Subject Description Form

Subject Code	ME31001
Subject Title	Dynamics and Vibrations
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME23001 Engineering Mechanics
Objectives	To teach students basic concepts of rigid body planar motion and mechanical vibration.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve planar motion problems in rigid body dynamics by applying knowledge of dynamic analyses and mathematics. b. Formulate and solve vibration problems in single DOF mechanical systems by applying knowledge of vibration theory and mathematics. c. Analyse and interpret data obtained from experiments in dynamics and vibrations. d. Present effectively in completing written reports of laboratory work.
Subject Synopsis/ Indicative Syllabus	***Dynamics*** **-** *Plane kinematics of rigid bodies*, rotation, absolute motion, 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, gear trains, work and energy, impulse, momentum, impulse-momentum equations, impact and applications and whirling of rotating shafts. ***Vibration of a Single-degree-of-freedom System*** **-** Free vibration of particles, equation of motion, damping effects, forced vibration of particles, vibration of rigid bodies, energy methods, computer simulations of the free and forced vibration response of a single-degree-of-freedom system. **Laboratory Experiment** There is one 2-hour laboratory session. Typical Experiments: 1. Gear train experiment 2. Forced vibration 3. Whirling of shaft

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding dynamics and single-degree-freedom vibration systems. Theories and examples will be presented to cover the syllabus on kinematics and kinetics of rigid bodies; equation of motions, work and energy, impulse and momentum, and one DOF vibrations. (Outcomes a and b)

Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skills of solving different engineering problems using the knowledge of dynamics and single-degree-freedom vibration systems. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a and b)

Experiments will provide students with experience on gear train systems, forced vibration systems and whirling of shafts. These experiments are designed to train students how to apply theories to practical applications, how to analyze and present experimental data. (Outcomes c and d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Laboratory			√	√

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	30%	√	√		
2. Homework	15%	√	√		
3. Laboratory	5%			√	√
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

Examination is adopted to assess students on the overall understanding and the ability to apply the concepts. It is supplemented by the tests, assignments and laboratory report which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	31 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Reading and review	45 Hrs.
	▪ Homework assignment	22 Hrs.
	▪ Laboratory report	6 Hrs.
	Total student study effort	112 Hrs.
Reading List and References	1. F.P. Beer and E.R. Johnson, Vector Mechanics for Engineers: Dynamics, McGraw-Hill, latest edition. 2. J.L. Meriam and L.G. Kraige, Engineering Mechanics, John Wiley, latest edition. 3. S. Graham Kelly, Fundamentals of Mechanical Vibrations, McGraw Hill, latest edition. 4. W.T. Thomson, Theory of Vibration with Applications, Prentice Hall, latest edition.	

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