

@CLASS: T.E. (Mechanical / Automobile)			Semester:- VI	
MECHATRONICS				
Periods per week I Period of 60 min.	Lecture	04		
	Practical	02		
	Tutorial	--		
		Hours	Marks	
Evaluation System'	Theory Examination	04	100	
	Practical	--	25	
	Oral Examination	--	--	
	Term Work	--	25	
	TOTAL		150	

Sr. no.	Details	Hrs
Module 01	Introduction to Mechatronics, Mechatronics Systems in Factory, Home and Business Applications. Basic Components of Mechatronic Systems, Mechatronics Design process, Objectives Advantages Disadvantages of Mechatronics.	02
Module 02	Overview of micro processors and micro-controllers 8051 microcontrollers: Functional block diagram and architecture, Instruction set and assembly language programming. Interfacing of: HEX-keyboards, LCD display, ADC, DAC and stepper motor	14
Module 03	(a) Pneumatic and Hydraulic actuation systems: Pneumatic and hydraulic systems. Electro-Pneumatic systems Electro- Hydraulic systems. Development of circuits for Industrial, automation. (b) PLC in Automation: Basic structure, I/O processing. Ladder logic diagram. Selection of PLC.	14
Module 04	Introduction to control systems. open loop and closed loop systems, Mathematical modeling of control systems, concept of transfer function, Block diagram algebra, State space modeling. Process control systems, ON-OFF control. P-I-D Control. Control system components: servomotor, stepper motors,	08
Module 05	Transient Response Analysis of First and Second order system, Time Domain specifications. Step response of second order system. . Classification of control systems according to 'TYPE' of systems, steady-state errors, static error constants, steady state, analysis of different type of systems using step, ramp and parabolic inputs.. Stability analysis: Introduction to concepts of stability. The Routh and Hurwitz stability criteria. Relative stability analysis.	08
Module 06	Root locus concepts. Frequency Response, Analysis Frequency: Frequency domain specification Correlation between time and frequency response. Polar Plots. Bode Plots, Nyquist Plots,	08

List of Experiments:

(At least 6 experiments from the list given below)

1. Study of basic principles of sensing and actuation techniques used in Mechatronics systems
2. Study of Electro-pneumatic Logic Trainer kit, and experiments on Electro Pneumatic circuits
3. Study of Electro-hydraulic Logic Trainer kit, and experiments on Electro hydraulic circuits
4. Experiments on Ladder programming for Mechatronics system (e.g. bottle filling plant) .
5. Experiments on interfacing of Mechanical system
6. Experiments on feedback control systems and servomechanisms
7. Experiments using Microprocessor kits, ADC/DAC on voltage Measurements.
8. Experimental Identification by frequency response approach of Mechanical, Electrical, Chemical system
9. Experimental Identification of flexural mechanism, Development of transfer function based on experimentally identified data, Stability analysis of predicted transfer function, and PID tuning and implementation on experimental setup
10. Experiment based on Waveform generation, Interfacing and control of motors etc.

(Institutes shall use standard setup like VIKERS hydraulic and electrohydrolic test rigs, FESTO pneumatic and electro-pneumatic test-rig, d space microcontroller system etc. for carrying out experiments)

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.

In question paper weight age of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Practical Examination:

Practical examination will be based on one experiment performed from the list of experiment given in tile syllabus.

Course Project

In course project students shall integrate and apply the knowledge gained during the course. The projects will be developed by teams of maximum four students and shall consist of the design, setup and implementation of a simple mechatronics system.

Term Work:

Term work shall consist of minimum 06 experiments, assignments and written test. The distribution of marks for term work shall be as follows:

. Laboratory work (experiments/assignments/Course project):	(15) Marks
.Test (at least one).....	(10) Marks
TOTAL:	(25) Marks

Text Books:

1. Mechatronics, Kenji Uchino and Jayne R. Giniewicz, publication: Marcel Dekker, Inc.
2. Mechatronics System Design, Shetty and Kolk *CENGAGE Learning, India Edition*
3. Design with Microprocessors for Mechanical Engineers, Stiffler *McGraw-Hili*
4. Introduction to Mechatronics and Measurement Systems, Alciatore and Histan *Tata McGraw-Hili*

5. Mechatronics, Neculescu, *Pearson education*.
6. Mechatronics - Electromechanics and Control Mechanics, Mill *Springer Verlag*
7. Mechatronics - Electronic Control Systems in Mechanical Engineering, Bolton *Pearson education*
8. Mechatronics - Electronics in products and processes, Bradley, et al. *Chapman and /fall*
9. Mechatronics - Mechanical System Interfacing, Auslander and Kempf, *Prentice Hall*
10. Introduction to Mechatronics, Appu Kuttan K.K., *OXFORD Higher Education*
11. Applied Mechatronics- A. Smaili and F. Mrad, *OXFORD university press*.
12. Microprocessor Architecture, Programming and Applications with 8085, Gaonkar. R.S., *Wiley Eastern Limited*.
13. Pneumatic Circuits and Low Cost Automation: by Fawcett *I.R.*
14. Control System Engineering: by Nagrath LT. and Gopal .M., *Wiley Eastern Lid.*
15. Modern Control engineering: by K.Ogata, *Prentice Hall*
16. The 8051 microcontroller Architecture, Programming and Applications by Kenneth J T Ayala, Pemam International Publishing, (India).

References:

1. The Art of Electronics, Horowitz and Hill Cambridge, *University Press*
2. The 8051 microcontroller and embedded systems using assembly and C by M.A.Mazidi, J. c.: Mazidi and R. D. McKinlay. PHI, second edition
3. Electromechanical Design Handbook, Walsh. *McGraw-Hill*
4. Electro-mechanical Engineering - An Integrated Approach, Fraser and Milne
5. Handbook of Electromechanical Product Design, Hurricks Longman, John Wiley, *Addison Wesley*
6. Principles and Applications of Electrical Engineering, Rizzoni *Irwin Publishing*
7. Understanding Electro-Mechanical Engineering - An Introduction to Mechatronics , Kamm *IEEE*
8. Modeling and control of Dynamic Systems, Macia and Thaler, *CENGAGE Learning. India Edition*
9. Mechatronics, A.Smaili, F. Mrad. *OXFORD Higher Education*.
10. Pneumatic and Hydraulic Control Systems: Aizerman. M.A.
11. Industrial Hydraulics: Pippenger
12. Vickers Manual on Hydraulics
13. Computer Numerical Control of Machine Tools : Thyer. G.R.
14. Pneumatic Applications: Deppert \Varner & Stoll Kurt
15. Mechanization by Pneumatic Control: Vol. J & 2 Deppert Warner & Stoll kurt
16. Hydraulics and Pneumatics for Production: Stewart
17. Hydraulic Valves and Controls: Pippenger
18. Automatic Control Engineering: Francis. I-I. Raven.
19. Mechatronics. Nitaigour Mahalik. *Tow AkCirc/I\,-Hill*
20. Mechatronics. *HMT*
21. System identification: Theory for the User (2nd Edition) . Lennart Ljung
22. Fundamentals of Pneumatics: Festo Series
23. Fundamentals of Electro-Pneumatics :Festo Series
24. Fundamentals of Hydraulics: Festo Series
25. Fundamentals of Electro-Hydraulics: Festo Series