, and worth studying with a main goal of protecting the food available for humans and animals as well as to overcome issues of food security and food safety. Our research in plant pathology is emphasizing on studies of fungal and bacterial pathogens from various genera. Research areas cover several aspects of mycology, pathogen biology, mycotoxigenic fungi, disease diagnosis, pathogenicity and host range, plant disease epidemiology, plant pathogen taxonomy, population genetics of plant pathogens, and disease control methods on a wide range of agricultural crops. Plant tissue culture and molecular biology techniques are also incorporated in related studies. The focus of plant pathology research also involves detailed examination of mycoherbicides, mycorrhizae, and tropical plant diseases.

Soil Fertility and Mycorrhizae

The research is concentrating on the accessibility of essential nutrients within the soil matrix and their assimilation by plant systems. A further significant dimension within this research domain pertains to the generation of superior quality biofertilizer, specifically vermicompost, which is synthesized through the digestive processes of epigeic earthworms, particularly *Eudrilus eugeniae*, nourished with a variety of organic waste materials. The process of vermicomposting embodies the principles of a circular economy; wherein waste materials are transformed into advantageous organic fertilizers. As a result, the positive impacts of integrating vermicompost into soil systems and the resultant enhancement of plant growth performance are systematically assessed. The mycorrhizal investigation is directed towards three distinct classifications of mycorrhizal fungi: arbuscular mycorrhizal fungi, ectomycorrhizal fungi, and orchid mycorrhizal fungi, all of which are recognized to inhabit tropical climatic zones. Mycorrhizal fungi are acknowledged for their pivotal function in facilitating nutrient absorption for plants, particularly with respect to phosphorus acquisition. Research concerning mycorrhiza is centred on the identification of mycorrhizal fungi, their biodiversity, and their interactions with host plants, as well as their ecological roles, such as utilizing mycorrhizal fungi to augment the phytoremediation process.

Plant Tissue Culture, Mycology & Mushroom Cultivation

This core research element combines plant tissue culture, mycology, and mushroom cultivation to support sustainable agriculture and agro-biotechnology. In plant tissue culture, the focus is on the micropropagation of strawberries, using ***in vitro*** techniques such as shoot tip culture and somatic embryogenesis to produce uniform, disease-free plantlets for commercial cultivation and genetic conservation. Students gain practical

skills in sterile handling, media preparation, and acclimatization of plantlets. Mycology complements this by examining fungi as both plant pathogens and beneficial organisms. Research includes the identification and management of agriculturally important fungi such as *Fusarium*, *Ganoderma*, and *Rhizoctonia*, alongside the development of fungal-based biocontrol strategies. Students also explore the ecological roles of fungi in soil and plant health. This element is further strengthened by applied research in mushroom cultivation, particularly on edible and medicinal species **such as** *Pleurotus* and *Ganoderma*. Students are involved in spawn production, substrate preparation using agro-waste, cultivation techniques, and post-harvest handling. This research not only contributes to food security and functional food development but also promotes rural entrepreneurship and sustainable agro-waste recycling. Collectively, this integrated research **elements equip** students with knowledge and skills relevant to modern plant propagation, disease management, and environmentally responsible agricultural practices.

Agricultural Pest Management (Insect and Vertebrate Pests)

Pest management involves the study of the biology and ecology of economically significant pests including both insect and vertebrate species. Classical pest control strategies such as physical, chemical, mechanical, cultural and biological are evaluated and implemented in combination to form a comprehensive Integrated Pest Management (IPM) approach. With the growing emphasis on sustainable agriculture, modern pest management is increasingly adopting environmentally responsible strategies that minimize harm to non-target organisms. Our research focuses on the development of area-wide IPM programs that integrate novel, sustainability-driven practices. A major portion of our work is centered on chemical control, particularly in understanding pesticide modes of action, toxicity, physiological effects, and environmental impact. We aim to improve pesticide specificity and reduce unintended effects on ecosystems and biodiversity. In addition, our research group, the Barn Owl and Rodent Research Group (BORG) (http://borg.usm.my) actively promotes the use of barn owls as biological control agents in rodent pest management. This natural approach offers an effective alternative to chemical rodenticides, significantly reducing risks to non-target wildlife and contributing to safer, more sustainable pest control strategies in agricultural systems.

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
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2	Hasber Salim, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/hasbersalim
3	Hasnuri Mat Hassan, Dr.	https://experts.usm.my/cvitae/hasnurimh
4	Latiffah Zakaria, Professor Dr.	https://experts.usm.my/cvitae/lfah
5	Masratul Hawa Mohd, Associate Professor Dr.	https://experts.usm.my/cvitae/masratulhawa
6	Mohammad Fadhli Mad' Atari, Dr.	https://experts.usm.my/cvitae/madatari
7	Nik Mohd Izham Mohamed Nor, Dr.	https://experts.usm.my/cvitae/nikizham
8	Rosnida Tajuddin, Dr.	https://experts.usm.my/cvitae/rosnidatajuddin

AGROBIOLOGY ACADEMIC PROGRAMME

Master of Science (Plant Pathology)

An applied programme in crop protection, plant pathology involves the study and understanding of the etiology, epidemiology and management of plant diseases with the aim of increasing agricultural production and limiting losses caused by pathogens and other predisposing factors. In addition to the traditional research on the various diseases of vegetable, ornamental, tree and fruit crops, other research disciplines include the study and use of microbial pathogens as bioherbicides and role of mycorrhizae in agricultural systems. The programme comprised of several fields including crop protection, fungal pathogens, soil science, mycorrhiza, biofertilizer, bioherbicide, entomology and plant pest management. Conventional and recent biological techniques, such as molecular tools, are adopted in research activities. Some areas of research are Fusarium diseases on agricultural crops in Malaysia, the role of mycorrhiza in agricultural systems, composting and development of biofertilizer and bioenhancer by rhizobacteria.

RESEARCH THRUST AREAS	
Plant Pathology	• Plant Pathogen • Tropical Plant Diseases • Plant Disease Management and Control • Mycoherbicides • Mycorrhiza • Plant Pathology

WHY CHOOSE THIS PROGRAM

- **Strong Foundation in Plant Pathology:**
  Focused on plant pathogens, tropical plant diseases, and disease management.

- **Specialized Knowledge:**
  Exposure to biological control approaches including mycoherbicides and mycorrhiza.

- **Practical & Applied Learning:**
  Students gain practical skills to improve plant health and crop protection.

- **Sustainability Focus:**
  Equips students with knowledge to support sustainable agriculture and food security.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Understand major plant diseases and their causal agents • Apply effective plant disease management strategies • Utilize biological control methods such as mycoherbicides and mycorrhiza • Develop strong analytical, diagnostic, and problem-solving skills • Support sustainable crop production and plant health management	• Plant Pathologist • Agricultural Officer • Crop Protection Specialist • Research Scientist • Roles in government agencies, plantations, laboratories, and agribiotech industries • Biological Control Specialist / Farm Advisory Services • Further studies in plant science and related fields

ADMISSION REQUIREMENTS	DURATION
Applicants should possess the following: • A minimum of 2.75/4.00 for BSc in Biology or equivalent; or • CGPA below 2.75/4.00 for BSc in Biology or equivalent with additional requirements	• Full-time: Min 2 semesters / Max 6 semesters • Part-time: Min 4 semesters / Max 12 semesters

LANGUAGE REQUIREMENTS
The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements. • A minimum of Band 5 for IELTS; or • A minimum score of 40 for TOEFL (Internet-based); or • A minimum of Band 7.5 for TOEFL Essentials (Online); or • A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or • A minimum score of 47 for Pearson Test of English (PTE); or • A minimum of Band 107 for CIEP Level (ELS); or • A minimum of Band 3.5 for Malaysian University English Test (MUET) Exemption is given to candidate if: • English is the candidate's mother tongue or National Language; or • Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

04. OVERVIEW OF THE PROGRAM ENTOMOLOGY & PARASITOLOGY

The Entomology & Parasitology Program is a research discipline focused on studying insects and parasites, exploring their biology, ecology, and impacts on human health, agriculture, and the environment. Key research areas include insect biology, parasitology, and vector biology, particularly concerning disease vectors like mosquitoes and ticks.

The program emphasizes applied science by developing pest management strategies and integrated pest management (IPM) practices that minimize environmental impact while effectively controlling pest populations. It also investigates the role of insects and parasites in public health, particularly in relation to vector-borne diseases such as malaria and dengue, aiming to create interventions to reduce disease incidence.

Additionally, the program provides training and education, equipping students with hands-on research experience and knowledge in entomology, parasitology, and epidemiology. Overall, the Entomology & Parasitology Program contributes significantly to understanding and managing the effects of insects and parasites on health and agriculture, promoting public health and environmental sustainability.

Medical Entomology

Medical entomology is a discipline that focuses on the insects and arthropods that impact human health, animals or wildlife either mental or physical. In addition, medical entomology provides a foundation of knowledge on the interaction between insects/arthropods and diseases, including biology, ecology concepts and epidemiology of arthropod disease vectors which involves the interest of public safety. Many species of arthropods are important in medical view, either causing nuisance, injury, diseases or serving as disease–causing agents and a potential of biosecurity risk. The interaction of disease transmission involves the arthropods as the main vector and alternative hosts for the transmission of diseases which involve parasites, bacteria, viruses and many more. Our research interest includes the surveillance/monitoring program, vector biology, bionomics, ecology and behaviour of vectors. Moreover, our research also focuses on the interaction of vector diseases, communication of the behavioural impact of vectors, control and management of vectors. The control and management of vectors involve chemical, bio–control methods. A part of it includes the innovation and designing of vector management with the principles and practices of integrated pest management in the public health sector. Understanding arthropod–disease interactions may help develop therapeutic measures and reduce the global economic burden of it.

Toxicology and Pesticide Resistance

A pest is any animal or plant which could cause harm to humans or brings a negative impact to human needs. An insect, rodent, weed or even fungi could be known as a pest especially if they cause damage to crop, structures or are a nuisance to people. Therefore, pesticides are constituents that control these various types of pests. One of the most common and effective pest control approaches are the usage of chemical pesticides. Toxicology of pesticide focuses on mode of action of pesticides, classification of different pesticide classes, pesticide formulation and the effects to the environment especially regarding the stability and persistence in the environment, and sublethal effects on wildlife. Uncontrolled and prolonged usage of pesticide poses a serious threat to the sustainability of pest control efforts due to the emergence of pesticide resistant population. Resistance is defined as a change in the sensitivity of a pest population to a pesticide, resulting in the failure of a correct application of the pesticide to control the pest. Understanding the underlying mechanism of pesticide resistance is crucial for the evolution of methods and practices to improve the sustainability of pest control approaches. Therefore, in order to use pesticides safely and effectively, not only must we know which pesticides to use in specific conditions, but we must also understand all biological, physiological and environmental consequences. At the School of Biological Sciences, our current study involves understanding the underlying mechanism of pesticide resistance by evaluating the efficacy of insecticides and rodenticides. Currently, several studies are focused on the development of alternative pest control methods to help control the pest population while protecting the environment and human health. These includes the usage of botanical and microbial insecticides, insect behavioural management strategies, physical approaches, and the development of biosafe–pesticide products.

Urban and Environmental Entomology

Urban Entomology is the study of insects, and related arthropods, that impact people and their property. Urban Entomology covers: (1) Pest problems resulting from modification of the environment by people. (2) Insect pest in and around structure or building. (3) Insect pest problems associated with urbanization. Environmental Entomology is the study of the biological, chemical, and physical interactions between insects and their environment. Research in this area focuses on the ecology of insects and the relationships between different insect species, either in natural environments or in laboratory settings. Other biological aspects like natality, mortality, migration, dispersal, density-dependent and density-independent factors, life tables and diversity indexes, have also been investigated in this discipline. Many insects from the orders Diptera (Culicidae, Muscidae, Calliphoridae, Sarcophagidae, and Stratiomyidae), Lepidoptera, Coleoptera, Blattodea, Hymenoptera, and Hemiptera are included in the research. Several studies have been carried out on mosquitoes (Aedes sp., Culex sp., and Anopheles sp.), houseflies (Musca domestica), black soldier flies (Hermetia illucens), termites, ants, and a wide variety of other insect species found in aquatic environments and agricultural areas. Other research topics also include insect diversity and abundance, life history of insects, phylogenetic affinities of different orders, insect adaptation in various geographical regions, species richness, and classification of insect orders up to species level with reference to the insect fauna of Malaysia. In addition to this, we maintain significant attention to the behaviour of insects. The fundamental concept of insect behaviour focuses on patterns of response to different types of environmental stimuli. Some of the research also highlights the genetic and biological functions of behaviour, including host finding, feeding, reproductive behaviour and dispersion. There are also behaviours shown by insects that are affected by environmental cues such as temperature and humidity, as well as pollution. The behaviour of insects can often be affected by a variety of environmental conditions, including those listed above.

Taxonomy and Systematics of Insects

Insects are the most diverse and abundant group of organisms in this world. The number of insect species exceed the number of all animal species. The number of insects that are still in place today is an important measure of the success of insects. Insects are not only numerous but also divergent in their taxonomic composition. Therefore, it is critical for insects to have a naming method or system for organizing them. Taxonomy and systematics of insects cover both terrestrial and aquatic insects. Taxonomy is the starting point of any biological research as being able to identify different species of insects is important in order to proceed for detailed insect study such as ecological survey of insect-pests and biological control of insect-pests. Insects are also studied as potential biological indicators for water quality monitoring, environmental disturbance and for insect-pests control approaches. Studies on insect biodiversity can help in determining their productivity potential and for better ecosystem management including urban, forest and river ecosystems. Study on these allow the management authorities, to know the condition of the existing insect fauna and assist in the management of flora and fauna of

the area in the future. Systematic covering taxonomy helps in reflecting the revolutionary relationships that link to the biology and distribution of the insect pest, vector, biological control, natural enemies and biological indicator.

