Faculty of Computer Science and Information Technology
Universiti Putra Malaysia

POSTGRADUATE PROGRAMME
BY COURSEWORK

MASTER OF SOFTWARE ENGINEERING

INTRODUCTION

The Master of Software Engineering programme is a 40 credits postgraduate programme by coursework. It offers an opportunity for advanced studies and career development in the field of software engineering. The objectives of this programme including:

1. to produce professionals with advanced knowledge in the field of Software Engineering who are able to use the best methodologies and techniques to provide innovative solutions to current problems in Software Engineering;
2. to produce professionals who have leadership skills and can communicate and interact effectively with various stakeholders;
3. to produce professionals who are positive, engage in lifelong learning activities and have an entrepreneurial mindset for a successful career; and
4. to produce professionals who uphold ethical and professional practices in maintaining personal and professional integrity.

ENTRANCE REQUIREMENTS

An applicant should have a Bachelor's degree or equivalent, in computing, science and technology or related to computing, with a minimum CGPA 2.75; or

Bachelor's degree or equivalent, in computing, science and technology or related to computing with a CGPA of 2.500 – 2.749 may be considered based on a minimum of 1 year of work experience in the related field; or

Bachelor's degree or equivalent, in computing, science and technology or related to computing with a CGPA of 2.00 – 2.49 may be considered based on a minimum of 5 year of work experience in the related field;

For a candidate who do not have a Computing Degree, the candidate must take a prerequisite course in computing.

ENGLISH LANGUAGE REQUIREMENT

International applicants must have obtained a minimum score of 550 for the TOEFL Paper-based Test (Academic Version) or Band 6.0 for IELTS (Academic Training), or 79-80 for TOEFL Internet-based Test (Academic Version) or Level 109 for CIEP at ELS Language Centre.

PROGRAMME OFFERED BY SEMESTER

First and Second Semester of every year.

GRADUATION REQUIREMENTS

In order to graduate, students must have achieved at least 40 credits. The minimum cumulative average is 3.00. The minimum credits distribution for this programme is as follows:

a) Compulsory courses (21 credits)

Course Code	Course Name	Credit
SSE5091	Empirical Research Methods for Software Engineering	3 (3+0)
SSE5203	Project Management for Software Construction	3 (3+0)
SSE5204	Software Development Methodology	3 (3+0)
SSE5302	Requirements Engineering	3 (3+0)
SSE5206	Software Measurement	3 (3+0)
SSE5207	Software Engineering Models and Methods	3 (3+0)
SSE5304	Software Testing	3 (3+0)

b) Project (10 credits)

Course Code	Course Name	Credit
SSE5991	Project	10 (0+10)

c) Elective Courses (9 credits)
Choose only 3 courses from the list in any specialization elective group. The specialization elective group is intended to help students make course selection plans based on their interests and career aspirations.

Course Code	Course Name	Credit
Software Construction		
SSE5205	Software Architecture and Design	3 (3+0)
SSE5305	Web Engineering	3 (3+0)
SSE5301	User Experience Design	3 (3+0)
SSE5401	Model-based Testing	3 (3+0)
System Security		
SSE5208	Software Security Engineering	3 (3+0)
SSK5500	Security in Computing	3 (3+0)
SSK5505	Cloud Computing Security	3 (3+0)
SSK5507	Cryptography and Security Protocol	3 (3+0)
Cyber-physical System		
SSE5402	Real-Time Software Engineering	3 (3+0)
SSK5220	Cyber-Physical Systems Modeling	3 (3+0)
SSK5221	Internet of Things	3 (3+0)
SSK5223	Pervasive Computing for Cyber-Physical System	3 (3+0)
Intelligent Computing		

SSE5209	Artificial Intelligence in Software Engineering	3 (3+0)
SSK5603	Machine Learning	3 (3+0)
SSK5606	Advanced Natural Language Processing	3 (3+0)
SSK5608	Evolutionary Computing	3 (3+0)
Data Science		
SSE5213	Big Data Engineering	3 (3+0)
SSE5403	Cloud-based Software Engineering	3 (3+0)
SSK5102	Big Data Computing	3 (3+0)
SSK5212	Big Data Technology	3 (3+0)

TUITION FEES

The fee structure for this programme consists of semester-based basic fee and credit fee:

a)   Basic Fee

Semester	Local	International
First Semester	RM 1,425.00	RM2,475.00
Second and Subsequent Semesters	RM 1,175.00	RM2,225.00

b)   Credit Fee

Student	Amount	Credit	Total Amount
Local	RM250.00 per credit	40	RM10,000.00
International	RM400.00 per credit		RM16,000.00

NOTE: The fee amount is subject to change from time to time WITHOUT prior notice by the University. Prospective and current students are advised to check the SGS website for any fee changes not earlier than one (1) month before the start of each semester/new students' registration. All fees must be paid upon registration.

