Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: : Design of Mechatronics Systems		Course Code:15MC52T
Mode(L:T:P) : 4:0:0	Credits: 4	Core/ Elective: Core
Type of Course: Lectures & Student Activities		Total Contact Hours: 52
CIE= 25 Marks		SEE= 100 Marks

Prerequisites: Knowledge of Basics of Mechanical engineering, Basics of Electrical and Electronics engineering and Measurement systems.

Course Objectives: Understand the techniques to design Mechatronics systems.

Course Outcomes: At the end of the course, the students will be able to

1. Explain how Mechatronics integrates knowledge from different disciplines in order to realize engineering and consumer products that are useful in everyday life.
2. Explain the need of real time interfacing in the Mechatronics systems.
3. Explain the Case studies on Data acquisition systems.
4. Explain the Case studies on Data acquisition and control systems.
5. Explain the Case studies of design of Mechatronics products.
6. Explain the advanced applications in designing of Mechatronics systems.

Course Outcome		Cognitive Level	Linked with PO	Teaching Hours
CO1	Explain how Mechatronics integrates knowledge from different disciplines in order to realize engineering and consumer products that are useful in everyday life.	*U*	2	10
CO2	Explain the need of real time interfacing in the Mechatronics systems.	*U*	2	06
CO3	Explain the Case studies on Data acquisition systems	*U*	2	06
CO4	Explain the Case studies on Data acquisition and control systems	*U*	2	06
C05	Explain the Case studies of design of Mechatronics products	*U*	2	12
C06	Explain the advanced applications in designing of Mechatronics systems	*U*	2	12
Total sessions				**52**

Legend: R; Remember, U: Understand A: Application

Mapping Of Course Outcomes with Program Outcomes

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Design of Mechatronics Systems		**3**	-	-	-	-	-	-	-	-

Course Content and Weightage For SEE

Unit No	Unit Name	CO	Hour	Marks allocated for different Cognitive level Questions			Marks weightage (%)
				R	U	A	
1	Introduction to Mechatronics system design	1	10	-	30	-	20.68
2	Real time interfacing	2	06	-	20	-	13.79
3	Case studies on Data acquisition systems	3	06	-	20	-	13.79
4	Case studies on Data acquisition and control systems	4	06	-	20	-	13.79
5	Case studies of design of Mechatronics products	5	12	-	30	-	20.68
6	Advanced applications	6	12	-	25	-	17.25
Total			52	145 marks			100

Contents

Unit-I

INTRODUCTION TO MECHATRONICS SYSTEM DESIGN

Integrated design issues in Mechatronics, key elements: Information system, Mechanical system, Electrical system, Computer system, Sensors and Actuators, Real time interfacing, Mechatronics Design process, Advanced approaches in Mechatronics.

10Hours

Unit-II

REAL TIME INTERFACING

Introduction, elements of Data Acquisition and Control System, overview of I/O process, Installation of I/O chard and software.

6Hours

Unit-III

CASE STUDIES ON DATA ACQUISITION SYSTEMS

Testing of transportation bridge surface material, Transducer calibration systems for automotive application, Strain gauge weighing system, Solenoid displacement calibration systems and Rotary optical encoder.

6Hours

Unit-IV

CASE STUDIES ON DATA ACQUISITION SYSTEMS AND CONTROL

Thermal cycle Fatigue of a Ceramic Plate, PH control system, De-Icing Temperature Control System, Skip control of CD player, speed control of a DC Motor and speed control of a Stepper Motor.

6Hours

Unit-V

CASE STUDIES OF DESIGN OF MECHATRONICS PRODUCTS

Pick and Place robot, car park barrier system, Automatic Camera, car engine management system, Bar Code Reader, coin counter, automatic washing machine, automatic windscreen wiper in Car Systems, automatic room heating system, Intelligent Mechatronic Devices.

12Hours

Unit-VI

ADVANCED APPLICATIONS

Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial Intelligence in Mechatronics, Fuzzy logic applications in Mechatronics and Micro-Sensors in Mechatronics.

12Hours

References Books.