Medical Parasitology

Medical parasitology involves three (3) major groups of animals: parasitic protozoa, parasitic helminths (worms), and those arthropods that directly cause disease or act as vectors of various pathogens. The diseases caused by these parasites constitute major human health problems throughout the world. Nevertheless, many parasitic infections are transmitted from animals to humans known as zoonotic infections; the human disease may or may not resemble the disease caused in the lower animal host. Several studies on zoonotic parasitic infections have been undertaken such as zoonotic malaria which focuses on the epidemiology, antimalarial drug resistance, and vector bionomics of malaria, which are being carried out in malaria-prone areas. In addition, studies are also conducted on a neglected protozoan parasite known as Blastocystis sp. which highlighted the basic properties of the pathogens, the pathogenesis of the diseases it causes, as well as the epidemiology in various species of animal hosts. Apart from that, sapro-zoonotic parasites refer to the parasites which infect humans via the environment such as soil, plants, or water sources (Blastocystis sp., Ancylostoma sp., Ascaris sp., Capillaria sp.) are also being studied focusing on the infection at the northern region of Peninsular Malaysia.

Veterinary Parasitology

Veterinary parasitology focuses on the study of animal parasites, particularly helminths and protozoa. The interaction between parasites and animal hosts is also being studied in order to learn more about the parasites behaviour and ecology. In ruminants, the research of nematodes focused on the bionomics of these nematodes, as well as therapeutic efficacy and the possible application of the plant extract, would be promising areas for exploration, particularly in Peninsular Malaysia's small ruminant industry. The use of the plant extract as an alternative to control and treat infection by nematodes was also carried out. Several potential plant extracts, such as neem (Azadirachta indica), cassava (Manihot esculenta), jackfruit (Artocarpus heterophyllus), pomegranate (Punica granatum), and guava (Psidium guajava), have shown some promising results in vitro studies against parasitic nematodes in ruminants. In addition, several studies have also been undertaken to explore protozoa infection in animal hosts. Protozoa infection in animals is a silent killer when they are responsible for the disease in the livestock industry. This study focuses on morphology and identification of the protozoan species that infect livestock as well as domestic animals. These animals include ruminant animals such as cows, buffaloes, goats, and even poultry animals. These studies also emphasise the dynamics of the infection to investigate the species and the factors that contribute to the protozoa infection in animals.

Molecular Entomology

Molecular Entomology combines entomology and molecular biology to study the genetic and molecular mechanisms of insects. Researchers use techniques like DNA sequencing, RNA-Seq, and proteomics to investigate various aspects of insect biology, including genetics, physiology, behavior, and ecology. A key research focus is identifying the genetic basis of traits such as pest resistance. By pinpointing specific genes that enable crops to resist pests, scientists can develop genetically modified organisms (GMOs) or breeding strategies that enhance crop resilience, reducing reliance on chemical pesticides.Additionally, researchers study how insects, especially disease vectors like mosquitoes, transmit diseases such as malaria and dengue. Understanding the genetic factors that affect their ability to spread these diseases is essential for developing effective public health interventions. Overall, this research aims to improve pest management and disease control through genetic insights.

Ecology & Epidemiology

Vector Ecology and Epidemiology is a research field focused on the interactions between disease vectors, such as mosquitoes and ticks, and the pathogens they transmit. It integrates ecology, entomology, and public health to understand how these vectors contribute to the spread of infectious diseases. Key research areas include vector biology, which examines the life cycles and behaviors of vectors; pathogen dynamics, which studies how pathogens thrive within vectors and their transmission abilities; and environmental influences, which analyze the impacts of climate change and land use on vector populations. Additionally, epidemiological modeling uses mathematical simulations to predict disease outbreaks and evaluate interventions like vaccination and vector control. Insights from this research are crucial for developing targeted public health strategies to control vectors and prevent disease outbreaks, ultimately enhancing disease prevention efforts and safeguarding public health from vector-borne diseases.

Household, Structural, Urban & Industrial Entomology

Household, Structural, Urban and Industrial Entomology is a research field focused on the study and management of insects that impact human environments, including homes, buildings, and industrial settings. Researchers investigate common household pests like ants, cockroaches, bed bugs, and termites, exploring their biology, behavior, and effective control methods. Structural entomology specifically examines pests that damage buildings, particularly wood-destroying insects, to develop prevention and treatment strategies. In industrial settings, the focus is on pests that infest stored products, such as grain weevils and moths, with an emphasis on integrated pest management (IPM) strategies. Additionally, many of these pests pose public health risks through disease transmission or allergens, making it crucial to understand their role in public health for effective pest management practices. Overall, research in this field aims to protect human health and property by providing insights that lead to effective pest control strategies and safer living and working environments.

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
1	Abdul Hafiz Ab Majid, Prof. Ts. Dr.	https://experts.usm.my/cvitae/abdhafiz
2	Azlinda Abu Bakar, Dr.	https://experts.usm.my/cvitae/azlindaab
3	Farah Haziqah Meor Termizi, Dr.	https://experts.usm.my/cvitae/zary
4	Hadura Abu Hasan, Dr.	https://experts.usm.my/cvitae/farahhaziqah
5	Intan Haslina Binti Ishak, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/intanishak
6	Nik Ahmad Irwan Izzauddin Nik Him, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/nikirwan
7	Nur Faeza Binti Abu Kassim, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/nurfaeza
8	Siti Nasuha Binti Hamzah, Ts. Dr.	https://experts.usm.my/cvitae/sitinasuha
9	Suhaila Binti Ab Hamid, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/ahsuhaila
10	Wan Fatma Zuharah Wan Musthapa, Assoc. Prof. Ts. Dr.	https://experts.usm.my/cvitae/wfatma
11	Zary Shariman Bin Yahaya, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/zary

ENTOMOLOGY & PARASITOLOGY ACADEMIC PROGRAMME

Master of Science (Applied Entomology)

The Applied Entomology programme are specialize in many aspects of entomology and offer training in the following areas of research: aquatic entomology, urban & structural entomology, chemical ecology, insect biochemistry and physiology, insect-plant interactions, molecular entomology, pest management, medical entomology, vector ecology & control and insect systematics. In addition, the School of Biological Sciences also houses the Vector Control Research Unit (VCRU), a leading centre in vector and urban pest control research in Asia. The unit is equipped with various facilities in insecticide resistance, toxicology and analysis, space spray applications, household and public health insecticide formulations and excellent rearing facilities for many species and strains of vector mosquitoes, cockroaches, flies, household ants and subterranean & drywood termites.

RESEARCH THRUST AREAS	
Applied Entomology	• Medical Entomology • Urban & Industrial Entomology • Agriculture Entomology • Insect Pest Management • Aquatic Entomology • Molecular Entomology • Insect Biology and Systematics

WHY CHOOSE THIS PROGRAM
• **High Career Demand:** Insects and parasites affect public health, buildings, agriculture, and the environment. Experts in entomology are needed in government, industry, and research sectors. • **Practical & Hands-On:** You will gain real-world skills in pest identification, urban pest management, vector control, and laboratory and field research. • **Industry-Relevant Research:** Your research focuses on real-world challenges such as mosquito-borne diseases, termite and bed bug infestations, insecticide resistance, and sustainable pest control. • **Strong Career Opportunities:** Graduates can work in pest management companies, public health agencies, research institutions, biopesticide and biotechnology industries, and academia.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • **Apply advanced knowledge** in entomology and parasitology to solve real-world problems in public health, agriculture, and urban environments. • **Identify and diagnose** insect and parasite species using morphological and molecular techniques. • **Design and conduct research** using appropriate scientific methods, data analysis, and critical interpretation. • **Develop sustainable pest and vector management strategies** based on scientific evidence and industry standards. • **Evaluate insecticide efficacy and resistance** using laboratory and field-based approaches. • **Communicate scientific findings effectively** in written, oral, and professional formats. • **Work collaboratively and ethically** with industry, government, and research stakeholders.	**Graduates can work in:** • Pest management companies • Public health agencies • Research institutions • Biopesticide and biotech industries • Product Development Executive (Biopesticides / Insecticides) • Regulatory or Technical Office • Academia • Vector Control Officer • Environmental Health Officer • Disease Surveillance Officer

• **Demonstrate innovation and entrepreneurial awareness** in developing practical solutions or commercial applications in pest management.	

Master of Science (Applied Parasitology)

The postgraduate programme in applied parasitology encompasses various aspects of both medical and veterinary parasitology. Studies on various aspects of malaria, especially the epidemiology and vector bionomics can possibly be carried out in the more malaria- prone areas of Perak, especially along the Malaysia-Thailand border. As regards to veterinary parasitology, the emphasis will mainly be on the trichostrongylid nematode of ruminant parasites. Studies on the bionomics of these nematodes, together with drug efficacy studies would be potential areas to be investigated both in the indigenous goat and sheep populations of northern Peninsular Malaysia. Studies using medicated urea molass blocks (MUMB) in the control of the trichostrongylid nematodes would definitely prove to be an interesting area of research for postgraduate students.

RESEARCH THRUST AREAS	
Applied Parasitology	• Parasite Biology • Protozoology • Helminthology • Molecular Parasitology • Aquatic Parasitology

WHY CHOOSE THIS PROGRAM

- **High Relevance to Global and Tropical Health**
  Parasites remain a major concern in tropical regions, affecting human health, animals, agriculture, and ecosystems. This program equips students with the knowledge and skills needed to understand, monitor, and control parasitic diseases.

- **Strong Scientific and Research Training**
  The program emphasizes advanced research in parasitology, allowing students to develop expertise in parasite biology, host–parasite interactions, diagnostics, and control strategies.

- **Focus on Real-World Applications**
  Applied parasitology focuses on practical solutions to real problems such as vector-borne diseases, zoonotic infections, food safety, and environmental health.

- **Opportunities to Work with Experts and Modern Facilities**

Students benefit from supervision by experienced researchers and access to laboratories equipped for molecular, ecological, and epidemiological studies.

- **Interdisciplinary Knowledge**
  The program integrates microbiology, entomology, epidemiology, molecular biology, and public health, preparing graduates for diverse scientific challenges.

- **Strong Career Opportunities**
  Graduates are well prepared for careers in public health and disease control agencies, research institutions and universities, biotechnology and diagnostic laboratories, pharmaceutical and vaccine industries, as well as environmental and veterinary sectors.

- **Contribution to Society and Disease Control**
  Students contribute to addressing important issues such as malaria, dengue, helminth infections, and emerging parasitic diseases affecting tropical regions.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate advanced knowledge in parasitology and related biological sciences. • Conduct independent research using appropriate scientific methods and techniques. • Analyze and interpret scientific data related to parasitic organisms and diseases. • Apply parasitological knowledge to address issues in public health, veterinary health, and the environment. • Communicate research findings effectively in written and oral forms. • Practice ethical and professional standards in research and scientific work.	• Research Scientist in universities or research institutes • Public Health Officer in disease surveillance and control • Medical / Diagnostic Laboratory Specialist • Vector Control or Pest Management Specialist • Biotechnology or Pharmaceutical Industry Professional • Environmental or Veterinary Health Consultant

ADMISSION REQUIREMENTS	DURATION
Applicants should possess the following: • A minimum of 2.75/4.00 for BSc in Biology or equivalent; or • CGPA below 2.75/4.00 for BSc in Biology or equivalent with additional requirements	• Full-time: Min 2 semesters / Max 6 semesters • Part-time: Min 4 semesters / Max 12 semesters

LANGUAGE REQUIREMENTS

The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements.

- A minimum of Band 5 for IELTS; or
- A minimum score of 40 for TOEFL (Internet-based); or
- A minimum of Band 7.5 for TOEFL Essentials (Online); or
- A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or
- A minimum score of 47 for Pearson Test of English (PTE); or
- A minimum of Band 107 for CIEP Level (ELS); or
- A minimum of Band 3.5 for Malaysian University English Test (MUET)

Exemption is given to candidate if:

- English is the candidate's mother tongue or National Language; or
- Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

05. OVERVIEW OF THE PROGRAM ENVIRONMENTAL BIOLOGY

The Environmental Biology postgraduate research program offers interdisciplinary research pathways that enhance understanding of ecosystem processes in freshwater, marine, coastal, and polar environments. Students will explore core research areas in intertidal ecology, ecological engineering, environmental assessments and aquaculture.

Our expertise in taxonomic and molecular identification of algae, zooplankton, marine invertebrates, corals and fish provide insight into current research trends in the field of biodiversity. Analytical techniques are a key component in this program designed to develop a critical eye in predicting anthropogenic influence impacting tropical mangroves, seagrass and coral reef ecosystems. Learn from experts on the current applications of nature-based solutions in blue carbon systems, habitat restoration, shoreline protection, food security and climate resilience.

Postgraduate-level training will incorporate a combination of field-based investigations and lab-based studies using cutting-edge methods such as stable isotope analysis, environmental DNA (eDNA) analysis and metagenomics. To preserve heritage values, our experts will impart knowledge on inclusivity, by building connections with communities for a holistic approach in sustainable aquaculture, conservation of natural resources and ecosystem functions. This program will unlock your potential in developing critical and technical skills for careers in research, consultancy, green technology, and conservation planning.