OTHER COST: Please refer to School of Graduate Studies website at **http://www.sgs.upm.edu.my**

Note: -   All fees must be paid within TWO (2 weeks) of registration.
-    Late payment fees will prevent the student's access to course lecture notes and academic records. Also, the student's study status will change to DROPPED status.

COURSES SYNOPSIS

SSE5101   Programming and Computer-based Problem Solving   3 (3+0)
This course covers problem-solving technique using computer programming. Programming elements and algorithms to produce effective program are discussed.

**SSE5091   Empirical Research Methods for Software   3 (3+0)
                Engineering**
This course covers the research methods in software engineering and gives ideas on how to plan, conduct and report on empirical research. Formulation of empirically-testable hypotheses, the design of experiments in order to test these hypotheses, and a range of statistical methods that are available for the evaluation and analysis of experimental results are emphasized

SSE5203   Project Management for Software Construction   3 (3+0)
This course covers the methods and principles of software project management in software construction. Various techniques in cost estimation, risk and resource management to optimize the software project construction are discussed. Quality, configuration and communication management are also emphasized

SSE5204   Software Development Methodology   3 (3+0)
This course covers software development methodologies used in computing environments. Software development strategies involving agile, service-based, component-based and object-based methodologies are discussed

SSE5302   Requirements Engineering   3 (3+0)
This course covers requirements engineering principles, theories, techniques, and models that can be used in producing quality systems. Methods of assessing system requirements according to user specifications in addressing the challenges of requirements evolution are discussed

SSE5206   Software Measurement   3 (3+0)
This course covers the concept, framework, methods and software measurement process. The uses of internal and external software attributes for controlling, managing and predicting software development process, product and resources are discussed

SSE5207   Software Engineering Models and Methods   3 (3+0)
This course covers the concepts, methods and modeling languages in software development. Typical software modeling approaches and techniques used in software development are discussed. Model evaluation and management from quality aspect are also emphasized

SSE5304   Software Testing   3 (3+0)
This course covers concepts, principles, strategies and techniques for testing conventional software, object-oriented software, mobile and web applications. The process of manual and automated software testing comprises of the mechanism of test data selection and test results evaluation are discussed

SSE5991   Project   10 (0+10)
This course covers the preparation of the original proposal implementation and project development related to software engineering. Suitable methodology for formulating, designing, and implementing the proposed project are emphasized

SSE5205   Software Architecture and Design   3 (3+0)
This course covers the architectural concepts, principles and styles in software development. Significant requirements and quality attributes, design, modelling and evaluation of architecture are discussed. Domain-specific software architecture, product line and architecture of modern software systems are emphasized

SSE5305   Web Engineering   3 (3+0)
This course covers the theory and techniques of web application engineering. Analysis, design and implementation of web application using appropriate frameworks are emphasized. Issues related to awareness of service quality, the importance of security and web application management are discussed

SSE5301   User Experience Design   3 (3+0)
This course covers cognitive psychology theories, models, methodology and conceptual design in user experience design. The application prototype development and evaluation using the user experience design approach are emphasized

SSE5401   Model-based Testing   3 (3+0)
This course covers the concepts and processes of model-based testing. Model preparation for the purpose of software testing is discussed. The process of deriving and executing tests is also emphasized

SSE5208   Software Security Engineering   3 (3+0)
This course covers the appropriate principles, techniques and guidelines for developing secure software according to the software development life cycle phases. Security maturity practice, risk tolerance and development style are also discussed

SSK5500   Security in Computing   3 (3+0)
This course covers protection methods against various attacks on legitimate users, including necessary actions to track, document, and prevent the threats. Awareness on security threats and vulnerabilities as well as best practices in computer security are discussed

SSK5505   Cloud Computing Security   3 (3+0)
This course covers advanced topics in Cloud network security that emphasizes the network security practices and practical applications that have been and are being adopted to ensure the security of the Internet and Cloud is guaranteed

SSK5507 Cryptography and Security Protocol 3 (3+0)
This course covers the concept of cryptography and its applications. Two categories of cryptography techniques, namely symmetric ciphers and public-key are discussed. Message authentication and functions for message authentication are also discussed. Appropriate cryptography techniques are implemented in constructing security protocol for application systems

