Subject Description Form

Subject Code	ME6101
Subject Title	Advanced Theory and Methods in Vibration Analysis
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: ME536 Vibrations and Structure-borne Noise
Objectives	The subject aims: 1. To equip students with the knowledge of MDOF systems; 2. To introduce students with elements of analytical dynamics; 3. To introduce students with continuous models and advanced analysis methods.
Intended Learning Outcomes	Upon satisfactory completion of the subject, students are expected to achieve the following outcomes: a. Able to understand and formulate the dynamic response of MDOF systems; b. Able to apply their knowledge of vibration theory and methods to model mechanical behavior and conduct modal analysis; c. Able to conduct analysis and design in sound and vibration systems with advanced analysis methods; d. Able to comprehend the theoretical aspects in the related literature.
Subject Synopsis/ Indicative Syllabus	***Introduction to Vibrations*** **-** Equivalent springs, dampers and masses; Nature of Excitations, and vibration about equilibrium points; Response of SDOF systems to nonPeriodic Excitations; Whirling of rotating shafts; Vibration isolation, energy dissipation and structural damping. ***Elements of Analytical Dynamics*** **-** Degree of freedom and generalized coordinates; The principle of virtual work and D'Alembert; The hamilton's principle; Lagrange's equations. ***Multi DOF Systems*** **-** Properties of the stiffness and Mass coefficients; Linear transformations – coupling; The eigenvalue problem; Orthogonality of modal vectors; Modal analysis. ***Continuous Models for Vibrations*** **-** Transverse vibration of strings; Vibration of beams; Vibration of plates; Wave Equation. ***Advanced Selective Topics*** **-** Advanced acoustics; Wave propagation and application; Nonlinear analysis methods (perturbation, harmonic balance, or Volterra series etc).
Teaching/Learning Methodology	Lectures and Tutorials

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1. Continuous Assessment</td><td>40%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. Final</td><td>60%</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture (13 weeks and 3 hrs per week)</td><td>39 Hrs.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Precepts or Tutorials</td><td>26 Hrs.</td></tr>
<tr><td>▪ After-class reading</td><td>39 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>104 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>1. Leonard Meirovitch, Fundamentals of Vibrations, McGraw Hill, latest edition.
2. Haym Benaroya, Mechanical vibration, Prentice Hall, latest edition.</td></tr>
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