

Subject Description Form

Subject Code	ME6103
Subject Title	Intelligent Robotic Systems
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Prerequisite: Students should have basic knowledge of robotics and programming skills
Objectives	<ol style="list-style-type: none"> 1. To provide students with both fundamental and advanced concepts and techniques for the design, modelling, analysis of robotic systems. 2. To provide students with the knowledge and state-of-the-art methods of intelligent robotic systems.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. Formulate and solve robot kinematics of robotic systems. b. Apply advanced techniques for robotic systems. c. Apply the appropriate control strategy for robotic systems. d. Design or implement artificial intelligence solutions for robotic applications.
Subject Synopsis/ Indicative Syllabus	<p>Analytical fundamentals: Coordinate transformations, forward and inverse kinematics, equations of motion, modelling of non-inertial systems, trajectory planning and navigation, kinematic constraints, multi-robot coordination, feedback control, interaction force control.</p> <p>Advanced topics: Under-actuated systems, redundancy resolution, medical and service robots, SLAM, machine learning and its applications for robotics.</p>
Teaching/Learning Methodology	<p>The teaching and learning methods include lectures, tutorials, homework assignment and project/experiments.</p> <p>Lectures aim at providing students with the fundamental and advanced knowledge required for understanding and analysing different robots, including system modelling, trajectory planning, control and artificial intelligence techniques.</p> <p>Tutorials aim at enhancing students' analytical and problem-solving skills on robotics.</p> <p>The project/experiment aims to have knowledge of computer simulations and hand-on experience on robot control.</p>

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			a	b	c	d
	1. Assignments	10%	√	√	√	√
	2. Tests	20%	√	√	√	√
	3. Projects	30%	√	√	√	√
	4. Examination	40%	√	√	√	√
	Total	100 %				
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:</p> <p style="text-align: center;">0.40 x Examination + 0.6 x Continuous Assessment</p> <p>The continuous assessment consists of three components: assignment (10%), tests (20%), and a team project (30%). They are aimed at assessing the understanding on modelling and analysis of robotic systems and its related technologies.</p> <p>The examination will be use to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently, and to determine the degree of achieving the subject learning outcomes.</p>						
Student Study Effort Expected	Class contact:					
	▪ Lecture		33 Hrs.			
	▪ Tutorial/Laboratory		6 Hrs.			
	Other student study effort:					
	▪ Reading and review		40 Hrs.			
	▪ Coursework (assignments, project)		30 Hrs.			
	Total student study effort		109 Hrs.			

Reading List and References

1. S. B. Niku, Introduction to robotics: analysis, control, applications, Wiley, latest edition.
2. M. W. Spong S. Hutchinson, and M. Vidyasagar, Robot Modeling and Control, Wiley, latest edition.
3. K. Lynch, Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, latest edition.
4. B. Siciliano, L. Sciavicco, L. Villani, and G. Oriolo, Robotics, Modelling, Planning and Control, Springer, latest edition.
5. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Pearson, latest edition.
6. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, latest edition.
7. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, Dive into Deep Learning, Preview Version, latest edition.
8. Eli Stevens, Luca Antiga, Deep Learning with PyTorch, Manning Publications, latest edition.

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