

MECHATRONICS SYSTEMS USING IOT**Course Code : 315365****Programme Name/s : Mechatronics****Programme Code : MK****Semester : Fifth****Course Title : MECHATRONICS SYSTEMS USING IOT****Course Code : 315365****I. RATIONALE**

The course aims to provide with a strong foundation in the principles and technologies of Mechatronics Systems and Internet of Things (IoT), enabling them to create more efficient, innovative, and adaptable systems for a wide range of industrial applications. IoT enables real-time data collection, connectivity and automation across industrial processes to enhance efficiency and decision-making.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop IoT-enabled mechatronics systems to improve industrial processes, efficiency, and product quality.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use different blocks of IoT systems.
- CO2 - Select hardware and IoT components for mechatronics Systems.
- CO3 - Integrate IoT hardware and components for given mechatronics Systems.
- CO4 - Apply different platforms and their interfacing for various Systems.
- CO5 - Develop applications of IoT using various hardware components and platforms.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week	SLH	NLH	Paper Duration	Theory				Based on LL & TL				Based on SL						
												Practical										
								CL		TL	LL	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
																Max	Min	Max	Min	Max	Min	
315365	MECHATRONICS SYSTEMS USING IOT	MIT	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150	

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify different characteristics of IoT Systems. TLO 1.2 Choose Physical and logical design of IoT. TLO 1.3 Compare different technologies used in IoT TLO 1.4 Select IoT enabling technologies. TLO 1.5 Select relevant deployment levels.	Unit - I Introduction to Internet of Things (IoT) 1.1 Introduction to IoT 1.2 IoT characteristics 1.3 Physical design of IoT: Things in IoT, IoT Protocols 1.4 Logical design of IoT: IoT Fundamental blocks, IoT Communication Model, IoT Communication API's 1.5 IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems 1.6 IoT Levels and Deployment templates — IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6	Lecture Using Chalk-Board Video Demonstrations Presentations
2	TLO 2.1 Select relevant sensor for the given application. TLO 2.2 Describe different input and output pins of the sensors. TLO 2.3 Identify relevant magnet relays and switches. TLO 2.4 Select relevant middleware for given IoT Systems.	Unit - II Sensors and Hardware Platforms 2.1 Sensors and its different parameters sensed by sensor: Light, Water detector, PIR Sensor, IR Sensor, Touch Sensor, Color Sensor, Tilt Sensor, Smoke Sensor, Gas and Alcohol Sensor. 2.2 Input and output pins of sensors, Magnet relays and switches 2.3 Middleware: M2M, RFID, WSN, SCADA	Lecture Using Chalk-Board Video Demonstrations Presentations

