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| unilogo1.gif Shoubra Faculty of Engineering | Untitled.jpgUntitled.jpgUntitled.jpgUntitled2.jpg Course Specifications : Advanced automatic control | Untitled2.jpg |
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| **University** : Benha university |

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| **Faculty** : Shoubra Faculty of Engineering |

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| **Department** : Mechanical Engineering Department |

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| **1- Course Data** |
| |  |  |  |  | | --- | --- | --- | --- | | Course Code : MDP444 | Course Title : Advanced automatic control | Study Year : Fourth Year | | | Specialization | : Production Mechanical Engineering Department | | | | Teaching Hours: | | | | | Lecture : 3 | Tutorial : 2 | Practical : |  | |

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| **2-  Course Aim** |
| For students undertaking this course, the aims are to: |
| |  | | --- | | 2.1- List concepts, principles of Automatic control | | 2.2- State basic principles and stability of control systems | | 2.3- Provide students with solid understanding of controller designs and compensation techniques | |

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| **3- Intended Learning Outcomes of Course (ILOS)** |
| |  | | --- | | **a-  Knowledge and Understanding** | | On completing this course, students will be able to: | | |  | | --- | | a- 1- Demonstrate the basics of information and communication technology (ICT) (A.1). | | a- 2 – Illustrate the methodologies of solving engineering problems, data collection interpretation (A.4) . | | a- 3 – Define current engineering technologies as related to Advanced automatic control (A.10). | | |  | | | **b-  Intellectual Skills** |  | | At the end of this course, the students will be able to: |  | | |  | | --- | | b- 1 - Think in a creative and innovative way in problem solving and design (B.2). | | b- 2 - Assess and evaluate the characteristics and performance of components, systems and processes (B.5).. | | b- 3 - Investigate the failure of components, systems, and processes (B.6).. | | b- 4 - Create systematic and methodic approaches when dealing with new and advancing technology (B.1). | | b- 5 - Analyze fluid power systems, subsystems and various control valves (B.8). | |  | |  | | | **c-  Professional Skills** |  | | On completing this course, the students are expected to be able to: |  | | |  | | --- | | c- 1 - Create and/or re-design a process, component or system, and carry out specialized engineering designs (C.2). | | c- 2 - Exchange knowledge and skills with engineering community and industry (C.1). | | c- 3 - Write computer programs pertaining to mechanical power and energy engineering (C.7) | |  | |  | | | **d-  General Skills** |  | | At the end of this course, the students will be able to: |  | | |  | | --- | | d- 1 - Collaborate effectively within multidisciplinary team (D.1). | | d- 2 - Work in stressful environment and within constraints (D.2). | | d- 3 - Communicate effectively (D.3). | | d- 4 - Effectively manage tasks, time, and resources (D.6). | |  | |  | | |

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| **4- Course Contents** |
| |  |  | | --- | --- | | **No.** | **Topics** | | 1 | Introduction &mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E. | | 2 | Modeling of physical systems Mechanical, Electrical | | 3 | Modeling of physical systems Hydraulic, Pneumatic, Thermal | | 4 | Transfer function, block diagram | | 5 | Time response analysis for 1st order and 2nd order with matlab application | | 6 | Steady state error analysis with matlab application | | 7 | State representation with Matlab application | | 8 | Salutation of state equations controllability and observability & Design of Industrial controllers P, PI, PD, PID | | 9 | Stability analysis, Rauth arrays, Nyquist | | 10 | Bode plot and bode stability | | 11 | Compensations Techniques | | 12 | Root locus technique | |

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| **5- Teaching and Learning Methods** |
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| |  | | --- | | 5.1- Lectures | | 5.2- Class activity | | 5.3- Assignments / homework | |

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| **6- Teaching and Learning Methods of Disables** |
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| |  | | --- | | 6.1- Practical training / laboratory | | 6.2- Seminar / workshop | | 6.3- Case study | |