Freshwater Ecology

Research areas and specializations of the freshwater ecology group include the identification and characterization of freshwater organisms comprising microalgae, zooplankton and fish using both traditional and molecular approaches. These approaches will allow a true assessment of their diversity and highlights rare, poorly known and possibly endemic species in our freshwater ecosystems. The community structural analysis of these organisms are used as biological indicators for habitat assessment based on trophic status. The ecology and feeding behaviour of zooplankton and fish are also of interest together with their biogeography, structuring of communities and population abundance. Microalgae culture collection is established to study various cellular attributes of algae for phytochemical analysis, phytoremediation, biotoxin etc.

Marine and Coastal Biodiversity and Ecology

The marine and coastal includes mangroves, coral reefs, seagrass, sandy and rocky shores ecosystems comprising carbon and nutrient budgets, primary and secondary productivity, and ecosystem functions. Researchers are expert in taxonomic identification of marine plankton, benthos (foraminifera, bivalves, gastropods, crustacean, corals) and fish. Environmental impact assessments on the effect of anthropogenic activities on soft sediment assemblages are also conducted using quantitative analyses, modelling, remote sensing and GIS. Sustainable development and effective management plans of natural resources as solutions to habitat loss and human–wildlife conflicts are also of interest.

Aquaculture

Research in aquaculture involves many aspects of aquaculture in order to support the nation's effort for food and to promote large scale sustainable practices. Research activities cover a wide spectrum including feed development, culture techniques, hatchery set ups, reproduction, biotechnology, population management and fish disease. The Laboratory of Fish Genetics focuses on population genetics studies to investigate local genetic population structure of cultured or endangered species. The Laboratory of Fish Nutrition and Laboratory of Feeds and Feed Development are well known in the areas of aquafeed development for locally cultured and indigenous fish species. Laboratory of Fish Biology looks into the physiology and biochemistry of candidate aquaculture species. Other areas include water quality, disease, fish behaviour, nutrition and other aspects.

Wetlands

The research in this field focuses on the ecology, conservation and management of wetland ecosystems (rice fields, peat lands, freshwater lakes, dams, swamps, rivers and mangroves). The research areas are ecology, evolution and diversity of semi-aquatic and aquatic plants, fish, plankton, invertebrates and insects, which include the phenotypic variations and life cycle of endemic endangered and invasive species found in Malaysia. Studies on threats and changes to the various wetland types and their impacts on these ecosystems are also undertaken.

Polar Biology

Polar Biology research group has been involved in expeditions to the Antarctic and Arctic since 2003. Various research aspects are being conducted on the collected samples from diverse localities. These included diversity and taxonomy of Antarctic and Arctic microalgae, cyanobacteria and other microflora (eg. fungi), and their adaptive mechanisms through gene and enzyme studies. 'Omics' technologies are also applied to better understand their survival mechanisms. Transportation of pollen & surface pollen distribution in the Antarctic are also of interest.

Environmental Management & Conservation

We need new strategies that transverse across diversity of disciplines and at different scales to address the surging challenges in conservation and management of ecosystems. As the demands on environmental resources are ever expanding and with conflicts exploded over land use and ecosystem conservation, researchers need to establish linkages to form successful partnership with various stakeholders such as governments, activists and industries. Our researchers are leading scientist in this field who emphasise on the development of critical thinking and analytical ability to support the management, decision-making and policy formulation to ensure sustainability of the national and international priority sites. Some key expertise we accentuate are in the preparation of Environmental Impact Assessment, Quantitative Ecology Assessment with the use of analytical and numerical models, spatial technology tools such as the GIS and Remote Sensing and ecological statistics.

Taxonomy and Systematics

Taxonomy and systematics of fish, algae and zooplankton are fundamental to understanding biodiversity across freshwater and marine ecosystems. Taxonomy focuses on species identification and classification based on morphological and genetic traits, while systematics explores evolutionary relationships and lineage histories. Together, they provide the foundation for tracking species diversity, discovering new taxa, and supporting conservation and ecosystem management. Accurate identification of aquatic organisms is essential for monitoring environmental change, managing fisheries and water quality, and protecting vulnerable species. As pressures on aquatic environments continue to grow, these disciplines remain vital for sustaining biodiversity and informing science-based decision-making.

Molecular Ecology of Aquatic Biodiversity

Molecular ecology and environmental genomics are revolutionising the conservation of fish and aquatic biodiversity, particularly in tropical ecosystems. These approaches offer critical insights into species identity, population structure, and evolutionary history, supporting effective ecosystem management and conservation planning. When combined with traditional taxonomy, molecular tools such as mitochondrial DNA, microsatellites, nuclear gene sequences, and DNA barcoding enhance species identification, uncover cryptic diversity, and track genetic connectivity. Environmental

DNA (eDNA) enables non-invasive species detection from water samples, aiding in the monitoring of rare, migratory, or invasive species. Metagenomics provides a broader view of microbial and macro-organismal communities, contributing to assessments of ecosystem health and function. Phylogeographic studies integrate genetic and geographic data to trace lineage divergence and species distributions shaped by environmental and historical factors. Together, these tools inform the design of marine protected areas, guide fisheries management, support habitat restoration, and strengthen the resilience of aquatic ecosystems under environmental change.

Ecological Engineering in Coastal Environments

Ecological engineering in coastal environments applies ecological principles to design and manage coastal systems sustainably and resiliently. The focus is on enhancing natural processes to meet human needs, such as shoreline protection, habitat restoration, and water quality improvement. A key area of growth is transforming marine built structures like seawalls, piers, and breakwaters into ecologically functional habitats by creating microhabitats (e.g., crevices, textured surfaces) and using eco-materials that attract marine life. Solutions like modular habitat panels can retrofit existing infrastructure to mimic natural complexity and foster biodiversity. In addition, integrating green infrastructure, such as mangroves, salt marshes, and living shorelines, with traditional engineering methods offers sustainable ways to enhance biodiversity, reduce coastal erosion, and build climate resilience.

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
1	Alexander Chong Shu Chien, Professor Dr.	https://experts.usm.my/cvitae/alex
2	Amir Shah Ruddin Md Sah, Associate Professor Dr.	https://experts.usm.my/cvitae/amirshah
3	Azma Hanim Ismail, Dr.	https://experts.usm.my/cvitae/azmahanim
4	Chee Su Yin, Dr.	https://experts.usm.my/cvitae/suyinchee
5	Faradina Merican Mohd Sidik Merican, Dr.	https://experts.usm.my/cvitae/faradina
6	Foong Swee Yeok, Dr.	https://experts.usm.my/cvitae/foong
7	Mahadi Mohammad, Associate Professor Dr.	https://experts.usm.my/cvitae/mahadi
8	Natasha Arina Mohd. Izham, Dr.	https://experts.usm.my/cvitae/natashaarina
9	Norhafiz Hanafi Ahmad Shah, Dr.	https://experts.usm.my/cvitae/hafizhanafi
10	Noor Adelyna Mohammed Akib, Dr.	https://experts.usm.my/cvitae/adelyna
11	Noor Khalidah Abdul Hamid, Dr.	https://experts.usm.my/cvitae/khalidah.hamid
12	Shuhaida Shuib, Dr.	https://experts.usm.my/cvitae/shuhaidashuib

13	Wan Maznah Wan Omar, Professor Dr.	https://experts.usm.my/cvitae/wmaznah
14	Hazzeman Haris, Dr.	https://experts.usm.my/cvitae/hazzeman

ENVIRONMENTAL BIOLOGY ACADEMIC PROGRAMME

Master of Science (Aquatic Biology)

Aquatic Biology is an area of applied biology that entails the multidisciplinary study and research on fresh-, brackish- and marine biology and the dynamics of these ecosystems. Since about 71% of the Earth's surface is covered by water, these aquatic ecosystems are the major environment and ecosystems on Earth. By doing research on this area, students will be applying the basic principles of aquatic science, and will be able to analyse, synthesize and evaluate the experimental data and information objectively. Research in aquatic biology also involves practical experience in aquatic sampling inventory and various field and lab-based measurement techniques. Management and sustainable utilization of aquatic resources for various ecological and economic importance will also be emphasized.

RESEARCH THRUST AREAS	
Aquatic Biology	• Aquaculture • Limnology • Marine Ecology • Oceanography • Coastal Ecosystems • Plankton Ecology & Productivity • Aquatic Animal Disease • Aquatic Animal Nutrition • Ichthyology

WHY CHOOSE THIS PROGRAM

- **Unique Focus on Freshwater and Aquatic Systems:**
  Emphasises freshwater ecosystems such as rivers, lakes, wetlands, and ponds, with in-depth study of fish populations, plankton, algae, aquatic plants, and water quality to support sustainable management of inland water resources and biodiversity.

- **Global & Local Relevance:**
  Aquatic ecosystems cover more than 70% of the Earth's surface and are vital for sustaining life and biodiversity, while in Malaysia, aquatic biology supports environmental sustainability through freshwater and marine ecosystem research and management, alongside specialised research in aquatic animal nutrition focusing on how dietary nutrients interact with physiology, metabolism, and environmental conditions to optimise growth, health, and feed efficiency in farmed species.

- **Multiple Career Path:**
  Graduates are equipped for diverse career pathways across aquaculture and fisheries, conservation and environmental management, government and policy, research and academia, as well as the private sector and consulting.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate mastery of aquatic ecology, physiology, and biodiversity. • Design and conduct independent research projects in aquatic biology. • Apply statistical and computational tools to analyze ecological data. • Uphold ethical standards in research, conservation, and resource use.	• Department of fisheris • Private aquaculture companies • Research institute • NGOs • Forestry department • Department of Environment • Universities • Environmental consultants • Engineering firm on hydrology and aquatic ecosystem services

Master of Science (Environmental Biology)

Environmental Biology is increasingly gaining attention, especially in these environmentally-conscience times. Malaysia enjoys the luxury of a rich biodiversity in a relatively small area. Its effective preservation and conservation requires a strong understanding and appreciation of the environment. Students are trained in fundamental and practical aspects of ecology and the environment. Knowledge and understanding of various concepts of ecology, function and interaction between abiotic and biotic components of various ecosystems will be strengthened. This will give a broad understanding about the diversity together with the structure and function of tropical ecosystems, the importance of environmental protection and conservation of natural resources. Aquatic biology and environmental biology are therefore very closely related. Academic personnel in the School of Biological Sciences doing research related to Environmental Biology are also involved in supervising postgraduate students working on Aquatic Biology-related research topics.

RESEARCH THRUST AREAS	
Environmental Biology	• Soil Science • Tropical Forest Ecology • Tropical Wetland Ecology • Chemical Ecology • Population & Community Ecology • Environmental Pollution • Biodiversity Conservation • Wildlife Ecology & Management • Animal Behaviour

WHY CHOOSE THIS PROGRAM
• **Deep Scientific Expertise:** Provides advanced knowledge in ecology, biodiversity, conservation biology, and environmental physiology, with a strong understanding of organism–environment interactions including responses to pollution, climate change, and habitat degradation. • **Applied Research & Skills:** Develops strong research competencies through laboratory and field-based training, including the design and implementation of ecological studies, analysis of complex datasets, and application of statistical and computational tools, alongside practical skills in environmental monitoring, impact assessment, and restoration ecology. • **Career Opportunities:** Graduates can pursue careers in government agencies, NGOs and conservation organisations, industry and consulting, as well as academia and research.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demostrate advanced understanding of environmental systems and ecological processes. • Conduct independent, publishable research. • Show commitment to responsible and ethical environmental practices.	• Department of Environment • Forestry Department • Fisheries Department • Research institute • Universities • NGOs • EIA consulant companies

Master of Science (Marine Sciences)

The study on marine and coastal ecosystem includes the sandy beaches, rocky shores, coral reefs, mangrove, estuaries and the open sea. In this research area, emphasis will be given on the processes and dynamics of these ecosystems, in relation with biotic and abiotic factors. The ecological and economic importance of each ecosystem will be emphasized. Research in this area also involves practical experience in sampling inventory and various field and lab-based measurement techniques. By studying the marine and coastal ecosystem, students are able to understand the flora and fauna adaptations to different ecosystems, which are currently threatened by humans and what options exist for dealing with these problems. This field of study is also inclusive of cultivation of marine organisms for food and other products.

RESEARCH THRUST AREAS	
Marine & Coastal Ecosystem	• Mangrove Ecosystem • Marine Pollution & Toxicology • Mariculture • Coral Reefs Ecosystems • Integrated Coastal Zone Management

WHY CHOOSE THIS PROGRAM

- **Specialized Knowledge:**
  Covers marine biology, ecology, physiology, taxonomy, and biodiversity of marine organisms, while integrating physical oceanography and climate science to link biological processes with broader environmental and oceanographic systems.

- **Opportunity for Specialisation:**
  Provides pathways to develop expertise in specialised and technical areas such as oceanography, marine biotechnology, marine pollution, and toxicology.

- **Advanced Technical Skills:**
  Builds competencies in GIS and Remote Sensing, bioinformatics, and stable isotope analysis.

- **Career Opportunities in the Blue Economy:**
  Prepares graduates for roles across marine-related industries, research, policy, and sustainable ocean resource management.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate advanced mastery of marine biology, ecology, oceanography, and marine resource management. • Understand the impacts of climate change, pollution, and human activities on marine ecosystems. • Design and conduct independent research projects in marine sciences. • Apply advanced laboratory and field techniques • Use statistical and computational tools to analyze marine ecological and environmental data.	• Environmental Consultancy • Aquaculture companies • Offshore resource management • Universities and marine research centers • Department of Fisheries • Department of Environment • Marine Parks

ADMISSION REQUIREMENTS	DURATION
Applicants should possess the following: • A minimum of 2.75/4.00 for BSc in Biology or equivalent; or • CGPA below 2.75/4.00 for BSc in Biology or equivalent with additional requirements	• Full-time: Min 2 semesters / Max 6 semesters • Part-time: Min 4 semesters / Max 12 semesters

LANGUAGE REQUIREMENTS

The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements.

