



BENHA UNIVERSITY



FACULTY OF ENGINEERING AT SHOUBRA

COURSE SPECIFICATIONS (2014-2015)

Model No.12

Course Specifications: 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: MDP424

Course Title: Automatic Control

Specialization: Mechanical Power Engineering

Course Type: Compulsory

Study Year: Fourth Year

Teaching Hours: Lecture: 2 Tutorial: 2

Practical: 0

Total: 4

2- Course Aims

For students undertaking this course, the aims are to:

1. List concepts, principles of Automatic control.
2. State basic principles and stability of control systems.
3. To provide students with solid understanding of controller designs and compensation techniques.

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

- a. Knowledge and Understanding Skills:** On completing this course, students will be able to demonstrate the knowledge and understanding of:
 - a.1) Basics of information and communication technology in control systems (ICT). (A.2)
 - a.2) Methodologies of solving engineering problems, data collection interpretation to recognize the business and management techniques of control systems. (A.5, a.17)
 - a.3) Current engineering technologies as related to advanced automatic control and trace the contemporary engineering topics. (A.7, A.12)
- 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 control system design (B.2)
 - b.2) Assess and evaluate the characteristics and performance of components, dynamic control 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) Appraise appropriate ICT tools to a variety of engineering problems and analysis of fluid power systems, subsystems and various control valves. (B.7, B.8, B.12, B.13, B.14)
- 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. (C.2)
 - c.2) Exchange knowledge and skills with engineering community and industry, and apply safe systems at work and observe the appropriate. (C.1, C.8)



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c.3) Apply numerical modeling methods to engineering problems and write computer programs pertaining to mechanical power and energy engineering. (C.7, C.15)

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, and block diagram
5	Time response analysis of 1st order and 2nd order with Matlab application
6	Steady state error analysis with Matlab application
7	State representation with Matlab application
9	Solution of state equations controllability and observability & Design of Industrial controllers P, PI, PD, PID
10	Stability analysis, Ruth arrays, Nyquist
11	Bode plot and bode stability
12	Compensations Techniques
13	Root locus technique
14	Design of modern controller based on state space representation (Pole placement, Linear quadratic regulator LQR).

5- Teaching and Learning Methods

- 5.1 Lectures
- 5.2 Tutorial
- 5.3 Class activity
- 5.4 Case study
- 5.5 Seminar/workshop

6- Teaching and Learning Methods of Disables

- Nothing.

7- Student Assessment

a- Student Assessment Methods

1. Five Assignments to assess knowledge and intellectual skills.
2. Two Quizzes to assess knowledge, intellectual and professional skills.
3. Midterm exam to assess knowledge, intellectual, professional and general skills.
4. Final exam to assess knowledge, intellectual, professional and general skills.



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b- Assessment Schedule

NO.	Assessment	Week
1	Assignments	3, 6, 9, 12, 14
2	Quiz	4, 11
3	Midterm exam	8
4	Final exam	15

c- Weighting of Assessments

Assessment	Weight (%)
Midterm Examination	20
Final Term Examination	70
Oral Examination	00
Semester Work	10
Other Types of Assessment	00
Total	100

8- List of References

a- Course Notes: Course notes prepared by instructor.

b- Recommended Books

- Modern Control Engineering , K. Ogata, Printice Hill, 2010
- Automatic control System, F. Golnaraghi, Johon Wiley, 2010

Course Coordinator: Prof. Dr. Saber Mahmoud Abdrabo & Dr. Mohamed Saber Sokar

Head of Department: Prof. Dr. Osama Ezzat Abdelatif



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COURSE SPECIFICATIONS (2014-2015)