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| **7- Student Assessment** |
| |  | | --- | | **a- Student Assessment Methods** | | |  |  | | --- | --- | | 1 | Assignments  to assess   knowledge and intellectual skills. | | 2 | Quiz  to assess   knowledge, intellectual and professional skills. | | 3 | Mid-term exam   to assess   knowledge, intellectual, professional and general skills. | | 4 | Oral exam   to assess   knowledge and intellectual skills. | | 5 | Final exam   to assess   knowledge, intellectual, professional and general skills. | | |  | | | **b- Assessment Schedule** |  | | |  |  |  | | --- | --- | --- | | **No.** | **Assessment** | **Week** | | 1 | Assignments | 2, 3, 5, 9, 11, 12 | | 2 | Quizzes | 4, 6, 10, 12 | | 3 | Mid-term exam | 8 | | 4 | Oral exam | 14 | | 5 | Final exam | 15 | |  | |  | | | **c- Weighting of Assessments** |  | | |  |  | | --- | --- | | **Assessment** | **Weight** | | Mid\_Term Examination | 10 % | | Final\_Term Examination | 60 % | | Oral Examination | 20 % | | Practical Examination | 00 % | | Semester work | 05 % | | Other types of assessment | 05 % | | Total | 100 % | |  | |  | | |

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| **8- List of References** |
| |  | | --- | | **a- Course Notes** | | |  | | --- | | 1- prepared by instructor | | | **b- Books** | | |  | | --- | | 1- Engineering Vibration Analysis with Application to Control Systems, Edward Arnold, 1995 | | | **c- Recommended Books** | | |  | | --- | | 1- Practical Balancing of Rotating Machinery, Elsevier, 2006 | | | **d- Web Sites** | | |  | | --- | | 1- www.controlengineer.com | | |

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| **- Course Coordinator :    Saber Mahmoud Abed Rabbo Tith** |
| **- Head of Department : Ahmed Maged ahmed Osman** |



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| **Faculty** : Shoubra Faculty of Engineering |

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| **Department** : Mechanical Engineering Department |

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| **Matrix of Knowledge and Skills of the course** |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **No.** | **Topics** | **week** | **Basic Knowledge** | **Intellectual Skills** | **Professional Skills** | **General Skills** | | 1 | Introduction ‎&mathematical basic ‎Concepts (control system, ‎open loop, closed loop), ‎Laplace Transform, D. E.‎ | 1 | a1 | b1 |  |  | | 2 | Modeling of physical ‎systems Mechanical, ‎Electrical | 2 | a2 | b1, b2 | c1 | d1 | | 3 | Modeling of physical ‎systems Hydraulic, ‎Pneumatic, Thermal | 3 | a1, a2 | b3 | c2 | d1, d2 | | 4 | Transfer function, block ‎diagram ‎ | 4 | a3 | b4 | c3 | d3 | | 5 | Time response analysis for ‎‎1st order and 2nd order ‎with matlab application ‎ | 5 | a3 | b2 | c1,c2 | d2 | | 6 | Steady state error analysis ‎with matlab application | 6 | a1, a3 | b1, b2 | c1 | d1, d2 | | 7 | State representation with ‎Matlab application | 7 | a1, a2 | b2, b3 | c2, c3 | d1, d2 | | 8 | Midterm exam | 8 | a3 | b2, b3 | c3 | d3 | | 9 | Soultution of state ‎equations controllability ‎and obserbavility & ‎Design of Industrial ‎controllers P, PI, PD, PID ‎ | 9 | a1, a2 | b1, b3 | c1,c2 | d1, d2 | | 10 | Stability analysis, Rauth ‎arrays, Nyquist | 10 | a2, a3 | b1, b2 | c1 | d3, d4 | | 11 | Bode plot and bode ‎stability | 11 | a1, a2 | b3 | c2, c3 | d1, d3 | | 12 | Compensations ‎Techniques ‎ | 12 | a3 | b4 | c3 | d4 | | 13 | Root locus technique | 13 | a1, a2, a3 | b1 | c3 | d4 | | 14 | Design of modern ‎controller based on phase ‎lead and lag | 14 | a1, a2, a3 | b1, b2, b3, b4 | c1,c2,c3 | d1, d2, d3, d4 | |

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**- Head of Department : Ahmed Maged ahmed Osman**

**Matrix of course content and ILO’s**

**Course Title**: Advanced automatic control **Code**: MDP444 **Lecture**: 3 **Tutorial:** 2 **Practical**: **Total:**  5