- A minimum of Band 5 for IELTS; or
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- A minimum of Band 7.5 for TOEFL Essentials (Online); or
- A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or
- A minimum score of 47 for Pearson Test of English (PTE); or
- A minimum of Band 107 for CIEP Level (ELS); or
- A minimum of Band 3.5 for Malaysian University English Test (MUET)

Exemption is given to candidate if:

- English is the candidate's mother tongue or National Language; or
- Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

06. OVERVIEW OF THE PROGRAM MICROBIOLOGY AND BIOTECHNOLOGY

The Biotechnology Program is a research discipline focused on the practical utilization of living cells, cellular components, genetics and biological systems in various manufacturing and service industries for the benefit of humankind. This interdisciplinary field synthesizes knowledge from microbiology, biochemistry, genetics, molecular biology, structural biology, fermentation and enzyme technology, bioinformatics, nanobiotechnology, plant biotechnology and tissue culture, aims to develop innovative solutions and technologies across diverse sectors. This program develops multidisciplinary expertise that enables the creation of pharmaceutical, diagnostic, agricultural, environmental, and other biotechnological products for the benefit of society, while fostering an awareness of societal concerns and regulatory frameworks associated with the biotechnology industry.

The Microbiology Program is a research discipline focused on studying bacteria, virus, yeast and fungi, exploring their microbial diversity, ecology and impacts on human health, agriculture, food production, industry, environment, medicine and pharmaceutical industry. The field integrates knowledge of various microbial groups, emphasizing their metabolic functions, genetic makeup, and growth dynamics. Key research areas include bacteriology, microbial ecology, virology, immunology, industrial and food microbiology, soil and agriculture microbiology, natural products, medical microbiology, microbial fermentation, molecular biology and bioinformatics. This program emphasizes to solve a range of problems affecting our health, the environment,

climate, food and agriculture, and address problems related to emerging microbes which may lead to long-term issues such as antimicrobial drug resistance, natural product application, sustainability, food safety and food security.

Overall, the Biotechnology and Microbiology Program contributes significantly to improve life through biological innovation, technology and sustainable solutions; and also, significantly contributes to understanding and managing the microorganism on agriculture, environment, health and food productions.

Environmental, Industrial and Medical Microbiology

The microbiology group covers a wide field, ranging from molecular studies like genomics to large scale environmental studies involving bacteria, viruses, and fungi. The studies could be either pure or applied microbiology, as well as interdisciplinary. The pure microbiological research areas include soil microbiology (nitrogen fixation), medical microbiology (dengue virus), agriculture microbiology (plant pathogenic fungi and bacteria, endophytic fungi), microbial ecology (microbial community, Vibrio sp., Serratia sp., marine/freshwater microbes) and diversity microbiology (diversity of phage). The applied microbiology studies include environmental microbiology (microbial fuel cells, bacteria degradation of oil spill, biomaterial and biodegradable plastics production from bacteria, and production of metabolites/enzymes from bacteria), applied medical microbiology (virology, epidemiology of tuberculosis, vector-parasite interaction between mosquito and dengue virus, and development of phage therapy), food microbiology (food safety, lactic acid bacteria, fermentation foods, mycotoxigenic fungi) and applied agriculture microbiology (biofertilizer). Interdisciplinary research incorporates various life science fields, as well as biochemical engineering, and fermentation technology.

Molecular Biology and Bioinformatics

The medical molecular biology group uses animal models (Drosophila melanogaster, Danio rerio and Aedes aegypti), cell lines and microorganisms to understand specific human diseases such as cancers and dengue fever. Using the latest techniques in molecular biology and biotechnology, we focus our research towards understanding mechanisms and pathways involved in developing novel therapeutic approaches. Among the cutting-edge technologies used to uncover the molecular mechanism includes molecular biology, biochemistry (DNA, RNA, and protein), transgenics, genomics, metagenomics, proteomics, transcriptomics, bioinformatics, advanced imaging, and genome engineering. The research areas include small RNA biology, gene regulation, developmental biology, cancer progression, drug development, dengue virus, and genome engineering technologies. In addition, powerful bioinformatics tools are utilised to accurately predict molecular structures and to discover fundamental information from structural biology perspective.

Plant Biotechnology and Tissue Culture

Plant tissue culture has led to significant contributions to the advancement of agricultural sciences and modern agriculture including biotechnology. Plant tissue culture technology is being widely used for the large-scale plant production of high-quality planting materials, Agrobacterium-mediated transformation for gene studies, cryopreservation, somaclonal variations, molecular markers studies, and the production of bioactive compounds through callus and cell suspension cultures.

Research activities also include micropropagation, cryopreservation, studies on transgenic plants, the production of secondary metabolites, and the LED technology for commercial applications.

The advantages of LED make it one of the important light sources for research development in plant tissue culture systems.

Fermentation and Enzyme Technology

The fermentation and enzyme technology group emphasise on five research areas: fermentation technology to produce microbial metabolites (enzymes, natural flavours, natural pigments, and biomass production) enzyme technology (application of enzymes in detergents, animal feeds, wastewater treatment, and de-inking process in recycling of waste papers); natural product discovery, bioremediation, marine biotechnology and bioprocessing

Nanobiotechnology

Research in Nanobiotechnology focuses on the utilisation of nanotechnology in biology. This emerging field has become interesting multidisciplinary research that manifests a significant impact for application in biological sciences. Three main research path is developed which includes: Biosynthesis and characterisation of nanoparticles (synthesis from biocompatible source, utilisation of bacteria-producing nanoparticles, antibiotics, and cytotoxicity effects of nanoparticles) Bioanalytic (monitoring the change of nanoparticles upon binding with analytes; biosensing) Regeneration (nanoparticles as scaffolding materials)

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
1	Ahmad Ramli Mohd Yahya, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/armyahya
2	Chew Bee Lynn, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/beelynnchew
3	K Sudesh Kumar, Prof. Dr.	https://experts.usm.my/cvitae/ksudesh
4	Nur Asshifa Md Noh, Dr.	https://experts.usm.my/cvitae/nurasshifa
5	Nurul Izza Ismail, Dr.	https://experts.usm.my/cvitae/nurul.ismail
6	Rashidah Abdul Rahim, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/rshidah
7	Siti Nor Syairah Anis, Dr.	https://experts.usm.my/cvitae/syairahanis
8	Yahya Mat Arip, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/ymarip
9	Yazmin Bustami, Dr.	https://experts.usm.my/cvitae/ybustami
10	Amir Hamzah Ahmad Ghazali, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/amirhg
11	Amira Suriaty Yaakop, Dr.	https://experts.usm.my/cvitae/amirasuriaty
12	Kamarul Zaman Zarkasi, Dr.	https://experts.usm.my/cvitae/kamarul.zarkasi

13	Noraini Philip, Dr.	https://experts.usm.my/cvitae/noraini.philip
14	Syarifah Ab Rashid, Dr.	https://experts.usm.my/cvitae/syarifahabrashid
15	Wan Siti Nur Atirah Wan Mohd Azemin, Dr.	https://experts.usm.my/cvitae/wanatirah

MICROBIOLOGY AND BIOTECHNOLOGY ACADEMIC PROGRAMME

Master of Science (Microbiology)

The microbiology postgraduate programme has evolved into multidisciplinary research, which encompasses traditional microbial disciplines and the more recent molecular approaches, such as DNA technology. Active research areas span both fundamental and applied microbiology. Its multidisciplinary nature leads to graduates who are more versatile and enjoy rewarding careers in science.

Current research projects include identification and characterization of compounds and metabolites from local plants that can inhibit Helicobacter pylori, bacterium that causes peptic ulcer; production of flavour or enhancer, dye and industrial enzymes from a variety of microorganisms; characterization of nighens (nitrogen fixation gene) in a number of Gram positive bacteria; isolation and identification of psychrophilic nitrogen fixing microbes from Antarctica; and developing a microbial process to convert oil palm to biodegradable plastic, polyhydroxyalkanoate (PHA). The department also houses a Fusarium collection as part of an international collaboration on Fusarium.

RESEARCH THRUST AREAS	
Microbiology	• Bacteriology • Mycology • Parasitology • Environmental Microbiology • Industrial Microbiology • Immunology • Microbiology

WHY CHOOSE THIS PROGRAM

- **Highly relevance to microbiology field:**
  Microbiology remain important field in food, agriculture, pharmaceutical, medical and health sector. This program equips students with the knowledge and skills needed to understand and apply in various field not limited to food industries, medical laboratory, bioremediation, agriculture, and environment monitoring.

- **Real world applications:**
  Microbiology focuses on practical solutions to real problems such as bioremediation, food safety, agriculture productivity, and environmental monitoring.

- **Career advancement:**
  Graduates are well prepared for diverse career opportunities in medical laboratory companies, public health and disease control agencies, research institutions and universities, biotechnology and diagnostic laboratories, pharmaceutical and vaccine industries, environmental and veterinary sectors, food safety and food industries, as well as industrial companies that apply microbial technologies.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Conduct and manage microbiology, molecular biology, biochemistry and medical laboratory operations. • Conduct independent research using scientific methods and techniques • Apply critical thinking and analytical skills to address problems in microbiology • Contribute to advancements in food safety, environmental monitoring, the food and pharmaceutical industries, and sustainable agriculture • Demonstrate effective leadership, communication and entrepreneurial skills	• Microbiologist • Research Scientist • Medical Laboratory Scientist • Biotechnologist • Environmental Officer or Consultant • Food Safety Specialist or Consultant • Academician • Roles in microbiology, biotechnology, food safety, environment and government agencies.

Master of Science (Biotechnology)

Biotechnology is one of the fastest growing areas in applied biology. The practical application of cells or its components in manufacturing and service industries entail the integration of knowledge from microbiology, biochemistry, genetics, molecular biology, chemistry as well as chemical and process engineering. The programme gives students theoretical and practical background in biotechnological techniques and applications while developing a strong understanding of cellular biology involving microbiology, biochemistry, genetics and molecular biology. The programme boasts modern research facilities such as an automated DNA sequencer, electron microscopes, protein crystallography and a 100 litre fermented. Current postgraduate students also perform studies on gene structure and regulation. Several members of the academic staff investigate aspects of cell culture techniques in plant and animal cells.

Research Thrust Areas:	
Biotechnology	• Cell Culture Technology • DNA Probe Technology • Enzyme Technology • Immunology • Industrial Biotechnology • Microbial Biotechnology • Agricultural and Environmental Biotechnology • Micropropagation and Plant Tissue Culture Techniques • Molecular Biology • Genetics and Plant Biotechnology • Biotechnology

WHY CHOOSE THIS PROGRAM

- **Highly relevance to microbiology field:**
  Biotechnology remain important field in food, agriculture, pharmaceutical, bioprocess, biochemistry, genetics and medical sector. This program equips students with the knowledge and skills needed to understand and apply in various field not limited to vaccine development, bioprocess industries, medical technology, sustainable agriculture, and animal/plant tissue culture.

- **Real world applications:**
  Biotechnology focuses on practical solutions to real problems such as bioprocess, animal/plant tissue culture, agriculture technology and sustainability, vaccine development and pharmaceutical industries.

- **Career advancement:**
  Graduates are well prepared for careers in biotechnology and bioprocess companies, plant and animal tissue culture laboratories and companies, research institutions and universities, diagnostic laboratories, pharmaceutical and vaccine industries, as well as agritech industrial companies.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Conduct and manage molecular biology, genetics, microbiology and biochemistry laboratory operations. • Conduct independent research using scientific methods and techniques • Apply critical thinking and analytical skills to address problems in biotechnology • Contribute to advancements in food safety, environmental monitoring, the food and pharmaceutical industries, and sustainable agriculture • Demonstrate effective leadership, communication and entrepreneurial skills	• Biotechnologist • Research Scientist • Plant/animal culture specialist and consultant • Bioprocess specialist • Academician • Roles in microbiology, biotechnology, and government agencies.

ADMISSION REQUIREMENTS	DURATION
Applicants should possess the following: • A minimum of 2.75/4.00 for BSc in Biology or equivalent; or • CGPA below 2.75/4.00 for BSc in Biology or equivalent with additional requirements	• Full-time: Min 2 semesters / Max 6 semesters • Part-time: Min 4 semesters / Max 12 semesters

LANGUAGE REQUIREMENTS
The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements. • A minimum of Band 5 for IELTS; or • A minimum score of 40 for TOEFL (Internet-based); or • A minimum of Band 7.5 for TOEFL Essentials (Online); or • A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or • A minimum score of 47 for Pearson Test of English (PTE); or • A minimum of Band 107 for CIEP Level (ELS); or • A minimum of Band 3.5 for Malaysian University English Test (MUET) Exemption is given to candidate if: • English is the candidate's mother tongue or National Language; or • Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

07. OVERVIEW OF THE PROGRAM PLANT AND ANIMAL BIOLOGY

The postgraduate program in Animal and Plant Biology at the School of Biological Sciences, Universiti Sains Malaysia (USM), offers a research-intensive academic experience that emphasizes ecological science, behavioral biology, sustainability, and the management of natural resources. Designed for both MSc and PhD candidates, the program provides a robust foundation in theoretical principles while fostering applied research skills to tackle contemporary biological and environmental challenges.

Research within the program is anchored in ecological theory and field-based investigations, focusing on population ecology, trophic interactions, habitat connectivity, and ecosystem dynamics in tropical terrestrial and aquatic settings. This approach prioritizes the understanding and preservation of ecosystem resilience amid increasing anthropogenic pressures. Studies on animal behavior further enhance ecological insights and conservation strategies, exploring areas such as foraging patterns, reproductive systems, species communication, and interspecies interactions. These investigations often feature native Malaysian species, including primates, herpetofauna, freshwater fish, and small mammals.