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Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Choose relevant methodology for designing and Integration of given IoT Systems. TLO 3.2 Select relevant methods to deploy IoT application. TLO 3.3 Select logical designing for different applications. TLO 3.4 Identify different protocols for IoT Systems.	Unit - III Design and Development of IoT Systems 3.1 IoT Design Methodology: Purpose and requirement specification, Process specification, Domain model specification, Information model specification, Service specification, IoT level specification. 3.2 Device and component integration, Functional view specification, Operational view specification. 3.3 Logical Designing using programming language, application development. 3.4 Interface with Hardware. 3.5 Protocols - The Open Systems Interconnection (OSI) model.	Lecture Using Chalk-Board Video Demonstrations Presentations
4	TLO 4.1 Identify different IoT physical devices. TLO 4.2 Select relevant cloud base platforms for given IoT System. TLO 4.3 Select configuration and interfacing platforms for the given IoT systems.	Unit - IV IoT Physical Device and End Point 4.1 Architecture of Physical Devices: Arduino, Raspberry Pi, Intel Galileo, Tibbo project systems. 4.2 Cloud base IoT platforms and other open-source platforms. 4.3 Configuration of hardware platform. 4.4 Interfacing of Arduino, Raspberry Pi.	Lecture Using Chalk-Board Video Demonstrations Presentations
5	TLO 5.1 Identify different home automation systems. TLO 5.2 Write steps to build IoT system to monitor air quality. TLO 5.3 Write steps to build IoT system to monitor climate for agriculture. TLO 5.4 Write steps to develop given health monitoring system.	Unit - V IoT Applications 5.1 Home automation: Controlling the lights, Smart Lock. 5.2 Environment and Agriculture: Air quality management, Climate Monitoring for agriculture. 5.3 Health: Heart rate monitoring system, Pulse Oximeter System.	Lecture Using Chalk-Board Video Demonstrations Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use USB cables, Wires, Power Supply Units, Transistors, Breadboards, Relay to design IoT systems. LLO 1.2 Operate Multimeter, Tester, Soldering Kit, Wire cutter, Hot glue gun and other components required for designing of IoT. LLO 1.3 Select various Components for designing IoT Systems.	1	*Components for IoT Systems.	2	CO1
LLO 2.1 Operate various components used in open-source prototype board and various microcontroller used in your lab.	2	Components used in open-source prototype board and microcontroller.	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Use different sensors with given microcontroller to design IoT Systems.	3	*Sensors integration with microcontroller using breadboard	2	CO2
LLO 4.1 Design a range of LED patterns and control mechanism for various IoT applications.	4	Program to display various patterns using LED.	2	CO2
LLO 5.1 Use various shields (Ethernet and Wi-Fi networking, Bluetooth, GSM cellular networking, motor control, RFID, audio, SD Card memory, GPS, sensors, color LCD screens, and more). LLO 5.2 Determine various performance parameters for shield and breakouts.	5	*Shield interface with controller for obtaining performance of particular shield and breakouts.	2	CO3
LLO 6.1 Build smart application using microcontroller and shields or breakouts.	6	Smart System application using microcontroller and shields or breakouts.	2	CO3
LLO 7.1 Use various protocols for IoT device communication. LLO 7.2 Design application using different types protocols used in IoT communication.	7	Protocols for IoT device communication.	2	CO3
LLO 8.1 Use various platforms for designing IoT Applications. LLO 8.2 Design application using any platform for 4 Digit 7 segment LED display.	8	*Platforms for designing IoT Applications.	2	CO4
LLO 9.1 Design application using Arduino or Raspberry-Pi for Smart Street light system.	9	Smart applications using Arduino or Raspberry-Pi.	2	CO4
LLO 10.1 Use Raspberry pi for stepper motor control. LLO 10.2 Build any application using Raspberry-Pi and stepper motor.	10	*Stepper motor control using Raspberry pi for any one application.	2	CO5
LLO 11.1 Develop smart applications using IoT.	11	Application for home or agriculture automation.	2	CO5
Note : Out of above suggestive LLOs - '*' Marked Practicals (LLOs) Are mandatory. - Minimum 80% of above list of lab experiment are to be performed. - Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Sensors: Temperature, Light, Ultra-Sonic, Humidity, Water Detector, PIR sensor, Pressure Sensor, IR sensor, Touch Sensor, Color Sensor, Humidity Sensor, Tilt Sensor, Flow and Level Sensor, Smoke, Gas and Alcohol Sensor	3,4,5,6,7,8,9,10,11
2	Arduino, Raspberry pi, Any Open-Source Prototype Board Available in Market	3,4,5,6,7,8,9,10,11
3	Shields: Ethernet and Wi-Fi networking, Bluetooth, GSM cellular networking, motor control, RFID, Audio, SD Card memory, GPS, sensors, color LCD screens	5,6,7,8,9,10,11

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
4	USB cables, wires, power supply units, transistors, breadboards, relay, Multimeter, Tester, Soldering Kit, wire cutter, Hot glue gun. seven-segment LED, Stepper Motor.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Internet of Things (IoT)	CO1	6	2	4	6	12
2	II	Sensors and Hardware Platforms	CO2	6	2	4	6	12
3	III	Design and Development of IoT Systems	CO3	12	4	6	8	18
4	IV	IoT Physical Device and End Point	CO4	8	2	4	8	14
5	V	IoT Applications	CO5	8	2	4	8	14
Grand Total				40	12	22	36	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Test
- Term work

Summative Assessment (Assessment of Learning)

- Theory
- Practical

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	2	2	-	-	2			
CO2	3	2	2	3	2	-	3			
CO3	2	2	3	3	2	-	2			
CO4	3	1	2	2	1	-	2			
CO5	3	3	3	3	2	3	3			

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Legends :- High:03, Medium:02,Low:01, No Mapping: -

*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Arshdeep Bahga, Vijay Madisetti	Internet of Things: A Hands-On Approach	University Pres, ISBN: 9788173719547, 1st Edition, Year: 2015
2	Adrin McEwen & Hakim Cassimality	Designing the Internet of things	Wiley India, Ltd, ISBN: 9781118430620, 1st Edition, Year:2013
3	Honobo Zhou	The internet of things in the cloud : a middleware perspective	CRC Press Taylor & Francis Group, ISBN: 9781439893029, Year:2019
4	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	Cisco Press, ISBN: 9781587144561, 1st Edition, Year: 2017
5	Richard Blum	Sams Teach Yourself Arduino™ Programming in 24 Hours	Pearson Education, Inc., ISBN: 9780672337123, 1st Edition, Year: 2014
6	Sean McManus, Mike Cook	Raspberry Pi For Dummies	Wiley India, ISBN: 9781119796824, 4th Edition, Year: 2021

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://intersog.com/blog/development/iot-platforms-overview-arduino-raspberry-pi-intel-galileo-and-others/	IoT Platforms Overview: Arduino, Raspberry Pi, Intel Galileo and Others
2	https://www.guru99.com/iot-tutorial.html	IoT Tutorial: Introduction to Internet of Things (IoT Basics)
3	https://docs.arduino.cc/tutorials/	Tutorials - Arduino Documentation
4	https://azure.microsoft.com/en-in/solutions/iot/iot-technology-protocols	IoT Protocols - The Open Systems Interconnection (OSI) model
5	https://nevonprojects.com/iot-projects/	All IOT Projects List

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students