Course Specifications

University: Benha University  
Faculty: High Institute of Technology

Course specifications
Programme(s) on which the course is given  
All Mechanical Engineering Programs

Major or minor element of programmes
Department offering the programme  
Mechanical Engineering
Department offering the course  
Mechanical Engineering
Academic year / Level  
4th year
Date of specification approval

A- Basic Information
Title: Automatic Control  
Code: M 482
Credit Hours:  
Lecture: 3
Tutorial: 2  
Practical: 2  
Total: 7

B- Professional Information

1 - Overall aims of course
This course is a basic course in automatic control. It gives the students the definitions of automatic control and introduces the basic control theory. The student will be able to model different systems such as the electrical, hydraulic, pneumatic and thermal systems. The student will be able also to obtain the transfer function and to draw the block diagram. The course aims also to let the student understand the behavior of the system and to obtain the transient response. By the end of the course the students will be able to apply basic control theories to examine the stability of the systems.
2- Intended learning outcomes of course (ILOs)

a. Knowledge and understanding:
By the end of the course the student will be able to
  a.1 Understand basic definitions on automatic control
  a.2 Draw system block diagrams
  a.3 Understand the transient response of the first and the second order systems
  a.4 Describe the performance of the first and the second order systems
  a.5 Describe different methods which are used to examine control systems

b. Intellectual skills
By the end of the course, the students will be able to:
  b.1 Obtain the system mathematical model.
  b.2 Analyze a system to get the transient response by solving the mathematical model.
  b.3 Determine of the system time and frequency responses.
  b.4 Apply different control theories to examines the stability of a control system
  b.5 Solve problems of automatic control

c- Professional and practical skills

By the end of the course the student will be able to
  c.1 Use computer programs to model control systems
  c.2 Identify the reasons of system instability
  c.3 Perform basic control lab experiments
  c.4 Design basic control circuits

d- General and transferable skills
  d.1 Present reports and discuss results
  d.2 Work coherently and successfully as a part of a team in lab assignments
  d.3 Share ideas and work in a team in an efficient and effective manner.
3- Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Hours</th>
<th>Lecture</th>
<th>Tutorial/Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction (open and closed loop systems, servomechanisms, definitions)</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Modeling of feedback control (block diagram representation, transfer function)</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Modeling of the physical systems and process description (Hydraulic, Pneumatic, and thermal)</td>
<td>14</td>
<td>6</td>
<td>8</td>
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<tr>
<td>Determination of system time (Solution of differential equations and Laplace transform)</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Transient response of closed-loop systems</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>System steady state performance (Steady state error)</td>
<td>7</td>
<td>3</td>
<td>4</td>
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<tr>
<td>The root–locus method</td>
<td>14</td>
<td>6</td>
<td>8</td>
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<tr>
<td>Nyquist stability criteria (Closed loop frequency response)</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Determination of system frequency responses (polar plot, Bode diagrams, M and N circles)</td>
<td>14</td>
<td>6</td>
<td>8</td>
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</tbody>
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4- Teaching and learning methods

4.1- Lectures
4.2- Tutorials and discussion sessions
4.3- Laboratories

5- Student assessment methods

5.1 Written exams to assess the understanding of the concepts and the ability to solve problems
5.1 Class work to assess the discussion of the technical reports assignments

Assessment schedule

Assessment 1 Week 7
Assessment 2 week 12
Assessment 3 (homework) Week 15
Assessment 4 (Final exam) Week 16
Weighting of assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Mid-term examinations</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>%</td>
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<tr>
<td>Practical examination</td>
<td>%</td>
</tr>
<tr>
<td>Semester work</td>
<td>20%</td>
</tr>
<tr>
<td>Other types of assessment</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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</table>

Any formative only assessments

6- List of references

6.1- Course notes
N.A.

6.2- Essential books (text books)
Modern Control Engineering, Katsuhiko Ogata

6.3- Recommended books
Automatic control engineering, Francis Raven
Modern control systems, Richard Dorf and Robert Bishop

6.4- Periodicals, Web sites, … etc

7- Facilities required for teaching and learning
Teaching facilities (whiteboard, presentation board, data show)
Laboratory

Course coordinator: Assoc. Prof. Hesham El-Batsh
Head of Department: Prof.Dr. Sameh Nada
Date: //