Model No.12
Course Specifications: Advanced Automatic Control

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Mechanical Engineering Department
Department offering the course: Mechanical Engineering Department

1- Course Data

Course Code: MDP444	**Course Title: Advanced Automatic Control**
Specialization: production Mechanical Engineering department	**Course Type:** Elective **Study Year:** Fourth Year

Teaching Hours: Lecture: 3   Tutorial: 2   Practical: 0   Total: 5

2- Course Aim

For students undertaking this course, the aims are to:

1. List concepts, principles of Advanced Automatic Control, in addition to studying the system's ability.
2. The student will understand the controller design.

3- Intended Learning Outcomes of Course (ILO's)

a. **Knowledge and Understanding Skills:** On completing this course, students will acquire the knowledge and understand:

a.1) The basics of information and communication technology (ICT) (A.2).

a.2) principles of control theories that improve the manufacturing process (A.4).

a.3) Engineering technologies in advanced Automatic Control related to mechanical engineering (A.13).

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 the control problems and design controllers (B.3).

b.2) Assess and evaluate the characteristics and performance of mechanical systems using advanced control algorithms (B.5).

b.3) applying the principles of mathematical models to improve the control system stability (B.13).

b.4) analysis the mechanical, electrical, hydraulic, and pneumatic systems. (B.14).

b.5) model the mechanical, electrical, hydraulic, and pneumatic systems to an analytical model that can be solved analytically (B.17).

c. **Practical and 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 in Advanced Automatic Control (C.3).

c.2) applying the modeling methods to solve the Advanced Automatic Control problems and enhance the system stability (C.1).

c.3) prepare a control reports about a problem definition and the methods used to solve it (C.7)

d. **General and Transferable 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).

4- Course Contents

Week 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	Root locus technique
12	State space representation
13	State space controllability and observability analysis
14	State space controller design

5- Teaching and Learning Methods

  5.1 Lectures
  5.2 Assignments / homework
  5.3 Class activity

6- Teaching and Learning Methods of Disables

  • Nothing.

7- Student Assessment

a- Student Assessment Methods

  1. Four assignments to assess knowledge and intellectual skills.
  2. Two quiz to assess knowledge, intellectual and professional skills.
  3. Mid-term exam to assess knowledge, intellectual, professional and general skills.
  4. Final exam to assess knowledge, intellectual, professional and general skills.

b- Assessment Schedule

NO.	Assessment	Week
1	Assignments	3, 5, 9, 12
2	Quizzes	6, 10,
3	Mid-term exam	8
4	Final exam	15

c- Weighting of Assessments

Assessment	Weight (%)
Mid-Term Examination	16 %
Final-Term Examination	64 %
Practical Examination	10 %
Semester work	10 %
Total	**100**

8- List of References

a- Course Notes: Course notes prepared by instructor.

b- Recommended Books

- 1- Engineering Vibration Analysis with Application to Control Systems, Edward Arnold, 1995

c- Recommended Books

- Practical Balancing of Rotating Machinery, Elsevier, 2006

d- Recommended Books

- www.controlengineer.com

Course Coordinator: Prof. Dr. Saber Mahmoud Abed Rabbo Tith

Head of Department: Prof. Dr. Osama Ezzat Abdelatif

Model No.11A
Course Specifications: Advanced Automatic Control

University: Benha University

Faculty: Faculty of Engineering at Shoubra

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

no.	Topics	Week no.	Knowledge and Understanding Skills	Intellectual Skills	Practical and Professional Skills	General and Transferable Skills
Matrix of Knowledge and Skills of the Course					
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	Solution 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, Ruth 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	Root locus technique	12	a3	b4	c3	d4
13	State space representation	13	a1, a2, a3	b1	c3	d4
14	State space controllability and observability analysis	14	a1, a2, a3	b1, b2, b3, b4	c1,c2,c3	d1, d2, d3, d4
15	State space controller design	15	a2	b3	c1,c2	d4

Course Coordinator: Prof. Dr. Saber Mahmoud Abed Rabbo Tith

Head of Department: Prof. Dr. Osama Ezzat Abdelatif

Matrix of Course Aims and ILO's

Course Title: Advanced Automatic Control

Course Code: MDP444

Teaching Hours: Lecture: 3   Tutorial: 2   Total: 5

Major or minor element of program: Major

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

Department offering the program: Mechanical Engineering Department

Academic year / level: 2014-2015 Fourth Year / First Semester

Date of specifications approval: 2014

Course aims	Basic Knowledge	Intellectual Skills	professional Skills	General Skills
1- List concepts, principles of Automatic control	a1,a3	b4	c2	d1
2- State basic principles and stability of control systems	a1	b3	c1	d1,d2
3- Provide students with solid understanding of controller designs and compensation techniques	a2,a4	b2	c3	d1,d3

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