Subject Description Form

Subject Code	ME31003
Subject Title	System Dynamics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME23001 Engineering Mechanics
Objectives	To provide students the knowledge in modeling and solving different dynamic systems including plane kinematics and kinetics of rigid bodies through theoretical and mathematical principles.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Construct and analyze the dynamic models of different systems by applying knowledge of physical laws and mathematical techniques. b. Formulate and analyze the translational and rotational motions of mechanical systems by applying knowledge of rigid body dynamics. c. Complete a given task in modeling and analysis of dynamic systems such as an assignment or a project by applying concepts and knowledge in system dynamics, mathematical and simulation tools. d. Present effectively in completing written reports of a given task.
Subject Synopsis/ Indicative Syllabus	***Dynamics*** - *Plane kinematics of rigid bodies*, translation and rotation, relative velocity, instantaneous centre of zero velocity, relative acceleration, motion relative to rotating axes. *Plane kinetics of rigid bodies*, force, mass and acceleration, general equation of motion, applications, e.g., four-bar linkage and slider-crank mechanisms, principles of work, energy, impulse and momentum. ***Modelling of Linear Systems*** **–** Dynamic equations of multi-degrees-of-freedom spring-mass-damper systems, and other systems; introduction to Laplace transform and analysis of vibration systems; block diagram construction and simplification; Transfer functions; Characteristic equations, Zeros and poles; Transient responses of 1^{st} and 2^{nd} order systems.
Teaching/Learning Methodology	Lectures aim at providing students with an integrated knowledge required for understanding and analyzing the dynamics of rigid bodies and systems. (Outcomes a to c) Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skill of modeling dynamic systems and determining their responses. (Outcomes a to c) Assignments aim at providing opportunities for students to apply concepts and knowledge in system dynamics and mathematical tools in solving real-world problems. The project aims at providing opportunities for students to design/enhance a real-life product or system using the knowledge they acquired in the class. (Outcomes a to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Tutorial	√	√	√	
Task (Assignments, Project)	√	√	√	√

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. Class test	20%	√	√		
2. Assignments	10%	√	√	√	
3. Project	20%			√	√
4. Examination	50%	√	√		
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

The continuous assessment includes three components: closed-book tests (20%), assignments (10%), and a project (20%). The closed-book tests aim at assessing the interim knowledge gained by the student. The assignments aim at assisting the students in preparation for the tests and checking the progress of their study. The project aims at integrating the knowledge through a design project.

The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the problems, critically and individually, related to modeling and analysis of linear dynamic systems.

Student Study Effort Expected

Class contact:	
▪ Lecture	32 Hrs.
▪ Tutorial	7 Hrs.
Other student study effort:	
▪ Reading and review	36 Hrs.
▪ Homework assignment and project	30 Hrs.
Total student study effort	105 Hrs.

Reading List and References	1. F.P. Beer and E.R. Johnson, Mechanics for Engineers: Dynamics, McGraw-Hill, latest edition. 2. J.L. Meriam and L.G. Kraige, Engineering Mechanics, John Wiley, latest edition. 3. N.S. Nise, Control Systems Engineering, Wiley, latest edition. 4. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition.

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