A significant aspect of the program also involves biodiversity documentation, encompassing species discovery, taxonomic revisions, and the mapping of species distribution. These efforts underpin conservation assessments and contribute meaningfully to both national and regional biodiversity databases, particularly concerning endemic and threatened species. In addition, the

program encourages research on sustainable land use, forest and aquatic habitat management, and policy-aligned conservation practices. Students are equipped to propose solutions that mitigate biodiversity loss and support integrated resource management strategies that align environmental sustainability with socio-economic development.

Tropical Biodiversity and Ecology

This field focused on the development of biological and ecological theories on how plants and animals interact and co-exist in their environments. The tropical rain forest ecosystems are the main target as they provide significant platforms for many of the world's most complex and interesting plant–animal interactions. Among the key research areas are the evolution of signals between plants and animals, plant mechanical and chemical defences, and plant–animal pollination and seed dispersal services. Studies on the ecology, behaviour, population dynamics, and management of terrestrial wildlife were also included. This involves assessing the effects of forest fragmentation, habitat heterogeneity and logging and its influence on various groups of vertebrates, and the subsequent approach in mitigating these effects through forest management and integration of wildlife management and land use practices in urban and agro ecosystems. We are also involved in research and education programmes with governmental and non–governmental agencies to highlight issues regarding biodiversity and evolutionary ecology from molecular to ecosystem level, plant population biology of both aquatic and terrestrial habitats, population genetics and genomics, and conservation biology and management of endemic plant species.

Primate Research and Conservation

While 60% of the world’s primates are threatened with extinction and Malaysia is a primate biodiversity hotspot, research on Malaysian primates is still scarce. Since 2015, the Primate Research and Conservation Lab has been dedicated to facilitating new research projects and conservation efforts related to Malaysian primates. Currently, we are conducting five major research projects: Macaca Nemestrina Project (“MNeP”), Langur Project Penang (“LPP”), Orang Utan conservation drones (“Primate Watch Malaysia”), Gibbon population assessments (“UNGKA – Small apes research and conservation”), and the study of the human–macaque interface. These projects are conducted in collaboration with renowned experts from international institutions, including University of California Davis, Liverpool John Moores University, University Leipzig Germany, Appalachian State University, and University of San Antonio Texas. Malaysian governmental agencies, such as PERHILITAN, and local and international societies, such as the Malaysian Primatological Society and IUCN Primate Specialist Group, are also involved in highlighting the need of primate conservation and education to the general public.

Plant Molecular Biology

Plant molecular biology focuses on the study of structure and function of biological macromolecules and the role of molecular constituents including their functions, and processes specific to plants and plant substances. The goal of this specialisation is to reach an understanding patterns and processes in living plants, as well as knowledge on the genetics, genomics, bioinformatics, transcriptomics, growth and development of plant, and its interaction with the environment, that can be applied in plant breeding, quantitative genetics, inheritance, evolution, diversity and conservation issues. Knowledge on plants and their interactions are fundamental in the work towards sustainable development. This research area also provides an excellent basis that cover a broad spectrum of research in collection and management of genetic data that applied cutting edge techniques such as next generation sequencing approach to address challenges of food security and environmental sustainability.

Plant–Animal Interaction

Plant animal interaction offers a unique combination of both animal and plant sciences, focussing on deeper understanding and discussion on the level of interaction. This research area re–examines all these interactions from both the perspective of animals and plants, which include investigating the mechanisms that are involved in the interactions, such as signals, attraction, deception, attack, defense and tolerance. The basic understanding of signal communication will be explored thoroughly between plants and animals. Basic commensalism, parasitism, from a more detailed approach of the evolutionary history and adaptive structures employed by plants and animals are also highlighted. Basic Artificial Intelligence introduction in conducting image classification and recognition for mimicry strategies employed by plants and animals will be included in the study.

Plant Ecology

Plant ecology research involve all possible interactions occurred among plants, between plants and their environment. These interactions included the reactions–interactions between soils, immediate micro–climate, and faunas. Studies in plant ecology also involve current theories, methods and interpretations within the field of plant ecology, as well as theoretical problem solving with respect to plant responses in terms of functional traits. Examples of these traits are history, demography, and ecosystem interactions in different ecosystems. Other studies in this research area are ecology of at–risk species in response to key drivers: habitat loss, habitat fragmentation, habitat degradation, invasive species, alteration of ecosystem.

Bats Ecology

Bats contribute to approximately 40% of mammals in Malaysia and 10% of bat species in the world. Bats' Ecology and Conservation Lab (BEcoOL) in the School of Biological Sciences, USM focuses on the exploration of new information to fill the knowledge gap about ecosystem services provided by bats. It is conducted by investigating new facts about bats' activity, dietary ecology, their association with public health and also their

reproductive ecology. There is a balance between fieldwork and labwork in BEcoOL's research activities. In certain cases, it involves taxonomic revision of some cryptic species discovered during fieldwork. Other relevant agencies, including Muda Agricultural Development Authority (MADA), the Department of Wildlife and National Parks (DWNP) and The Habitat Foundation (THF) are also involved in the research. Discoveries from the studies are simplified and used as the main content for public awareness activities; these are usually conducted in collaboration with local universities and bat experts at the Malaysian Bat Conservation Research Unit (MBCRU). International collaboration with other chiropterologists from the Southeast Asian Bat Conservation Research Unit (SEABCRU) and Global Union of Bat Diversity Network (GBatNet) is also done for research and long–term bat conservation plans in Malaysia.

Molecular Ecology, Phylogenetics and Population Genetics

Biodiversity, which can be defined as the diversity of living organisms, of their structures and functions, from molecules to ecosystems, is the result of Evolution. Molecular Ecology, Phylogenetics and Population Genetics are three intertwined and active evolutionary research fields aiming to assess genetic variability at different organization levels for the purpose to uncover the structure of biodiversity and the historical causes that shaped it. These three research fields attempt to make sense of the vast diversity of living forms and functions in a predictable way. Results from the three research fields have fundamental implications for building natural classification (taxonomy), for explaining the geographical distribution of organisms and communities (biogeography), for describing the architecture of genomes (genomics), etc. Ultimately, investigations in Molecular Ecology, Phylogenetics and Population Genetics are central to improve the farming (aquaculture and agriculture) of plants and animals and to prepare conservation management plans of natural resources. Lecturers and graduated students at the School of Biological Sciences are actively involved in Molecular Ecology, Phylogenetics and Population Genetics, developing research projects based on modern concepts and state–of–the–art methods. This will enable us to take a decisive step towards outlining a working practice for the management and conservation of biodiversity of wild and captive animals.

Plant Biosystematics and Taxonomy

This research area is divided into two components; taxonomy and systematics. Plant taxonomy is the branch of botany which deals with characterisation, identification, the five kingdoms classification and nomenclature of plants based on their similarities and differences. Taxonomic keys as defined taxonomic devices are applied to identify the unknown species based on its characteristics and by comparing with already existing species. Chemotaxonomy and molecular taxonomy that utilizes chemical and genetic evidences for classification purposes will also be discussed, as well as information from breeding system, plant geography and ecology including the hybridizing species, isolation mechanism, patterns of geographical distribution, concepts of disjunction and vicariance, biogeographical hypothesis and ecological differentiation. This research area also highlighted principles and procedures for conducting numerical taxonomy or

phenetic analysis. Meanwhile, plant systematics deals with interrelation between plants and their evolutionary descent. The application of DNA sequence for constructing phylogenetic trees is emphasized. Evolutionary relationships between diverse plant species from the phylogenetic method based on character and distance–based characters organise the information into a classification. Plants are classified on the basis of similarities, closeness or relationship between them.

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
1	Ahmad Sofiman Othman, Prof. Dr.	https://experts.usm.my/cvitae/sofiman
2	Asyraf Mansor, Prof. Madya Dr.	https://experts.usm.my/cvitae/asyrafm
3	Dahlia Shahbuddin, Dr.	https://experts.usm.my/cvitae/dahliashah
4	Darlina Md. Naim, Prof. Madya Dr.	https://experts.usm.my/cvitae/darlinamdn
5	Farah Alia Nordin, Dr.	https://experts.usm.my/cvitae/farahalianordin
6	Khaironizam Md. Zain, Prof. Madya Dr.	https://experts.usm.my/cvitae/khaironizam
7	Nik Fadzly N. Rosely, Prof. Madya Dr.	https://experts.usm.my/cvitae/nfadzly
8	Nurul'Ain Elias, Dr.	https://experts.usm.my/cvitae/nurulain.elias
9	Rosazlina Rusly, Dr.	https://experts.usm.my/cvitae/rosazlinarusly
10	Rahmad Zakaria, Prof. Madya Dr.	https://experts.usm.my/cvitae/rahmadz
11	Sebastien Lavoue, Dr.	https://experts.usm.my/cvitae/sebastien
12	Shahrul Anuar Mohd Sah, Prof. Dr.	https://experts.usm.my/cvitae/sanuar
13	Sreeramanan Subramaniam, Prof. Dr.	https://experts.usm.my/cvitae/sreeramanan
14	Zarul Hazrin Hashim, Dr.	https://experts.usm.my/cvitae/zarul

PLANT AND ANIMAL BIOLOGY ACADEMIC PROGRAMME

Master of Science (Botany)

The plant biology postgraduate programme is dedicated to provide training and experience to allow talented developing scientists to become active and competent professional plant scientists and effective academics. Modern and well-equipped research facilities are available for use by students in the School of Biological Sciences. These include low temperature rooms, tissue culture facilities and GLC. The programme offers special opportunities for research in plant cell and molecular biology, and plant systematic and evolution. The newly furbished Herbarium facility provides access to preserved plant specimens collected from various parts of Peninsula Malaysia. Other modern instrumentation for all aspects of plant cell and molecular biology such as electron microscope, ultracentrifuges, electrophoresis equipment and computing facilities for DNA and protein sequence analysis housed in individual laboratories and shared facilities are also available. Interdisciplinary study is encouraged and facilitated by programmes in environmental biology, agronomy and plant pathology and biotechnology. The plant biology programme, in collaboration with the environmental

and ecology programmes, is actively researching the conservation status of several threatened plant species in Malaysia such as Cryptocoryne.

Research Thrust Areas:	
Botany	• Plant Taxonomy • Plant Tissue & Cell Culture • Weed Biology • Molecular Taxonomy • Botany

WHY CHOOSE THIS PROGRAM

- **Mastery of Integrated Taxonomy**
  The program offers a rare opportunity to train under regional leaders in Integrated Taxonomy. While many programs focus on traditional methods, USM's experts bridge the gap between classical morphology and cutting-edge DNA barcoding. This dual-competency approach ensures that postgraduates are equipped to identify and describe species within the complex biodiversity of the Indo-Malayan region to international standards.

- **Research Excellence in Molecular Ecology**
  Choosing this program provides direct access to high-impact mentorship in Molecular Ecology and Population Genetics. The curriculum empowers students to utilize advanced genomic tools and molecular markers. This expertise is vital for those aiming to solve critical challenges in evolutionary biology and genetic conservation management.

- **Authority in Tropical Ichthyology & Aquatic Systems**
  USM is the definitive hub for studying freshwater and marine fauna. The program offers deep-dive specialization into Ichthyology and Riverine Ecology. Students benefit from a research environment that actively influences national aquatic conservation, providing a practical platform for studying the impacts of environmental change on fish populations.

- **Advanced Vertebrate Field Ecology**
  The program is distinguished by its focus on modern field techniques for Terrestrial Vertebrate Ecology. The faculty's expertise in high-tech monitoring, including camera trapping, radio telemetry, and ecological modelling—provides students with the technical edge required for modern wildlife research. Mentorship from pioneers in tropical mammalogy and herpetology ensures that graduates are field-ready for global conservation roles.

- **Influence Through APEX Status and Policy Leadership**
  As an APEX University, USM's MSc in Zoology program is led by lecturers who serve as consultants for the National Policy on Biological Diversity. Enrolling in this program places students at the intersection of academic rigor and national policymaking. The expertise of the faculty ensures that research projects are not

only scientifically sound but also industry-relevant and strategically aligned with global sustainability goals.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate advanced knowledge of animal biology, evolutionary patterns, and physiological adaptations. • Critically evaluate zoological data to solve complex problems in wildlife management or pest control. • Master field sampling techniques for fauna and advanced microscopy for anatomical studies. • Defend research findings in peer-reviewed journals and technical presentations to stakeholders. • Use statistical models (e.g., population modelling) to interpret zoological data. • Manage zoological research projects independently while adhering to ethical animal welfare standards.	• Wildlife Biologist & Conservation Executive: Leading biodiversity surveys and habitat restoration projects for international NGOs (e.g., WWF, WCS) or government agencies like PERHILITAN. • Environmental Consultant: Conducting high-level fauna assessments for Environmental Impact Assessments (EIA), ensuring developmental compliance with biological conservation laws. • Aquatic Resource Manager / Ichthyologist: Managing fisheries, riverine health, and marine biodiversity for government bodies or sustainable aquaculture ventures. • Academician / Research Officer: Driving scientific discovery in universities or specialized research institutes such as the Institute for Medical Research (IMR). • Science Policy Advisor: Shaping national and regional biodiversity legislation. • Quality Control (QC) Manager: Ensuring biological standards in the manufacturing of food, herbal medicine, and supplements. • PhD Research Fellow: Accessing global doctoral pathways in elite institutions worldwide. • Industry Insight (2026): With Malaysia's increasing focus on the Green Economy and ESG (Environmental, Social, and Governance) compliance, USM graduates are in high demand to help corporations navigate biological sustainability and carbon sequestration projects.