Model No.11A

Course Specifications: 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

Matrix of Knowledge and Skills of the Course

no.	Topics	Week no.	Knowledge and Understanding	Intellectual Skills	Practical and Professional Skills	General and Transferable Skills
1	Introduction & mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E.	1	a1, a2	b1		
2	Modeling of physical systems Mechanical, Electrical	2	a2, a3	b2		d3
3	Modeling of physical systems Hydraulic, Pneumatic, Thermal	3	a3	b1, b2	c1	d3
4	Transfer function, block diagram	4		b1	c2	
5	Time response analysis for 1st order and 2nd order with Matlab application	5			c1	d1
6	Steady state error analysis with Matlab application	6		b2	c1	d2
7	State representation with Matlab application	7		b1	c2	d4
8	Midterm Exam	8				
9	Solution of state equations controllability and observability & Design of Industrial controllers P, PI, PD, PID	9	a2, a3	b4		d2
10	Stability analysis, Ruth arrays, Nyquist	10	a1	b3	c3	d4
11	Bode plot and bode stability	11	a2	b1		d2
12	Compensations Techniques	12			c2	d1
13	Root locus technique	13		b5	c3	
14	Design of modern controller based on state space representation (Pole placement, Linear quadratic regulator LQR).	14		b1	c2	d4
15	Final Exam	15				

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COURSE SPECIFICATIONS (2014-2015)

Matrix of Course Content and ILO's

Course Title: Automatic Control

Course Code: MDP424

Teaching Hours: Lecture: 2 Tutorial: 2 Total: 4

Major or minor element of program: Major

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

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

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

Date of specifications approval: 16/3/2010

Course contents	a1	a2	a3	b1	b2	b3	b4	b5	c1	c2	c3	d1	d2	d3	d4
Introduction & mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E.	✓	✓		✓											
Modeling of physical systems Mechanical, Electrical		✓	✓		✓									✓	
Modeling of physical systems Hydraulic, Pneumatic, Thermal			✓	✓	✓				✓					✓	
Transfer function, block diagram				✓						✓					
Time response analysis for 1st order and 2nd order with Matlab application									✓			✓			
Steady state error analysis with Matlab application					✓				✓				✓		
State representation with Matlab application				✓						✓					✓
Solution of state equations controllability and observability & Design of Industrial controllers P, PI, PD, PID		✓	✓				✓						✓		
Stability analysis, Ruth arrays, Nyquist	✓					✓					✓				✓
Bode plot and bode stability		✓		✓									✓		
Compensations Techniques										✓		✓			
Root locus technique								✓			✓				
Design of modern controller based on state space representation (Pole placement, Linear quadratic regulator LQR).				✓						✓					✓

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COURSE SPECIFICATIONS (2014-2015)

Course Curriculum Map

Course Title: Automatic Control

Course Code: MDP424

Teaching Hours: Lecture: 2 Tutorial: 2 Total: 4

Major or minor element of program: Major

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

Department offering the program: Mechanical Engineering Department

Department offering the course: Mechanical Engineering Department

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

Date of specifications approval: 16/3/2010

Course contents	a1	a2	a3	b1	b2	b3	b4	b5	c1	c2	c3	d1	d2	d3	d4	Teaching Methods	Assessment Methods
Introduction & mathematical basic Concepts (control system, open loop, closed loop), Laplace Transform, D. E.	✓	✓		✓												<ul style="list-style-type: none"> • Lecture • Tutorial 	Tutorial assignment, quizzes, oral exam, midterm exam and written final exam
Modeling of physical systems Mechanical, Electrical		✓	✓		✓									✓			
Modeling of physical systems Hydraulic, Pneumatic, Thermal			✓	✓	✓				✓					✓			
Transfer function, block diagram				✓						✓							
Time response analysis for 1st order and 2nd order with Matlab application									✓			✓					
Steady state error analysis with Matlab application					✓				✓				✓				
State representation with Matlab application				✓						✓					✓		
Solution of state equations controllability and observability & Design of Industrial controllers P, PI, PD, PID		✓	✓				✓						✓				
Stability analysis, Ruth arrays, Nyquist	✓					✓					✓				✓		
Bode plot and bode stability		✓		✓									✓				
Compensations Techniques										✓		✓					
Root locus technique								✓			✓						
Design of modern controller based on state space representation (Pole placement, Linear quadratic regulator LQR).				✓						✓					✓		

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Matrix of Course Aims and ILO's

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Course contents	a1	a2	a3	b1	b2	b3	b4	b5	c1	c2	c3	d1	d2	d3	d4
1. List concepts, principles of Automatic control	✓	✓		✓		✓			✓	✓		✓	✓		✓
2. State basic principles and stability of control systems		✓	✓		✓		✓	✓	✓		✓			✓	
3. To provide students with solid understanding of controller designs and compensation techniques				✓			✓			✓		✓	✓		✓

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