SEMESTER S6

MECHATRONICS

Course Code	PCMUT602	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites	PCMUT501, PCMUT503	Course Type	Theory

Course Objectives:

1. To familiarize various sensors, microprocessor, control systems and Engine management system
2. To know about the implementation of Mechatronics in automobiles
3. To understand MEMS and the working of PLC

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Mechatronics: Sensors - Characteristics - Temperature, flow, pressure sensors. Displacement, position and proximity sensing by magnetic, optical, ultrasonic, inductive, capacitive and eddy current methods. Encoders: incremental and absolute, grey coded encoder. Resolvers and synchro's. Piezoelectric sensors. Acoustic Emission sensors. Principle and types of vibration sensors. Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors.	9
2	Actuators: Hydraulic and Pneumatic actuators - Directional control valves, pressure control valves, process control valves. Rotary actuators. Development of simple hydraulic and pneumatic circuits using standard Symbols. Application of sensors in Automobiles: Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen	9

	level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.	
3	Micro Electro Mechanical Systems (MEMS): Fabrication: Deposition, Lithography, Micromachining methods for MEMS, Deep Reactive Ion Etching (DRIE) and LIGA processes. Principle, fabrication and working of MEMS based pressure sensor, accelerometer and gyroscope. Programmable Logic Controllers (PLC) –Basic structure, input/ output processing. Programming: Timers, Internal Relays, Counters and Shift registers. Development of simple ladder programs for specific purposes.	**9**
4	Fundamentals of Automotive Electronics and Microprocessor control system: Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and Adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile. Engine Management System (EMS): Introduction, remapping of ECU, Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, Fuel injection system parameters affecting combustion.	**9**

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Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the concept of Mechatronics System	**K2**
CO2	Describe the working of different sensors and Actuators	**K2**
CO3	Understand MEMS and its fabrication methods	**K2**
CO4	Enumerate the working and applications of PLC	**K2**
CO5	Discuss the working of Microprocessors and ECU	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	2										2
CO3	3	2										2
CO4	3	2										2
CO5	3	2										2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering.	Bolton W.	Pearson Education Limited, New Delhi	2007
2	Mechatronics	HMT	Tata McGraw-Hill Publishing Company Ltd., New Delhi	2004
3	Electronic Engine Control Technologies	Ronald K. Jurgen	2nd Edition- -SAE International	
4	Mechatronics: Integrated Mechanical Electronic Systems	Ramachandran K. P., G. K. Vijayaraghavan, M. S. Balasundaram	Wiley India Pvt. Ltd., New Delhi	2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Mechatronics and Measurement Systems	David G. Aldatore, Michael B. Histand	McGraw-Hill Inc., USA	2003
2	Smart Material Systems and MEMS: Design and Development Methodologies	Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan	John Wiley & Sons Ltd., England	2006
3	Industrial Robotics	Gordon M. Mair	Prentice Hall International, UK	1998

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