Master of Science (Zoology)

The animal biology programme offers postgraduate training that prepares students for careers in conservation, management, biomedical, academic and a variety of other professional opportunities. Students are trained to do original and significant research in zoological science, to develop a broad understanding of the zoological literature, and to provide experience and training in the presentation and publication of scientific findings. The School of Biological Sciences offers special opportunities for animal research in zoological sub disciplines. In addition the broad range of biological sciences permits collaborative programmes in oceanography, wildlife and aquatic sciences. Some areas of study include wildlife ecology, water quality, habitat management, fishery science and conservation zoology. Postgraduate studies in wildlife and aquatic research are designed to provide training in ecological principles, field research technique, and the application of these tools for the management of all types of zoological resources. Modern research facilities (including molecular laboratories, specimen collections and a computer laboratory) are available and would be beneficial for in depth research in zoology and trans-disciplinary research. The animal biology group consists of members with diverse approaches, expertise, and subject organisms. Specialties include behavioural studies, population ecology, ecological genetics, phylogenetic systematic and population genetics. The group emphasizes lower invertebrates (fish, amphibians) and insects (cockroaches, ants) although postgraduate student research often involves other groups of organisms.

Research Thrust Areas:	
Zoology	• Animal Taxonomy • Entomology • Mammalogy • Herpetology

WHY CHOOSE THIS PROGRAM
• **Expertise in Advanced Plant Systematics and Phylogeny** The program is a regional leader in Plant Systematics, driven by lecturers who specialize in the evolution and classification of tropical flora. Students will gain access to specialized knowledge in Molecular Phylogenetics. This expertise allows postgraduates to move beyond traditional morphology, using DNA-based evidence to solve complex taxonomic puzzles and understand plant evolutionary lineages. • **Pioneering Research in Ethnobotany and Phytochemistry** USM is renowned for its focus on the relationship between plants and people. SBS's expertise in Ethnobotany provides students with a unique platform to document traditional knowledge while applying modern scientific validation. This research is often linked to Phytochemical Analysis, where students learn to

identify bioactive compounds, preparing them for high-level careers in the pharmaceutical and natural product industries.

- **Specialized Knowledge in Plant Physiology and Stress Biology**
  With global climate change affecting crop yields and forest health, the expertise of SBS's lecturers in Plant Physiology is a critical draw. The program offers deep insights into how plants adapt to environmental stressors. This expertise is essential for research aimed at food security, sustainable agriculture, and the restoration of degraded tropical ecosystems.

- **Access to World-Class Herbarium and Curation Expertise**
  The Animal and Plant Biodiversity cluster manages our renowned Herbarium (USMP), which serves as an invaluable research tool — a vital record of biodiversity, used for long-term botanical research, identification, and education. Our Herbarium contains around twelve thousand preserved vascular plant specimens. These specimens contain a wealth of information about plants that have been collected around Malaysia over the past 50 years. Mentorship from curators and botanical experts ensures that students are trained in professional herbarium techniques, plant preservation, and digital archiving—skills that are highly sought after by botanical gardens and international research institutions.

- **Leadership in Conservation Botany and Forest Ecology**
  SBS's MSc in Botany program is led by authorities in Conservation Biology who are actively involved in protecting Malaysia's endangered flora. The school's expertise in Forest Ecology allows students to conduct field-based research in diverse habitats, ranging from highland forests to coastal ecosystems. This ensures that the research produced is not only academically rigorous but also contributes to the National Policy on Biological Diversity.

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate a systematic understanding of plant diversity, anatomy, and physiological processes. • Synthesize botanical research to address challenges in agriculture, conservation, or phytochemistry. • Master herbarium techniques, plant identification, and laboratory-based plant analysis. • Communicate complex botanical findings to the scientific community and the bio-based industry.	• Plant Biotechnologist: Driving innovation in agricultural R&D and crop improvement. • Botanical Consultant: Leading Environmental Impact Assessments (EIA) for land and forest management. • Research Officer: Contributing to government bodies such as FRIM (Forest Research Institute Malaysia) or MARDI. • Natural Products Scientist: Developing new plant-based applications for the cosmetic, nutraceutical, and pharmaceutical sectors.

• Utilize statistical software for ecological and floristic studies. • Lead botanical expeditions or lab projects with a high degree of autonomy and research ethics.	• Conservation Manager: Overseeing protected areas, botanical gardens, and reforestation projects. • Science Policy Advisor: Shaping national and regional biodiversity legislation. • Quality Control (QC) Manager: Ensuring biological standards in the manufacturing of food, herbal medicine, and supplements. • PhD Research Fellow: Accessing global doctoral pathways in elite institutions worldwide. Industry Insight (2026): With Malaysia's increasing focus on the Green Economy and ESG (Environmental, Social, and Governance) compliance, USM graduates are in high demand to help corporations navigate biological sustainability and carbon sequestration projects.

ADMISSION REQUIREMENTS	DURATION
Applicants should possess the following: • A minimum of 2.75/4.00 for BSc in Biology or equivalent; or • CGPA below 2.75/4.00 for BSc in Biology or equivalent with additional requirements	• Full-time: Min 2 semesters / Max 6 semesters • Part-time: Min 4 semesters / Max 12 semesters

LANGUAGE REQUIREMENTS

The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements.

- A minimum of Band 5 for IELTS; or
- A minimum score of 40 for TOEFL (Internet-based); or
- A minimum of Band 7.5 for TOEFL Essentials (Online); or
- A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or
- A minimum score of 47 for Pearson Test of English (PTE); or
- A minimum of Band 107 for CIEP Level (ELS); or
- A minimum of Band 3.5 for Malaysian University English Test (MUET)

Exemption is given to candidate if:

- English is the candidate's mother tongue or National Language; or
- Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

08. DOCTOR OF PHILOSOPHY (PHD) PROGRAMME IN THE SCHOOL OF BIOLOGICAL SCIENCES

The School of Biological Sciences offers a Doctor of Philosophy (PhD) programme encompassing diverse fields of biological sciences, including Applied Entomology, Applied Parasitology, Aquatic Biology, Biotechnology, Botany, Environmental Biology, Marine & Coastal Ecosystems, Microbiology, Plant Pathology and Zoology. The programme supports advanced research across medical, agricultural, environmental and industrial domains, with strong laboratory and field-based training, modern research facilities, and specialized units such as the Vector Control Research Unit (VCRU). Research thrust areas span molecular biology, pest and disease management, biodiversity conservation, aquatic and marine sciences, microbial and industrial biotechnology, wildlife ecology, and sustainable resource management, equipping candidates with interdisciplinary expertise and high-impact research capabilities.

Research Thrust Areas:	
Doctor Of Philosophy	• Applied Entomology • Applied Parasitology • Aquatic Biology • Biotechnology • Botany • Environmental Biology • Marine & Coastal Ecosystem • Microbiology • Plant Pathology • Zoology

WHY CHOOSE THIS PROGRAM
• **Flexible Research Mode:** Independent, research-based programme with guided supervision and flexible study structure • **Broad Research Expertise:** Covers key biological fields including applied entomology, parasitology, aquatic biology, biotechnology, botany, environmental biology, marine and coastal ecosystems, microbiology, plant pathology, and zoology • **High-Impact Research:** Focus on original, publishable research addressing current scientific, environmental, and industry challenges • **Advanced Skills Development:** Strengthens analytical, methodological, and interdisciplinary research capabilities using advanced tools and techniques • **Career Advancement:** Prepares graduates for leadership roles in academia, research institutions, industry, and policy development

PROGRAM OUTCOMES	CAREER PROSPECTS
Graduates will be able to: • Demonstrate advanced and specialised knowledge across diverse biological disciplines • Design and conduct independent, original, and high-impact research • Apply critical thinking and advanced analytical skills to solve complex biological and environmental issues • Utilise appropriate research methodologies, statistical, and computational tools • Communicate research findings effectively in academic and professional platforms • Uphold ethical, sustainable, and responsible research practices	• Academia and research (lecturer, researcher, postdoctoral fellow) • Government and policy agencies (biodiversity, environment, biosecurity) • Industry (biotechnology, agriculture, aquaculture, environmental consulting) • NGOs and international organisations (conservation and sustainability) • Private sector and consultancy services

ADMISSION REQUIREMENTS	DURATION
Applicants should possess one of the following: • A Master's degree in related area with CGPA 3.00/4; or • A Master's degree in related area with CGPA 2.50-2.99/4 with additional requirements; or • Bachelor's degree in related area with minimum CGPA 3.67/4 (fast-track to PhD)	• Full-time: Min 4 semesters / Max 10 semesters • Part-time: Min 6 semesters /Max 15 semesters

LANGUAGE REQUIREMENTS

The minimum score for each programme can be vary from the below list, candidates are required to check for each programme requirements.

- A minimum of Band 5 for IELTS; or
- A minimum score of 40 for TOEFL (Internet-based); or
- A minimum of Band 7.5 for TOEFL Essentials (Online); or
- A minimum score of 154 for Cambridge English: Advance (CAE)/Proficiency (CPE) /Preliminary (PET) /First (FCE)/ Linguaskill Online min. score 154; or
- A minimum score of 47 for Pearson Test of English (PTE); or
- A minimum of Band 107 for CIEP Level (ELS); or
- A minimum of Band 3.5 for Malaysian University English Test (MUET)

Exemption is given to candidate if:

- English is the candidate's mother tongue or National Language; or
- Candidate graduated from an Institution of Higher Learning in which the medium of instruction at Bachelor and/or Master degree level is English (statement of proof required)

FEES

Malaysian (MYR)	
Full Time	Part Time
• Registration Fee : 330.00 • Tuition Fee (Semester) : 3,350.00 • Thesis Evaluation Fee : 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00	• Registration Fee : 330.00 • Tuition Fee (Semester) : 2,775.00 • Thesis Evaluation Fee: 800.00 • Convocation Fee : 200.00 • Research Methodology : 320.00

International (USD)*	
Full Time	Part Time
• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,800.00 • Thesis Evaluation Fee: 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00	• Registration Fee : 225.00 • Personal Bond : 1,000.00 • Tuition Fee (Semester) : 1,530.00 • Thesis Evaluation Fee : 250.00 • Convocation Fee : 50.00 • Research Methodology : 80.00

09. MASTER OF SCIENCE TROPICAL PLANT DISEASE MANAGEMENT - MIXED MODE

Master of Science in Tropical Plant Disease Management (TPDM) is a programme by mixed mode. Students will only need to complete 2 (two) semesters in 1 (one) year study with a total of 40 credits. The aim is to provide a strong knowledge in the field of plant pathology and disease management through comprehensive lectures and hands-on laboratory practices.

MSc TPDM is specifically designed for those who have the interest to study tropical plant diseases and plant disease management. This programme offers subjects ranging from principles of plant pathology, advanced plant disease management, plant pathogenic fungi, plant bacteriology and virology, plant biotechnology, insect and vertebrate agricultural pests and also field crop agronomy. The students will be exposed to current issues on tropical plant diseases not only through lectures, but also through field trips and active round table discussions. The students will also conduct a mini research project related to tropical plant diseases and their management starting from the first semester and continue to the second semester. This is believed will help to prepare the students to deal with the actual problems happening in the agriculture field because it will require the students to apply all the knowledge gained during the lectures, field trips and round table discussion into practical work. This will indirectly help to provide the soft and practical skills to future graduates of plant pathology and disease management.

OBJECTIVES AND PROGRAMME OUTCOMES

The Programme Educational Objectives [PEO] of the Master of Science in Tropical Plant Disease Management are to:

PEO 1	Graduates can apply fundamentals knowledge and research skills as plant pathologists to comprehend information, organise ideas, evaluate and analyse information and apply these to any situation
PEO 2	Graduates share knowledge of plant disease laboratory and management skills, disease diagnosis with the latest methods, and the ability to perform skills independently.
PEO 3	Graduates of tropical plant disease management have the ability to learn new skills, have good communication skills, demonstrate professionalism and leadership to be applied in the national education system and the national agricultural industry.

Students who have completed their Master of Science in Tropical Plant Disease Management at the School of Biological Sciences are expected to comply on the following Programme Learning Outcomes [PLOs]:

PLO 1	Apply advanced knowledge in the field of tropical plant disease management and demonstrate theoretical and conceptual skills in research and innovation.
PLO 2	Analyse critical and creative thinking skills in problem solving and decision making related to research.
PLO 3	Conduct research under minimal supervision and apply the latest research methods.
PLO 4	Work in groups to solve plant disease diagnosis problems and determine appropriate plant disease control methods.
PLO 5	Demonstrate good communication skills while working in the plant pathology laboratory, research institution and industry.
PLO 6	Apply digital and multimedia techniques to explain information on tropical plant disease management.
PLO 7	Apply mathematical skills to analyse data and verify results in the management of plant diseases.
PLO 8	Demonstrate active leadership skills in plant disease management
PLO 9	Recognise needs, ability and preparation for change and continuous self-improvement in the field of plant pathology and plant disease management.
PLO 10	Demonstrate an entrepreneurial attitude in the field of plant pathology and plant disease management.
PLO 11	Demonstrate high ethical and professional values throughout the programme and during conducted research, as well as being knowledgeable in the areas of legal and regulatory provisions in research.

PROGRAMME STRUCTURE

In order to qualify for the Master of Science in Tropical Plant Disease Management, students are required to fulfil **40 credits** over a period of **not less than 2 semesters**. The distribution of units is shown as below:

No	Course classification	Credit value	Percentage (%)
1	Compulsory*	-	-
2	Core**	36	90
3	Elective***	4	10
TOTAL		**40**	**100**

Note:

* Compulsory courses refer to *Mata Pelajaran Umum* (MPU) and other courses required by the HEP

** Core courses also include common courses of faculty

*** Optional/elective courses refer to courses where students can exercise choice

LIST OF COURSES

Six (6) core courses (36 credits) and choose any one (1) course for elective (4 credits).

