



**ST. JOSEPH'S**  
COLLEGE OF ENGINEERING  
AND TECHNOLOGY,  
- PALAI -  
**AUTONOMOUS**

Choondacherry P.O., Pala, Kottayam - 686579  
Kerala, India



# **CURRICULUM & SYLLABUS**

## **Minor in Intelligent Systems and Automation**

**Offered by : Department of Electronics and Communication  
Engineering (EC)**

**Eligible Departments: AD, CA, CC, CE, CS, ME**

**2024 SCHEME**

## CURRICULUM

Minor in Intelligent Systems and Automation											
Sl. No	Semester	Course Code	Course Title	Credit Structure			SS	Total Marks		Credits	Hrs./ Week
				L	T	P		CIA	ESE		
1	3	24SJMNECT309	INTRODUCTION TO SENSORS AND ACTUATORS*/ MOOC#	3	1	0	5	40	60	4	4
2	4	24SJMNECT419	FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS*/ MOOC#	3	1	0	5	40	60	4	4
3	5	24SJMNECT519	EMBEDDED SYSTEMS*/ MOOC#	3	1	0	5	40	60	4	4
4	6	24SJMNECT619	INTRODUCTION TO ROBOTICS & AUTOMATION* /MOOC#	3	0	0	5	40	60	3	3
<b>Total</b>							<b>20</b>			<b>15</b>	<b>15</b>

*\*Students must register for theory courses listed in the 3<sup>rd</sup> and 4<sup>th</sup> semesters of the Minor curriculum.*

*#Students who fail a theory course listed in the Minor curriculum are permitted to register for an alternate MOOC course specified in the Minor curriculum.*

## Department of Electronics and Communication Engineering

### SEMESTER 3 (S3)

#### INTRODUCTION TO SENSORS AND ACTUATORS

Course Code	24SJMNECT309	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Mins
Prerequisites (if any)	Nil	Course Type	Theory

#### Preamble:

Sensors and actuators play a vital role in manufacturing, machinery, aerospace, medicine, and robotics. Most of the advancements of the present day would not be possible without sensors.

Course Outcomes		Bloom's Knowledge Level (KL)
CO 1	Get an exposure to sensors and actuators and its importance in the real world.	K2
CO 2	Explain the working of sensors and actuators, and its applications in real time scenario.	K2
CO 3	Explain the working principle of different types of rotary actuators	K2
CO 4	Understand the basic idea on the controls in NC machine and fluidic system.	K2

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

#### Syllabus

##### Module 1 (9 Hours)

Introduction- Classification of Sensors and Actuators - Magnetic Sensors - Linear and Latching Solenoid Actuators - Stepper Motors - Special Magnetic Devices - Rotary and Linear Actuators - Magnetic Materials and Technology - Soft Magnetic Materials - Hard Magnetic Materials - Coating Technologies - Magnetic Materials Applications

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### **Module 2(9 Hours)**

Magnetic Sensors - Theory of Magnetic Sensors - Magnetic Sensor Analysis - VR Sensors - Solid-State Sensors - Magnetic Sensor Applications - Magnetic Speed Sensor Requirements - Magnetic Speed Sensor Applications - Magnetic Position Sensor Applications.

Linear Actuators - Mathematical Model for Linear Actuators - Fast-Acting Actuators - Disk Solenoids - Plunger Solenoids - Ball Solenoids - Conical Solenoids - Applications of Solenoid Actuators - Compressor Solenoid Valves - Transmission Solenoids

### **Module 3 (9 Hours)**

Rotary Actuators - Disk Rotary Actuators - Disk Rotary Actuator Design - Disk Rotary Actuator Excitation Electromagnetic Circuit - Disk Rotary Actuator Toothed Magnetic Part - Claw Pole Rotary Actuators - Claw Pole Rotary Actuator Design - Claw Pole Rotary Actuator Excitation Electromagnetic Circuit - Claw Pole Actuator Toothed Magnetic Part - - Cylindrical Rotary Actuators - Cylindrical Rotary Actuator

Excitation Electromagnetic Circuit - Cylindrical Rotary Actuator Toothed Magnetic Structure - Rotary Actuator Applications - Disk Rotary Actuator Application - Claw Pole Rotary Actuator Application - Cylindrical Rotary Actuator Application

### **Module 4 (9 Hours)**

Controls in NC Machines and fluidic control- stepping motors- feedback devices- encoders - resolvers - inductosync –Tachogenerators - principles of fluid logic control -Coanda effect - basic fluidic devices - fluidic logic gates - bistable flip-flop - OR and NOR gates - exclusive OR gates - fluidic sensors - backpressure sensor.

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

**Continuous Internal Evaluation Marks (CIE): 40 Marks**

Attendance  (Weightage: 12.5%)	Assignment/ Microproject  (Weightage: 37.5%)	Internal Examination- 1 (Written)  (Weightage: 25%)	Internal Examination- 2 (Written)  (Weightage: 25%)	Total
5	15	10	10	40

**End Semester Examination Marks (ESE) : 60 marks**

*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*



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Part A	Part B	Total
<ul style="list-style-type: none"><li>• 2 Questions from each module.</li><li>• Total of 8 Questions, each carrying 3 marks</li></ul> <p><b>(8x3 = 24marks)</b></p>	<ul style="list-style-type: none"><li>• Each question carries 9 marks.</li><li>• Two questions will be given from each module, out of which 1 question should be answered.</li><li>• Each question can have a maximum of 3 sub divisions.</li></ul> <p><b>(4x9 = 36 marks)</b></p>	<p><b>60</b></p>

### Text Books

1. Andrzej M. Pawlak , “Sensors and Actuators in Mechatronics, Design and Applications” , Taylor & Francis Group, 2006

### Reference Books

1. Andrew Parr, “Hydraulics and Pneumatics“, Jaico Publishing House, Mumbai
2. YoramKoren, ‘Computer control of Manufacturing Systems’, TataMc.Graw Hill Publishers, New Delhi
3. Robert H. Bishop, “Mechatronic systems, Sensors and Actuators Fundamentals and Modelling, Taylor & Francis Group, 2007