MODULE DESCRIPTION FORM

16361 (ME305 sem1/ 16318 sem2) DYNAMICS AND CONTROL

Module Registrar: Dr I Trendafilova
irina.trendafilova@strath.ac.uk

Taught To (Course): Cohorts for whom class is compulsory

Other Lecturers Involved: Prof M Vasile

Credit Weighting: 20 (ECTS 10)

Semester: 1 and 2

Assumed Prerequisites: 16232 Engineering Mechanics, MM117 Mathematics 1M

Compulsory class

Academic Level: 3

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Laboratory</th>
<th>Groupwork</th>
<th>External</th>
<th>Online</th>
<th>Project</th>
<th>Assignments</th>
<th>Private Study</th>
<th>Total</th>
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<tbody>
<tr>
<td>48</td>
<td>48</td>
<td>2</td>
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<td></td>
<td></td>
<td>28</td>
<td>74</td>
<td>200</td>
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Educational Aim

The 1st semester Dynamics module aims to:
1) introduce the general principles of the kinematics of rigid bodies and different types of motion: translation, rotation and general plane motion;
2) study the kinetics of rigid bodies focusing on plane motion, equations of motion, angular momentum and D'Alembert's Principle;
3) utilise the fundamentals taught in second year Dynamics to demonstrate the principles of analysis of the dynamic performance of mechanical engineering systems;
4) introduce the basics of modelling the vibrations of mechanical systems.
5) combine the fundamental theory of free and forced vibrations of damped and undamped systems with some essential laboratory practice and demonstrations.

The 2nd semester Control element aims to:
6) introduce the concept of control theory to the students,
7) provide essential knowledge to model a physical system and linearize it.
8) introduce the tools to design a feedback control system.
9) develop skills to assess the performance of a feedback control system.

Learning Outcomes

On completion of the 1st semester, the student is expected to:

LO1 be able to understand and apply the basic physical principles of kinematics and kinetics of rigid bodies.
LO2 have an understanding of and be able to apply the basic relations between the forces acting on a rigid body, its mass and shape and the resulting motion.
LO3 be able to analyse simple one degree of freedom vibrating mass-elastic systems.
LO4 be able to apply and understand the above methods and principle to predict and analyse the vibration of simple mechanical systems.

On completion of the 2nd semester, the student is expected to:

LO5 have an understanding of the procedures for engineering system modelling and analysis.
LO6 be able to apply and understand the analytical methods needed to assess engineering system dynamics.
LO7 Be able to design a simple feedback control system.
Syllabus

Semester 1 will teach the following:
- General kinematics and kinetics of rigid bodies: translation, rotation and general plane motion.
- Application of plane kinematics and kinetics to rigid bodies and mechanisms.
- Vibrations of a single degree of freedom (1 dof) systems. Free and forced vibrations. Damping. Analysis of free and forced vibration of damped 1 dof systems. Equivalent dynamic systems.

Semester 2 will teach the following:
- Introduction to control systems.
- Measurement and Models of systems. Physical principles of measuring devices and modelling of physical systems using differential equations, linear approximations, state variable models.
- Laplace transforms, Block diagrams and transfer functions.
- The performance of feedback control systems.
- The stability of linear feedback systems.
- The root locus method.

Assessment of Learning Outcomes

Criteria

Semester 1
All the outcomes will be assessed by the ability of the students to do the corresponding Tutorial questions. LO1-LO4 will be assessed by the ability of the students to model simple systems and estimate their characteristics. Students should demonstrate their understanding by being able to interpret problems, create simple models and determine appropriate solutions. LO4 will be assessed through the students' performance and understanding at Laboratory exercise. Students should be able to take appropriate measurements, interpret the results and understand the analysis of the results. LO1, LO4 will be assessed through the students participation in the discussion at the Demonstration Labs. Students should demonstrate their knowledge by being able to answer questions on experiment and discuss results with peers.

Semester 2
LO5 will be assessed by the ability of students in modelling a physical system in their first course project and also by their solution to final exam questions. Students should demonstrate knowledge by demonstrating ability to set up a relevant model for the problem and determine an appropriate solution to the analysis. LO6 will be assessed by the ability of students in analysing the control system dynamics in the second course project and also by ability of students in answering related exam questions. Students should demonstrate knowledge by demonstrating ability to set up a relevant model for the problem and determine an appropriate solution to the analysis. LO7 will be assessed by their final design of the control system in their second course project and also by ability of students in answering related exam questions. Students should demonstrate knowledge by demonstrating ability to set up a relevant model for the problem and determine an appropriate solution to the analysis.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

12 Principles of Assessment and Feedback
(on Learning & Teaching web pages: www.strath.ac.uk/learnteach/teaching/staff/assessfeedback/12principles/)

Assessment is given in different forms
- Immediate self-directed feedback through in class discussions
- Immediate self-directed feedback and self-assessment through question and answers sessions in class
- Written feedback from the report
Immediate self-directed feedback and self-assessment at tutorials at presenting the solutions of the problems and through discussions.

- Feedback will be provided individually at tutorials by assessing the students' work.
- Feedback for the sem1 and sem2 activities/questionnaires will be given individually online. Comments will be provided.

### Assessment Method(s) Including Percentage Breakdown and Duration of Exams

<table>
<thead>
<tr>
<th>Examinations</th>
<th>Courseworks</th>
<th>Projects</th>
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<tbody>
<tr>
<td>Number</td>
<td>Month(s)</td>
<td>Duration</td>
</tr>
<tr>
<td>1</td>
<td>January</td>
<td>2 hrs</td>
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<tr>
<td>1</td>
<td>May/June</td>
<td>2 hrs</td>
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<tr>
<td></td>
<td>Wk11</td>
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LO1-LO4 January exam
LO5, LO6 Wk11 exam **change due to circumstances**
LO1-LO3
LO5-LO7

Indicate which learning outcomes (LO1, LO2 etc) are to be assessed by exam/coursework/project as required.

### Coursework / Submissions deadlines:
- 2 weeks after completion of the Laboratory exercise in sem1; 2 weeks after assignments become available in sem2.

### Resit Assessment Procedures:
- 2 hours during the August resit diet.

**PLEASE NOTE:**
Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.

### Recommended Reading

****Purchase essential; ***Purchase recommended; **Highly recommended reading; *Simply for reference (do NOT purchase)


**Daniel J Inman, Engineering Vibrations, Prentice Hall,2001


### Additional Student Feedback
(Please specify details of when additional feedback will be provided)

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Session: 2014/15

Approved:

Course Director Signature: [Signature]

Date of Last Modifications: 01 September 2014
Module Timetable

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<th>Module Code:</th>
<th>16361</th>
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<tbody>
<tr>
<td>Module Title:</td>
<td>Dynamics and Control/Dynamics</td>
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**Brief Description of Assessment:**

Laboratory and report: submission date 2 week after the Laboratory exercise.
Coursework: submission date 2 weeks after becoming available.
Exams in the January and May exam periods.

**Assessment Timing:**

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment(s).

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<thead>
<tr>
<th>Semester One</th>
<th>WK1</th>
<th>WK2</th>
<th>WK3</th>
<th>WK4</th>
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<th>WK6</th>
<th>WK7</th>
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