No	Code/ course credit	Course title
Compulsory core course		
1	BGT511/3	Principles and Applications of Plant Pathology
2	KAA500/3	Research Methodology
3	BGT512/4	Plant Pathogenic Fungi
4	BGT501/20	Dissertation
5	BGT513/3	Advanced Plant Disease Management
6	BGT514/3	Plant Pathogenic Bacteria and Viruses
Elective core course		
1	BGE521/4	Advanced Plant Cell Culture Technology
2	BGE522/4	Insect and Vertebrate Agricultural Pests
3	BGE523/4	Field Crop Management

COURSE REGISTRATION PLANNING SCHEDULE
FULL-TIME CURRICULUM STRUCTURE

<table>
<tr><th colspan="3">Semester 1</th><th colspan="3">Semester 2</th><th colspan="3">Semester 3 (KSCP)</th></tr>
<tr><th>Code</th><th>Course</th><th>Credits</th><th>Code</th><th>Course</th><th>Credits</th><th>Code</th><th>Course</th><th>Credits</th></tr>
<tr><td>BGT511 (Core)</td><td>Principles and Applications of Plant Patholog</td><td>3</td><td>BGT501* (Research) (Core)</td><td>Dissertation</td><td>20 (TL)</td><td rowspan="6">BGT501* (Research) Viva Voce (Core)</td><td rowspan="6">Dissertation</td><td rowspan="6">20</td></tr>
<tr><td>KAA500 (Core)</td><td>Research Methodology</td><td>3</td><td rowspan="2">BGE521 (Elective)</td><td rowspan="2">Advanced Plant Cell Culture Technology
OR</td><td rowspan="4">4</td></tr>
<tr><td>BGT512 (Core)</td><td>Plant Pathogenic Fungi</td><td>4</td></tr>
<tr><td>BGT513 (Core)</td><td>Advanced Plant Disease Management</td><td>3</td><td>BGE522 (Elective)</td><td>Insect and Vertebrate Agricultural Pests
OR</td></tr>
<tr><td>BGT514 (Core)</td><td>Plant Pathogenic Bacteria and Viruses</td><td>3</td><td>BGE523 (Elective)</td><td>Field Crop Management</td></tr>
<tr><td colspan="2">Total</td><td>16</td><td colspan="2">Total</td><td>24</td><td colspan="2">Total</td><td>0</td></tr>
</table>

Note:
For more information, kindly contact the Programme Coordinator, Associate Professor Dr. Masratul Hawa Mohd, at masratulhawa@usm.my

COURSE REGISTRATION PLANNING SCHEDULE
PART-TIME CURRICULUM STRUCTURE

Semester 1			Semester 2			Semester 3			Semester 4			Semester 5 (KSCP)		
Code	**Course**	**Credits**	**Code**	**Course**	**Credits**	**Code**	**Course**	**Credits**	**Code**	**Course**	**Credits**	**Code**	**Course**	**Credits**
BGT511 (Core)	Principles and Applications of Plant Pathology	3	BGE521 (Elective)	Advanced Plant Cell Culture Technology OR	4	BGT513 (Core)	Advanced Plant Disease Management	3	BGT501* (Research) (Core)	Dissertation	20 (TL)	BGT501* (Research) Viva Voce (Core)	Dissertation	20
KAA500 (Core)	Research Methodology	3	BGE522 (Elective)	Insect and Vertebrate Agricultural Pests OR		BGT514 (Core)	Plant Pathogenic Bacteria and Viruses	3						
BGT512 (Core)	Plant Pathogenic Fungi	4	BGE523 (Elective)	Field Crop Management										
	Total	**10**		**Total**	**4**		**Total**	**6**		**Total**	**20**		**Total**	**0**

Note:
For more information, kindly contact the Programme Coordinator, Associate Professor Dr. Masratul Hawa Mohd, at masratulhawa@usm.my

SYNOPSIS OF THE COURSES

BGT501/20 Dissertation

This course offers students the opportunity to conduct a research project on tropical plant disease management under the supervision of a lecturer. In addition to conducting the research project, students in this course will learn about reference management software and thesis writing techniques. Students will also have the opportunity to broaden their experience of key techniques and current methodologies in the field of tropical plant disease management. This course is delivered through the supervision of laboratory research, discussions and workshops. Students will be assessed through thesis projects, seminars and supervision.

BGT511/3 Principles and Applications of Plant Pathology

The course introduces the concepts, basic principles and history of plant pathology, including the basic symptomatology and aetiology of plant diseases. Various aspects related to plant diseases are covered, such as symptoms and signs of plant diseases, infectious and non-infectious diseases, disease triangle, disease cycle, inoculum potential, pathogenicity and virulence, pathogen entry processes and mechanisms, and host defence mechanisms against pathogen infection. Current topics related to plant health such as food safety and mycotoxins are also covered. In addition to conventional teaching methods, current learning methods such as information exchange via the e-learning platform, video presentation and online discussion are also used.

BGT512/4 Plant Pathogenic Fungi

This course provides in-depth knowledge on the diversity of fungus-like organisms and fungi that cause diseases on plants. It also includes detailed information on plant-pathogen interaction, adaptation to pathogenicity, types of plant diseases and control strategies, recognition of pathogens from different groups, discrimination of disease signs and symptoms, isolation of pathogens from diseased plants, morphological identification, and skills for accurate diagnosis of plant diseases in the field. Pathogens from each group will be described with emphasis on the disease cycle, production, survival and spread of the inoculum. Students will be assessed through sample collection, practical reports, presentations, tests, and a final examination. Mixed teaching and learning are practiced in this course. In addition to conventional teaching methods, current learning methods such as information sharing via the e-learning platform, video presentations and online discussions are used.

BGT513/3 Advanced Plant Disease Management

This course is an advanced course designed to introduce students to the application of plant disease management principles. Various methods of management from current and latest techniques will be learned, such as management with chemicals, biological agents, cultural practices, resistant varieties, and law enforcement. Students will discuss more about important diseases and their management. Students will analyse and discuss current issues related to plant disease management using current journals, field work and online learning. In addition to conventional teaching methods, current learning methods such as information sharing via the e-learning platform, video presentations and online discussions will be used.

BGT514/3 Plant Pathogenic Bacteria and Viruses

This course provides core knowledge on plant pathogenic bacteria and viruses, covering in detail the classification, symptoms, disease transmission and common plant diseases caused by both microorganisms. This course also includes detailed information on research methods, current case studies and the latest methods of controlling plant diseases caused by bacteria and viruses. This course is delivered through lectures, exercises, discussions, and problem-based learning. Students are assessed through assignments, presentations, reports, practical reports, and final examinations. In addition to conventional teaching methods, current learning methods are also used, such as information exchange via the e-learning platform, video presentations and online discussions.

BGE521/4 Advanced Plant Cell Culture Technology

This course provides students with the fundamentals for a deeper understanding of plant biotechnology. The objective of this course is to provide an understanding of the basic principles of plant science and molecular biology and the integration of these disciplines to provide healthy plants in a safe environment for food, non-food, animal feed and health applications. This course is designed to provide students with theoretical knowledge through lectures and critical discussion of current technological developments in research with trends in the goals and needs of today's biotechnology industry through the seminar. Selected topics include the latest scientific achievements in the field of plant biotechnology: the cultivation of plant cells, the genetic transformation of plants, the application in biotechnology, the importance of plant biotechnology in agriculture, environmental protection, medicine, the energy sector and in the production of high-value products for food and pharmaceuticals, as well as the social, economic, ethical and/or legal aspects of plant biotechnology. In addition to conventional teaching methods, current learning methods such as information exchange via the e-learning platform, video presentation and online discussion are also used.

BGE522/4 Insect and Vertebrate Agricultural Pests

This course covers the biology of pests of economic importance in tropical agriculture in Malaysia. The focus is on insect and vertebrate pests of important crops such as rice, oil palm, coconut, cocoa, rubber, vegetables, and fruits. The biotic and abiotic factors that enable the pests to live as agricultural pest populations are discussed, as well as the various measures to control them, namely physical, chemical, mechanical, and biological control, and quarantine measures. In the context of chemical control, aspects of the action, toxicity, physiology and technology of pesticides and their impact on the environment are discussed. The concept of integrated pest management and sustainable agriculture is discussed from the perspective of plant protection. In addition to conventional teaching methods, current learning methods such as sharing information via the e-learning platform, video presentations and online discussions are also used.

BGE523/4 Field Crop Management

This course introduces the practises of growing perennial and annual crops, including soil management, selection of crop varieties, identification of plant diseases and insect pests, symptoms of damage, fertiliser rates and requirements, and the risk of economic threshold from specific diseases in each crop. Current learning methods are used, such as sharing information via the e-learning platform, video presentations and online discussions. In addition, topics related to the soil nutrient plan, water drainage and current issues related to agronomy are discussed.

KAA500/3 Research Methodology

This course covers research proposal elaborating on key elements of research methodology like problem statement, objectives, philosophy, and scientific method. Emphasis is also given on the important subjects in Scientific Writing starting from introduction to strategies of writing good quality manuscript. Ethics and technical aspect in research and journal publication will also be emphasised.

ACADEMIC STAFF INVOLVED IN TEACHING FOR THE MASTER OF TROPICAL PLANT DISEASE MANAGEMENT [MSC TPDM]

EXPERTISE & ACCESS TO USM EXPERTS		
No	**Name**	**Expertise (USM expert link)**
1	Hafizi Rosli, Dr.	https://experts.usm.my/cvitae/hafizirosli
2	Hasber Salim, Assoc. Prof. Dr.	https://experts.usm.my/cvitae/hasbersalim
3	Hasnuri Mat Hassan, Dr.	https://experts.usm.my/cvitae/hasnurimh
4	Latiffah Zakaria, Professor Dr.	https://experts.usm.my/cvitae/lfah
5	Masratul Hawa Mohd, Associate Professor Dr.	https://experts.usm.my/cvitae/masratulhawa
6	Mohammad Fadhli Mad' Atari, Dr.	https://experts.usm.my/cvitae/madatari
7	Nik Mohd Izham Mohamed Nor, Dr.	https://experts.usm.my/cvitae/nikizham
8	Rosnida Tajuddin, Dr.	https://experts.usm.my/cvitae/rosnidatajuddin

REGISTRATION

Self-registration must be completed in accordance with the dates specified in the USM Admission Offer Packet and the Academic Calendar. For the latest course registration announcements, please visit the IPS website https://ips.usm.my/.

Enrolment for postgraduate studies is via the internet. Original documents of degree certificates and academic transcripts must be submitted for verification upon request from IPS.

Deferral of enrolment is possible in justified cases. An official application can be submitted to IPS for review. If your application is approved, you will receive a new offer. If your application is not approved, you may reapply for the same programme without penalty: https://onlineips.usm.my/admission/.

CANDIDATURE MATTERS DURATION

A student who registers for postgraduate study must fulfil the duration of candidature as stated in the offer letter.

Programme	**Full-time**		**Part-time**	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Mixed mode	1 year / 2 semesters	2 years / 4 semesters	2 years / 4 semesters	4 years / 8 semesters

Renewal of registration and course(s) registration
It is a student's responsibility to renew enrolment each semester and pay tuition fees within the renewal period. Announcement of enrolment renewal and course registration period will be posted on the IPS website, www.ips.usm.my usually two (2) months prior to the start of the new semester. Students are advised to check the USM website and official email regularly for updated information prior to the registration period.

Renewal of registration
Renewal of registration is compulsory to be completed via the CampusOnline Portal (http://campusonline.usm.my) before the beginning of each semester.

Mixed Mode
Login to the Campus Online Portal and click 'Online Reg'. You will be directed to course registration page. Complete the course selection process until invoice of the fees is generated. Fees payment needs to be made before the new semester commence.

Payment of tuition fees
Renewal of registration is considered complete once payment of tuition fees has been made. All payments MUST be made within the prescribed time limit to avoid the penalty for late registration. A copy of the invoice and proof of payment/scholarship letter MUST be sent to the Bursary and IPS within the renewal period of each semester.

Students who have renewed their enrolment through the internet but have not made the payment within the prescribed time limit will be considered as late enrolment and will be liable to pay a penalty of RM200. Students who do not renew their enrolment within the prescribed period (without valid reasons) will be suspended from their studies.

If one or more courses you wish to register for are not offered this semester, you may apply to defer your studies for that semester. Re-registration is therefore not required, but the request for deferral must be submitted before the start of the new semester.

Malaysian Culture and Malay Language (LKM111)
Compulsory for all international students and to be passed prior to graduation. The minimum required passing grade is C. Registration of the course is at the School of Languages, Literacies and Translation.

Exemption can be given to students who have taken and pass the equivalent course. Application for exemption must be submitted for approval to the Dean, School of Languages, Literacies and Translation.

Pre-requisite course(s)
Registration of all pre-requisite courses (if applicable) must be done latest by the first week of the semester. Students need to complete the pre-requisite form, obtain approval from the respective School/Centre/Institute and submit to IPS together with the evidence (receipt) of payment. Pre-requisite form can be downloaded from IPS website.

Add/drop of courses for mixed mode students

Any add/drop of course(s) must be made using the Add/Drop form available at IPS website. The form must be signed by the respective Dean/Director/Deputy Dean and submitted to IPS immediately. Final confirmation of course registration after the add/drop of courses can be checked through Campus Online Portal.

Course(s) can be added within the first two (2) weeks of the semester. The application must be made using the Add/Drop Form.

