A. Basic Information

Course Title: System Dynamics & Mechanical Vibration  
Code: MDP322
Lecture: 2  
Tutorial: 3  
Practical:  
Total: 5
Program on which the course is given: B.Sc. Mechanical Engineering (Production)
Major or minor element of program: Major
Department offering the program: Mechanical Engineering Department
Department offering the course: Mechanical Engineering Department
Academic year / level: Third Year / Second Semester
Date of specifications approval: 10/5/2006

B. Professional Information

1. Overall aims of course
   By the end of the course the students will be able to:
   i. Understanding concepts, principles of Automatic control
   ii. Understanding of basic principles and stability of control systems
   iii. To provide students with solid understanding of controller designs and compensation techniques

2. Intended Learning outcomes of Course (ILOs)

a. Knowledge and Understanding:
   a.3) Characteristics of engineering materials related to discipline.
   a.4) Principles of design including elements design, process and/or a system related to specific disciplines.
   a.12) Contemporary engineering topics.
   a.16) Relevant contemporary issues in mechanical engineering.
a.19) Engineering design principles and techniques.

b. **Intellectual Skills**
   b.14) Analyze and interpret data, and design experiments to obtain primary data.
   b.16) Interpret numerical data and apply analytical methods for engineering design purposes

c. **Professional and Practical Skills**
   c.1) Apply knowledge of mathematics, science, information technology, design, business context and engineering practice to solve engineering problems.
   c.3) Create and/or re-design a process, component or system, and carry out specialized engineering designs.

d. **General and Transferable Skills**
   d.9) Refer to relevant literatures.

3. **Contents**

<table>
<thead>
<tr>
<th>No</th>
<th>Topic</th>
<th>No. of hours</th>
<th>ILOs</th>
<th>Teaching / learning methods and strategies</th>
<th>Assessment method</th>
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</table>
| 1  | Modeling mechanical systems:  
   •Translation                  | 2             | a.3, a.4, a.12 | Lecture                                    | -                 |
| 2  | Modeling mechanical systems:  
   •Rotation  
   •Kinematics                 | 5             | a.13, b14, c.1 | Lecture, Class activity, Assignments       | Assignments       |
<p>| 3  | Modeling of physical systems Electrical and | 5             | a.13, b16, c.3 | Lecture, Class activity, Assignments       | Assignments       |</p>
<table>
<thead>
<tr>
<th>Electromechanical systems</th>
<th>Modeling of physical systems Hydraulic, Pneumatic</th>
<th>5</th>
<th>a.4, b.14, c.1, c.3</th>
<th>Lecture, Class activity</th>
<th>Quiz</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>Modeling of physical systems Thermal and combined systems</td>
<td>5</td>
<td>a.4, b.16, c.1, c.3</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
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<tr>
<td>6</td>
<td>Laplace transform method: •Partial fraction expansion •Expansion with matlab •Transfer functions</td>
<td>5</td>
<td>a.13, a.4, b.16, c.1, d.9</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
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<tr>
<td>7</td>
<td>Block diagram, Signal flow graph representation</td>
<td>5</td>
<td>a.16, b.16, c.1, d.9</td>
<td>Lecture</td>
<td>Quiz</td>
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<tr>
<td>8</td>
<td>Midterm exam</td>
<td></td>
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<td>9</td>
<td>Steady state error analysis with matlab application</td>
<td>5</td>
<td>a.3, a.5, b.14, b.13</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
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<tr>
<td>10</td>
<td>Linearizing nonlinear models about equilibrium</td>
<td>5</td>
<td>a.3, a.19, b.16, c.3, d.9</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
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<tr>
<td>11</td>
<td>Stability: •Internal stability •Asymptotic stability •BIBO stability</td>
<td>5</td>
<td>a.4, a.16, b.16, c.1</td>
<td>Lecture, Class activity</td>
<td>Quiz</td>
</tr>
<tr>
<td>12</td>
<td>Free damped vibration</td>
<td>5</td>
<td>a.19, b.16, c.3</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
</tr>
<tr>
<td>13</td>
<td>Forced damped vibration-1</td>
<td>5</td>
<td>a.4, b.14, c.3, d.9</td>
<td>Lecture, Class activity, Assignments</td>
<td>Assignments</td>
</tr>
</tbody>
</table>
4. Teaching and Learning Methods
   __X__ Lectures
   ____ Practical training / laboratory
   ____ Seminar / workshop
   __X__ Class activity
   ____ Case study
   __X__ Assignments / homework
   Other:__________________________

5. Student Assessment Methods
   __X__ Assignments to assess knowledge and intellectual skills.
   __X__ Quiz to assess knowledge, intellectual and professional skills.
   __X__ Mid-term exam to assess knowledge, intellectual, professional and general skills.
   __X__ Oral exam to assess knowledge and intellectual skills.
   __X__ Final exam to assess knowledge, intellectual, professional and general skills.
   Other: ________________to assess ____________________________.

6. Assessment schedule
   Assessment 1 on weeks 2, 3, 5, 6, 9, 10, 12, 13
   Assessment 2 Quizzes on weeks 4, 7, 10
   Assessment 3 Mid-term exam on week 8
   Assessment 4 Oral Exam on week 14
   Assessment 5 Final exam on week 15
7. Weighting of Assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>Mid-Term Examination</td>
<td>20%</td>
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<tr>
<td>Final-Term Examination</td>
<td>60%</td>
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<tr>
<td>Oral Examination</td>
<td>10%</td>
</tr>
<tr>
<td>Practical Examination</td>
<td>00%</td>
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<tr>
<td>Semester Work</td>
<td>05%</td>
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<tr>
<td>Other (Quizzes)</td>
<td>05%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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8. List of References

8.1 Course Notes

… Course notes prepared by instructor.

8.2 Essential Books (Text Books)

*System Dynamics, 2nd Ed, William Palm, McGraw-Hill*

Recommended Books

8.3 Periodicals, Web sites, etc

[www.systemdynamics.com](http://www.systemdynamics.com)

9. Facilities Required for Teaching and learning

Lecture room equipped with Presentation board, computer and data show.

**Course coordinator:** Dr. Maha Lashin

**Course instructor:** Dr. Maha Lashin

**Head of department:** Prof. Dr. Maher Gamil Hegazy

**Date:** 09/01/2011