1.Devadas shetty,Richard A Kolk,"Mechatronics system design", Thomson Learning Publishing company,Vikas publishing house,2001

2.Bolton Mechatronics-Electronic control systems in Mechanical and Electrical engineering, Addison Wesley Longman Ltd.,1999

3. Brian Morris, Automated Manufacturing systems –Actuators, Controls, Sensors and Robotics, Mc Graw Hill International Edition 1995

4. Clarence de Silva_Mechatronics an Integrated Approach , click to download :

http://een.iust.ac.ir/profs/Shamaghdari/Mechatronics/Resources/11-Silva_Mechatronics%20an%20Integrated%20Approach.pdf

e-References/ URLS

http://www.allaboutcircuits.com/

http://www.allaboutcircuits.com/videos

Student Activity

Activity No.	Description of the Student Activity
1	Students can study the Mechatronics systems viz. currency machine, ATM machine, Metro rail door open and close etc. and make report

Note:

1. Group of max four students should do any one of the above activity or any other similar activity related to the course Cos and get it approved from concerned Teacher and HOD.
2. No group should have activity repeated or similar
3. Teacher should ensure activities by different groups must cover all COs
4. Teacher should asses every student by using suitable **Rubrics** approved by HOD

Sample Rubrics

Dimension	Exemplary	Accomplished	Developing	Beginning	Roll No. of the Student				
	5/4	3	2	1	1	2	3	4	5
Organization	Information presented in logical, interesting sequence	Information in logical sequence	Difficult to follow presentation--student jumps around	Cannot understand presentation--no sequence of information	Ex: 2				
Subject Knowledge	Demonstrates full knowledge by answering all class questions with explanations and elaborations	At ease with expected answers to questions but does not elaborate	Uncomfortable with information and is able to answer only rudimentary questions	Does not have a grasp of the information. Cannot answer questions about subject	3				
Graphics	Explain and reinforce screen text and presentation	Relate to text and presentation	Occasionally uses graphics that rarely support text and presentation	Uses superfluous graphics or no graphics	4				
Oral Presentation	Maintains eye contact and pronounces all terms precisely. All audience members can hear	Maintains eye contact most of the time and pronounces most words correctly. Most audience members can hear presentation	Occasionally uses eye contact, mostly reading presentation, and incorrectly pronounces terms. Audience members have difficulty hearing	Reads with no eye contact and incorrectly pronounces terms. Speaks too quietly	5				
Total Score=2+3+4+5=14/4=3.5=4									

Institutional Activity

Activity No.	Description of the Institutional Activity
1	Organize Seminar, workshop, Lecture, from experts on modern Mechatronics system designs.
2	Motivate student to take case study on different Mechatronics system designing.

Course Assessment Pattern

Particulars			Max Marks	Evidence	Course outcomes
Direct Assessment	**CIE**	Three tests (Average of three tests)	20	Blue books	1,2,3,4,5,6
		Student Activity	05	Student Activity Sheets	1,2,3,4,5,6
	SEE	End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	**Student Feedback on course**	Middle of the course		Feedback forms	1,2,3
		End of the course		Feedback forms	4, 5, 6

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier*: *The following documents to be verified by CIE verifier at the end of semester

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Model Question Paper (CIE)

Date and Time	Semester	Course	Max Marks
3rd Test(14 th weak of sem) 10-11 Am	V SEM	Design of Mechatronic Systems	20
	Year: 2017-18	Course code:15MC52T	

Name of Course coordinator : Units:5,6 Co: 5,6

Answer the following questions.

Question No	Question	CL	CO	PO
1	Explain the design of Pick and Place robot OR Explain the design of car park barrier system 10m	U	5	2
2	Explain the design of Mechatronic control in automated manufacturing. OR Explain Artificial intelligence in Mechatronics. 5m	U	6	2
3	Explain Fuzzy logic applications in Mechatronics. OR Explain Micro sensors. 5m	U	6	2

Model Question Paper
V Semester Diploma in Mechatronics Engineering
Design of Mechatronic Systems

Instructions: Answer any six questions from part A and Seven full questions from part B

PART- A

Answer any six questions. **5X6=30 marks**

1. Explain the integrated design issues in Mechatronics.
2. Explain the block diagram of general scheme of hardware and software integration.
3. Explain the I/O channels of Analog signals.
4. Explain Digital Signals.
5. Explain the Strain gauge weighing system.
6. Explain the Solenoid displacement calibration systems.
7. Explain the Skip control of CD player.
8. Explain the speed control of a DC Motor.
9. Explain the applications of Sensors for conditioning monitoring.