Course(s) can be dropped up to the sixth (6) week after the semester commence.

Tuition fee will be credited into the student's account for the following semester if the course(s) is dropped within the first two (2) weeks of the semester. No refund will be made for courses dropped after the second (2) week of the semester.

The application must be made using the Add/Drop Form.

a) Students are required to check the final list of courses registered through the Campus Online Portal latest by the ninth (9) week of the semester.
b) For Malaysian Culture and Malay Language (LKM 111), add/drop of course can be done at the School of Languages, Literacies and Translation, within the first week of the semester.

Postponement / Deferment of studies

Postponement of studies is only allowed after registration and completion of at least one (1) semester, except for medical or valid personal reasons. Postponement Form is available at IPS website. Students are allowed to postpone their studies maximum of two (2) semesters throughout the entire duration of the candidature period.

Extension of candidature

Application for extension of candidature must be made two (2) months prior to the date of expiration of a student's candidature. The maximum period of extension allowed is two (2) semesters only. Application must be made using the available form at the IPS website.

Withdrawal from the programme

Withdrawal from programme can be made by sending a withdrawal letter to Dean/Director of School/Centre/Institute.

Refund of all fees (except registration and smart card fees) will be made for withdrawal up to two (2) weeks from the date of registration.

Change of mode of study

Student must submit a new application for admission together with the processing fees for change of mode of study.

Termination of candidature

The University reserves the right to terminate a student's candidature based on:

a) Student's failure to renew the registration before new semester commences
b) Unsatisfactory academic performance (Mixed mode)
c) Failure to pay the tuition fees
d) Maximum candidature

Reactivation of candidature

Students may reactivate their candidature within 1 year of termination, depending on the duration of the candidature. Reactivation for students in research mode (terminated due to maximum candidature duration) will only be considered if the student submits a draft of their thesis within one (1) year of the date of maximum candidature. Reactivation of candidature is subject to the decision of the University.

EXAMINATIONS AND GRADUATION REQUIREMENTS

Examinations are held at the end of each semester. The examination form is required to access the examination hall and can be printed from the CampusOnline Portal. It is the student's responsibility to be present in the examination hall at the agreed time, date and place of the examination.

If a student is unable to attend the examination, he/she must notify the Examination Department (Registry Department) immediately in writing and include proof (if available) with the notification. Students must meet all academic requirements (for lectures, tutorials, practical, etc.) in order to qualify for the examinations.

The examination process is based on the principle of continuous assessment, consisting of coursework and written examination components. The coursework component may be based on participation in tutorials, tests, essays, project work, studio work, field work, etc.

Performance is assessed according to the examination grading method, which the Cumulative Grade Point Average (CGPA), based on the following scale:

Graded	Points	Master Degree
A	4.00	Pass
A-	3.67	
B+	3.33	
B	3.00	
B-	2.67	
C+	2.33	
C	2.00	Fail
C-	1.67	
D+	1.33	

D	1.00	
D-	0.67	
F	0.00	

The passing grade for all master degree programmes is minimum grade C+ and for a doctorate degree is minimum grade B. Courses that are graded as follows will not be taken into account in the calculation of the GPA & CGPA.

- TL (Incomplete)
- DK (with permission)
- P/F (Dissertation)
- Courses with code Y & Z

Dissertation course for Mixed Mode Programme will be considered for graduation and will be awarded a PASS/FAIL grade.

Academic Status GPA above 3.00 is necessary for an "ACTIVE" status and opportunity to continue the programme.

- GPA below 3.00 for any one semester will be categorised as "MONITORING" status.
- Fail and OUT (F&O) status will be awarded for failure to obtain any credits.
- Student will be terminated if the CGPA is between 0.00-0.99 accumulated after 2 semesters.

Repeating Course

- Student is allowed to repeat course(s) to improve the CGPA to be minimum of 3.00 as long as the duration of student candidature is still active.
- If student obtains grade B- or below for any course, the course can be repeated if offered either in Semester I or Semester II or Inter-Academic Session Break (KSCP).
- Repeating of course(s) is not allowed in KSCP for students who obtain grade F* or X in the normal semester.
- Project/dissertation must be completed during the stipulated period according to the programme.
- Student who repeats the project/dissertation is required to select a new topic.

ACADEMIC INTEGRITY

All parties shall assist the University in preventing any misconduct involving misattribution of data, stealing of ideas or direct plagiarism, intentional interference and failure to act with integrity in the creation, development, application and use of knowledge, ideas and information in relation to the work of others.

10. VECTOR CONTROL RESEARCH UNIT (VCRU)

The VCRU was established in 1991 to consolidate and enhance the research potential in vector control. The unit is equipped with various facilities in insecticide resistance, toxicology and analysis, space spray applications, and household and public health insecticide formulation studies. The VCRU, also a leading centre in vector and urban pest control research in Asia, has excellent rearing facilities for many species and strains of vector mosquitoes, cockroaches, flies, household ants and subterranean and dry wood termites and facilities for conducting field research. With its strong productivity in scientific publications, services, postgraduate students output, the unit is recognised as one of the leading research facilities for vector and urban pest control studies in the Asia-Pacific region.

11. FACILITIES AND SERVICES

As a postgraduate student in the School of Biological Sciences, USM, you can use a myriad of services in the school and university while pursuing your studies, namely:

- Hamzah Sendut Library 1 & 2 – books, periodicals and online databases are available for use, many of which are accessible from home or office. Please go to this website for more information. http://www.lib.usm.my/

- Institute of Postgraduate Studies (IPS) – This is the secretariat for all USM's postgraduate programs. A lot of information regarding application, registration, candidature, examination, financial assistance, workshops, etc. are in its website at http://ips.usm.my/

- On-campus accommodation – USM provides some accommodations for postgraduate students. If you need a place to stay during your study, you can enquire and seek help form this website https://www.myusminfo.com/usminfo/facilities/hostels

- Sports and recreation – There are many sports and recreation facilities on campus, such as football and hockey fields, stadiums, swimming pool, gymnasium, indoor badminton courts, outdoor tennis and futsal courts and many others. The USM's Sports and Recreation website (https://pusatsukan.usm.my/) has more information that you may what to check.

- Thesis Room – The School of Biological Sciences has allocated a room to place past theses for MSc and PhD. All students are most welcome to use the room.

- Postgraduate Room – The School of Biological Sciences also has allocated a spacious and cozy room for postgraduate students. This is a meeting place for students to come and mingle among themselves and lecturers, and do other things related to their studies.

- Computer lab – Our school has one computer lab that can support students computing needs.

- Internet access – Throughout the campus, all students can freely get access to the internet. All registered students will also be given an official email account.

- Bio-postgraduate Society – This is informal club set up and managed by the postgraduate students, which is active in organizing not only academic-type activities such as conference, seminars, and workshops, but also social and sport programs.

11. ACADEMIC CALENDAR

ACADEMIC CALENDAR - ACADEMIC SESSION 2025/2026

FOR ALL SCHOOLS (EXCEPT FOR SCHOOL OF MEDICAL SCIENCES AND SCHOOL OF DENTAL SCIENCES)

Main Campus : Registration for New Student (26 - 28 September 2025) / **Orientation Week (29 September - 04 October 2025)
Engineering Campus : Registration for New Student (28 September 2025) / **Orientation Week (29 September - 04 October 2025)
Health Campus : Registration for New Student (30 September 2025) /Orientaion Week (30 September - 04 October 2025)**

SEM	WEEKS	ACTIVITIES	DATE	REMARKS
ONE	1	Teaching & Learning (T&L 7 Weeks)	Monday, 06.10.2025 - Sunday, 12.10.2025	
	2		Monday, 13.10.2025 - Sunday, 19.10.2025	
	3		Monday, 20.10.2025 - Sunday, 26.10.2025	20.10.2025, Monday - Deepavali**
	4		Monday, 27.10.2025 - Sunday, 02.11.2025	
	5		Monday, 03.11.2025 - Sunday, 09.11.2025	
	6		Monday, 10.11.2025 - Sunday, 16.11.2025	
	7		Monday, 17.11.2025 - Sunday, 23.11.2025	
	8	Mid Semester Break (1 Week)	Monday, 24.11.2025 - Sunday, 30.11.2025	
	9	Teaching & Learning (T&L 7 Weeks)	Monday, 01.12.2025 - Sunday, 07.12.2025	
	10		Monday, 08.12.2025 - Sunday, 14.12.2025	
	11		Monday, 15.12.2025 - Sunday, 21.12.2025	
	12		Monday, 22.12.2025 - Sunday, 28.12.2025	25.12.2025, Thursday - Christmas Day
	13		Monday, 29.12.2025 - Sunday, 04.01.2026	01.01.2026, Thursday - New Year of 2025
	14		Monday, 05.01.2026 - Sunday, 11.01.2026	
	15		Monday, 12.01.2026 - Sunday, 18.01.2026	
	16	Revision Week (1 Week)	Monday, 19.01.2026 - Sunday, 25.01.2026	
	17	Examination (3 Weeks)	Monday, 26.01.2026 - Sunday, 01.02.2026	01.02.2026, Sunday - Thaipusam
	18		Monday, 02.02.2026 - Sunday, 08.02.2026	02.02.2026, Sunday - Replacement leave for Thaipusam (Main & Engineering Campus)
	19		Monday, 09.02.2026 - Sunday, 15.02.2026	
	20	Mid Semester Break / Industrial Training (4 Weeks)	Monday, 16.02.2026 - Sunday, 22.02.2026	17 & 18.02.2026, Tuesday & Wednesday - Chinese New Year 19.02.2026, Thursday - 1st day of Ramadhan
	21		Monday, 23.02.2026 - Sunday, 01.03.2026	
	22		Monday, 02.03.2026 - Sunday, 08.03.2026	07.03.2026, Saturday - Nuzul Al-Quran
	23		Monday, 09.03.2026 - Sunday, 15.03.2026	
TWO	24/1	Teaching & Learning (T&L 7 Weeks)	Monday, 16.03.2026 - Sunday, 22.03.2026	21.03.2026 & 22.03.2026, Saturday & Sunday - Eid al-Fitr**
	25/2		Monday, 23.03.2026 - Sunday, 29.03.2026	23.03.2026, Monday - Replacement leave for Eid al-Fitr****
	26/3		Monday, 30.03.2026 - Sunday, 05.04.2026	
	27/4		Monday, 06.04.2026 - Sunday, 12.04.2026	
	28/5		Monday, 13.04.2026 - sunday, 19.04.2026	
	29/6		Monday, 20.04.2026 - Sunday, 26.04.2026	
	30/7		Monday, 27.04.2026 - Sunday, 03.05.2026	01.05.2026, Friday - Labour Day
	31/8	Mid Semester Break (1 Week)	Monday, 04.05.2026 - Sunday, 10.05.2026	
	32/9	Teaching & Learning (T&L 7 Weeks)	Monday, 11.05.2026 - Sunday, 17.05.2026	
	33/10		Monday, 18.05.2026 - Sunday, 24.05.2026	
	34/11		Monday, 25.05.2026 - Sunday, 31.05.2026	27 & 28.05.2026, Wednesday & Thursday - Eid al-Adha** 31.05.2026, Sunday - Wesak Day
	35/12		Monday, 01.06.2026 - Sunday, 07.06.2026	01.06.2026, Monday - Replacement leave for Wesak Day (Main & Engineering Campus) 01.06.2026, Monday - Yang di-Pertuan Agong's Birthday
	36/13		Monday, 08.06.2026 - Sunday, 14.06.2026	
	37/14		Monday, 15.06.2026 - Sunday, 21.06.2026	17.06.2026, Wednesday - Awal Muharram
	38/15		Monday, 22.06.2026 - Sunday, 28.06.2026	
	39/16	Revision Week (1 Week)	Monday, 29.06.2026 - Sunday, 05.07.2026	
	40/17	**Examination (2 Weeks) / Examination (3 Weeks)	Monday, 06.07.2026 - Sunday, 12.07.2026	07.07.2026, Tuesday - Georgetown World Heritage City Day 11.07.2026, Saturday - Penang Governor's Birthday
	41/18		Monday, 13.07.2026 - Sunday, 19.07.2026	
	42/19		Monday, 20.07.2026 - Sunday, 26.07.2026	
COURSES DURING LONG BREAK / SEMESTER BREAK	43/20	Long Semester Break / Industrial Training (10/11 Weeks)	Monday, 27.07.2026 - Sunday, 02.08.2026	
	44/21		Monday, 03.08.2026 - Sunday, 09.08.2026	
	45/22		Monday, 10.08.2026 - Sunday, 16.08.2026	
	46/23		Monday, 17.08.2026 - Sunday, 23.08.2026	
	47/24	*T&L	Monday, 24.08.2026 - Sunday, 30.08.2026	25.08.2026, Tuesday - Maulidur Rasul
	48/25		Monday, 31.08.2026 - Sunday, 06.09.2026	31.08.2026, Monday - National Day
	49/26	Examination	Monday, 07.09.2026 - Sunday, 13.09.2026	
	50/27		Monday, 14.09.2026 - Sunday, 20.09.2026	16.09.2026, Wednesday - Malaysia Day
	51/28		Monday, 21.09.2026 - Sunday, 27.09.2026	

Note: Reduction of the study period by one (1) week, from 28.09.2026 to 4.10.2026.

**This Academic Calendar is subject to change

HEBAHAN BPA BIL. 1/2026 (13 FEBRUARI 2026)
SENAT KE-297 (29 JANUARI 2026)

12. FURTHER INFORMATION

For further information on the programmes offered by the School of Biological Sciences, please visit the USM admissions website: https://www.usm.my/en/admission

For enquiries or additional information, please contact:

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