**Program on which the course is given:** B.Sc. Mechanical production Engineering

**Major or minor element of program:** N.A.

**Department offering the program:** Mechanical EngineeringDepartment

**Department offering the course:** Mechanical EngineeringDepartment

**Academic year / level: 2013-2014 forth Year / first semester**

**Date of specifications approval:** 16/3/2010

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|  | **K& U** | | | 1. **S.** | | | | | | **P. S.** | | | | **G.&T. S.** | | | | **Teaching Methods** | | **Assessment Methods** | |
| **Course contents** | **a1** | **a2** | **a3** | **b1** | **b2** | **b3** | **b4** | **b5** | **c1** | | **c2** | **c3** | **d1** | | **d2** | **d3** | **d4** | | Lecture  self-training | Tutorial assignment,  quizzes, oral exams and written final exam |
| Introduction &mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E. | ✓ |  |  | ✓ |  |  |  |  |  | |  |  |  | |  |  |  | | lecture  tutorial |
| Modeling of physical systems Mechanical, Electrical |  | ✓ |  |  | ✓ | ✓ |  | ✓ |  | | ✓ |  |  | | ✓ |  | ✓ | | lecture  tutorial |
| Modeling of physical systems Hydraulic, Pneumatic, Thermal | ✓ | ✓ |  |  | ✓ |  |  |  |  | |  |  |  | |  | ✓ |  | | lecture  tutorial  team work |
| Transfer function, block diagram |  |  | ✓ |  |  |  | ✓ | ✓ |  | |  |  |  | |  |  | ✓ | | lecture  tutorial |
| Time response analysis for 1st order and 2nd order with matlab application |  | ✓ |  |  | ✓ |  |  |  | ✓ | |  |  |  | | ✓ |  |  | | lecture  tutorial  team work |
| Steady state error analysis with matlab application |  |  | ✓ |  |  | ✓ |  |  | ✓ | |  |  | ✓ | | ✓ |  |  | | lecture  tutorial |
| State representation with Matlab application | ✓ |  |  | ✓ |  | ✓ |  |  |  | | ✓ | ✓ |  | | ✓ |  |  | | lecture  tutorial  team work |
| Soultution of state equations controllability and obserbavility & Design of Industrial controllers P, PI, PD, PID |  |  |  | ✓ |  |  |  | ✓ |  | |  | ✓ | ✓ | |  |  |  | | lecture  tutorial |
| Stability analysis, Rauth arrays, Nyquist | ✓ | ✓ |  | ✓ |  |  |  |  | ✓ | |  |  |  | |  | ✓ | ✓ | | lecture  tutorial |
| Bode plot and bode stability |  | ✓ | ✓ |  |  | ✓ |  |  | ✓ | | ✓ | ✓ | ✓ | |  | ✓ |  | | lecture  tutorial |
| Compensations Techniques |  |  | ✓ |  |  |  | ✓ |  | ✓ | |  | ✓ |  | |  |  | ✓ | | lecture  tutorial  team work |
| Root locus technique | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  | |  | ✓ |  | |  |  | ✓ | | lecture  tutorial |
| Introduction &mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | Lecture  self-training |
|  | 6 | 7 | 7 | 7 | 5 | 5 | 3 | 4 | 6 | | 4 | 6 | 4 | | 5 | 4 | 6 | |  |  |

**Matrix of course aims and ILO’s**

**Course Title**: Advanced automatic control **Code**: MDP444 **Lecture**: 3 **Tutorial:** 2 **Practical**: **Total:**  5

**Program on which the course is given:** B.Sc. Mechanical production Engineering

**Major or minor element of program:** Major.

**Department offering the program:** Mechanical EngineeringDepartment

**Department offering the course:** Mechanical EngineeringDepartment

**Academic year / level: 2012-2013 First Year / first semester**

**Date of specifications approval:** 16/3/2010

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| **Course aims** | **K& U** | | | | **ll.S.** | | | | | **P. S.** | | | **G&T.S** | | |
| **a1** | **a2** | **a3** | **a4** | **b1** | **b2** | **b3** | **b4** | **b5** | **c1** | **c2** | **c3** | **d1** | **d2** | **d3** | |
| 2.1- List concepts, principles of Automatic control | ✓ |  | ✓ |  |  |  |  | ✓ |  |  |  |  | ✓ |  |  | |
| 2.2- State basic principles and stability of control systems | ✓ |  |  |  |  |  | ✓ |  |  |  | ✓ |  | ✓ | ✓ |  | |
| 2.3- Provide students with solid understanding of controller designs and compensation techniques |  | ✓ |  | ✓ |  |  |  | ✓ |  |  |  |  | ✓ |  | ✓ | |

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| **- Course Coordinator :    Saber Mahmoud Abed Rabbo Tith** | |
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**- Head of Department : Ahmed Maged Ahmed Osman**