SSE5402 Real-time Software Engineering 3 (3+0)
This course covers conceptual and practical aspect of the tools, techniques and methodologies of real-time software engineering. Embedded software development processes, design patterns, development methodologies, performance analysis and arrangements are discussed

SSK5220 Cyber Physical Systems Modeling 3 (3+0)
This course covers the principles of cyber-physical systems and their related components. It focuses on modeling, which includes design and analysis of cyber-physical system. Concepts of hybrid and dynamic systems as well as their effectiveness are discussed

SSK5221 Internet of Things 3 (3+0)
This course covers technical aspects that are used in development, processing and managing Internet of Things paradigm. IoT services and related applications are also discussed

SSK5223 Pervasive Computing for Cyber-Physical System 3 (3+0)
The course covers development techniques of pervasive computing application for cyber-physical system. It consists of software and hardware of the pervasive system platforms, their environments, and development approaches. The trends of pervasive application and its impacts on future computing applications and society are discussed

SSE5209 Artificial Intelligence in Software Engineering 3 (3+0)
This course comprises the artificial intelligence approach in solving software engineering problems. Various techniques and algorithms to solve and improve the software engineering process are discussed

SSK5603 Machine Learning 3 (3+0)
This course covers the concepts and types of machine learning namely supervised, unsupervised and reinforcement learning. Algorithms for pattern recognition, classification, optimization and complex neural network architecture are emphasized

SSK5606 Advanced Natural Language Processing 3 (3+0)
This course covers the concept of natural language modeling and processing using formal method. Syntactic and semantic decomposition besides approaches in knowledge and thinking representations are also discussed, including using the latest method, word embedding

SSK5608   Evolutionary Computing   3 (3+0)
This course covers theory and techniques in evolutionary computing including the adaptation of biological techniques. Optimization, modeling and simulation using different types of evolutionary algorithms in application domain are discussed

SSE5213   Big Data Engineering   3 (3+0)
This course covers concepts, techniques, frameworks, tools, and platforms in big data engineering to support decision making. Big data analytics and visualization using various systematic data processing and analysis techniques are discussed

SSE5403   Cloud-based Software Engineering   3 (3+0)
This course covers concepts, principles and technologies related to cloud computing. Architectural models of cloud computing and development applications using the cloud computing paradigm are discussed. Cloud-based application is develop and deploy using appropriate cloud services

SSK5102   Big Data Computing   3 (3+0)
This course covers the programming structures and algorithms for large-scale data processing and visualization. It includes the usage of big data eco-system for large-scale data storage and computation. Machine learning algorithm and data analytics are discussed

SSK5212   Big Data Technology   3 (3+0)
This course covers the technical aspects that are used in processing and managing big data. The big data architecture and technologies for the collection, storage, integration, processing and applications of big data are discussed

SUGGESTED STUDY SCHEME

YEAR 1

First Semester			Second Semester		
Code	Course Name	Credit/ Status	Code	Course Name	Credit/ Status
SSE5091	Empirical Research Methods for Software Engineering	3 YW	SSE5206	Software Measurement	3 YW
SSE5203	Project Management for Software Construction	3 YW	SSE5207	Software Engineering Models and Methods	3 YW
SSE5204	Software Development Methodology	3 YW	SSE5304	Software Testing	3 YW
SSE5302	Requirements Engineering	3 YW	SSE5991	Project**	2 YW
	Elective	3 ELF		Elective	3 ELF
Total Credits		**15**	**Total Credits**		**12**

YEAR 2

First Semester		
Code	Course Name	Credit/ Status
SSE5991	Project	8 YW
	Elective	3 ELF
Total Credits		**13**

**Note: Project (SSE5991) should be registered in 2nd semester Year 1 and continue in 1st semester Year 2. The carry marks in 2nd semester Year 1 will bring forward to 1st semester Year 2.

International students may be required to register for the following courses in their first semester:
1. LPM2100 MALAY LANGUAGE COMMUNICATION (2 credits); and

2. Postgraduate Intensive English (PIE) courses for international applicants who have been given provisional admission without meeting the university's English language requirements. For more information, please visit: http://sgs.upm.edu.my/content/english_language_requirement-40581

Course registration: Maximum of 15 credits per semester and Minimum 6 credits

Course registration status: YW= Compulsory, ELF= Elective

CONTACT LIST

Application for Admission:

School of Graduate Studies
Zone 4, Off Jalan Stadium
Universiti Putra Malaysia
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For further information on academic programmes, please contact:

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Master Programme Coordinator (by coursework)
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