PART- B

Answer any seven full questions. **10x7=70 Marks**

1. Explain the design of Mechatronic control in automated manufacturing. 10m
2. Explain Artificial intelligence in Mechatronics. 10m
3. a) Explain the concept of Overframing 5+5m
   b) Explain the methods to overcome Overframing
4. a) Explain Testing of transportation bridge surface material 5+5 m
   b) Explain the Transducer calibration systems for automotive application.
5. a) Explain the PH control system
   b) Explain the De-Icing Temperature Control System
6. Explain the design of Coin Counter. 10m
7. Explain the design of automatic washing machine. 10m
8. Explain the design of automatic windscreen wiper in Car Systems 10m
9. Explain the design of Mechatronic control in automated manufacturing.
10. a) Explain Artificial intelligence in Mechatronics.
    b) Explain Fuzzy logic applications in Mechatronics.

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Model Question Bank
V Semester Diploma in Mechatronics Engineering
Design of Mechatronics Systems

Unit-I

Cognitive level- Understanding

1. Explain the term Mechatronics.
2. Explain the three phases of Mechatronics system design.
3. Explain the key elements of Mechatronics system design.
4. Explain the integrated design issues in Mechatronics.
5. Explain the block diagram of general scheme of hardware and software integration.
6. Explain the Mechatronics key elements.
7. Explain the automatic controls.
8. Explain the Mechanical system.
9. Explain the Electrical system.
10. Explain the Computer system.
11. Explain the Sensors and Actuators.
12. Explain the block diagram of Mechatronic design process.
13. Explain the Model based monitoring system with block diagram.
14. Explain the block diagram of open- architecture system.

Unit-II

Cognitive level- Understanding

1. Explain the elements of a data acquisition and control system.
2. Explain the Real Time Interfacing
3. Explain the safety used in Mechatronics
4. Explain the I/O channels of Analog signals
5. Explain Digital Signals
6. Explain Frequency signals
7. Explain the concept of Overframing
8. Explain the methods to overcome Overframing

Unit-III

Cognitive level- Understanding

1. Explain the Cantilever Beam Force Measurement
2. Explain Testing of transportation bridge surface material
3. Explain the Transducer calibration systems for automotive application
4. Explain the Strain gauge weighing system
5. Explain the Solenoid displacement calibration systems
6. Explain the Rotary optical encoder.

Unit-IV

Cognitive level- Understanding

1. Explain the Thermal cycle Fatigue of a Ceramic Plate
2. Explain the PH control system
3. Explain the De-Icing Temperature Control System
4. Explain the Skip control of CD player
5. Explain the speed control of a DC Motor
6. Explain the speed control of a Stepper Motor

Unit-V

Cognitive level- Understanding

1. Explain the design of Pick and Place robot
2. Explain the design of car park barrier system
3. Explain the design of Automatic digital Camera
4. Explain the design of car engine management system
5. Explain the design of Bar Code Reader
6. Explain the design of Coin Counter.
7. Explain the design of automatic washing machine.
8. Explain the design of automatic windscreen wiper in Car Systems
9. Explain the design of automatic room heating system.
10. Explain the design of intelligent Mechatronic system.

Unit-VI

Cognitive level- Understanding

1. Explain the applications of Sensors for conditioning monitoring.
2. Explain the design of Mechatronic control in automated manufacturing.
3. Explain Artificial intelligence in Mechatronics.
4. Explain Fuzzy logic applications in Mechatronics.
5. Explain Micro sensors.
6. Explain the advanced applications of Mechatronics.
7. Explain the three different types of microsensors.
8. Explain the process of fabrication of microsensor.