Description: Dynamics II

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<th>Subject</th>
<th>Cat-Nbr</th>
<th>Class</th>
<th>Term</th>
<th>Mode</th>
<th>Units</th>
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<td>MEC</td>
<td>3403</td>
<td>24620</td>
<td>2, 2003</td>
<td>ONC</td>
<td>1.00</td>
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Academic Group: FOENS
Academic Org: FOES02
HECS Band: 2
ASCED Code: 030701

STAFFING
Examiner: Sai-Cheong Fok
Moderator: Chris Snook

PRE-REQUISITES
Pre-requisite: MEC2401 and MAT2100

OTHER-REQUISITES
Prerequisites 70350+64613

SYNOPSIS
The application of the principles of Mechanics is abound in our daily life. Buildings and bridges are designed to operate under normal conditions with the help of the principles of Statics. Under extraordinary conditions such as earthquake or high wind speed, the design is governed by the principles of Dynamics (loading conditions vary significantly with time). Mechanical systems are inherently dynamic. Moving parts exist in many products and equipment: simple household electrical appliances, office equipment, cars, robots, production factories, mining, construction, agricultural machineries, ships, aeroplanes and spacecrafts, etc. Knowledge of dynamics plays an essential role in the design and analysis of any of these systems. Apart from pure mechanical functionalities, modern systems incorporate more robust and accurate control with the help of electronic devices. Flexible and intelligent systems such as robots, computer controlled factories, autonomous vehicles are now common. These achievements are possible because very detailed and accurate system dynamics is understood and advanced electronics and control are available. This advanced course covers the formulation of vector mechanics for general three dimensional systems of rigid bodies and the theory of vibration and its applications. The principles and methods covered are essential to the understanding of mechanical systems.
OBJECTIVES

On completion of this course, students should be able to:

- explain the fundamental physical postulates of the theory of Newtonian Mechanics;
- demonstrate the relevant mathematical foundation for Newtonian Mechanics;
- apply the principles of 3D kinematics to the analysis of 3D mechanical systems such as articulated robots;
- analyse physical singularities and recognise their mathematical manifestation in inverse kinematics;
- apply Hamilton's Principle and Lagrange's equations;
- explain the physical concept of inertia and apply Newton's first law;
- explain the physical concept of mass and force and apply Newton's second law;
- explain the concept of energy and momentum and make use of the associated laws of conservation;
- apply Newton's third law and law of universal gravitation;
- apply basic equations of motion derived from the fundamental principles;
- model, formulate and solve problems in 3D kinematics and kinetics of rigid bodies;
- apply the principles of vibration theory, vibration measurements and control;
- explain the process of and carry out discrete modelling of vibratory continuous systems;
- determine the vibrational behaviour of systems of discrete bodies having two or more degrees of freedom, with or without viscous damping;
- explain the limitation of closed form analytical methods and the need for computer discrete modelling tools;
- identify important phenomena such as dynamic imbalance and resonance and explain these phenomena mathematically;
- develop and write simple computer programs for the solution of certain problems in Mechanics.

TOPICS

<table>
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<tr>
<th>Description</th>
<th>Weighting (%)</th>
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<tr>
<td>1. Space rigid body kinematics</td>
<td>30.00</td>
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<td>2. Space rigid body kinetics</td>
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<tr>
<td>3. Theory of multi-DOF vibration</td>
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TEXT and MATERIALS required to be PURCHASED or ACCESSED:

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.

MEC3403 Dynamics II External Study Package, USQ Publication,

The Student Edition of MATLAB (Manual and CD), Prentice Hall.

Tran-Cong, T. 1998, Dynamics for Engineering Students, USQ Publication,
REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

(SI Version)

STUDENT WORKLOAD REQUIREMENTS

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>HOURS</th>
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<tbody>
<tr>
<td>Assessment</td>
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<td>Examinations</td>
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<tr>
<td>Lectures</td>
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<tr>
<td>Private Study</td>
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<td>Tutorial</td>
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ASSESSMENT DETAILS

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<tr>
<th>Description</th>
<th>Marks Out of</th>
<th>Wtg(%)</th>
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<tr>
<td>ASSIGNMENT</td>
<td>300.00</td>
<td>30.00</td>
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<tr>
<td>CMA</td>
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<tr>
<td>3 HOUR OPEN EXAMINATION</td>
<td>700.00</td>
<td>70.00</td>
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NOTES:

. Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1 Attendance requirements:
   It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2 Requirements for students to complete each assessment item satisfactorily:
To complete each of the assessment items satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for each assessment item.

3 Penalties for late submission of required work:
   If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks gained by the student for the assignment will apply for each working day late. A CMA submitted after the due date will not be marked if the results and answers have been released.

4 Requirements for student to be awarded a passing grade in the course:
   To be assured of a passing grade, students must demonstrate, via the summative assessment items, that they have achieved the required minimum standards in relation to the objectives of the course by satisfactorily completing all summative assessment items (the examination and assignments), as stated in 2 above.

5 Method used to combine assessment results to attain final grade:
   The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.

6 Examination information:
   In an Open Examination, candidates may have access to any material during the examination except the following: electronic communication devices, bulky materials, devices requiring mains power and material likely to disturb other students.

7 Examination period when Deferred/Supplementary examinations will be held:
   Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

8 University Regulations:
   Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL http://www.usq.edu.au/SECARIAT/calendar/Part5/ or in the printed version of the current USQ Handbook.

ASSESSMENT NOTES

1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.

2 Students must retain a copy of each item submitted for assessment. This must be despatched to USQ within 24 hours if required by the Examiner.

3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.

4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.

5 The Faculty will NOT accept submission of assignments by facsimile.
6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.

8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded the temporary grade: IM (Incomplete - Make up). An IM grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non-directed personal study.

9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

OTHER REQUIREMENTS

1 Students will require access to e-mail and internet access to USQConnect for this course.