



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

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



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

Semester IV, V & VI

www.sjcetpalai.ac.in

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
Total							20			15	15

**Students must register for theory courses listed in the 3rd and 4th 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.*

SEMESTER 4 (S4)

**FUNDAMENTALS OF ANALOG AND DIGITAL
ELECTRONICS**

Course Code	24SJMNECT419	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basics of Electronics	Course Type	Theory

Course Objectives:

1. To provide foundational knowledge of analog and digital electronic circuits, including the operation, characteristics, and applications of BJTs, FETs, op-amps, oscillators, multivibrators, and active filters, enabling students to design and analyze basic analog systems.
2. To develop proficiency in digital logic design and sequential circuits, through the study of logic gates, Boolean simplification, combinational circuits, flip-flops, shift registers, and counters, fostering the ability to implement and troubleshoot basic digital systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	BJT as an amplifier (CE configuration) - Concept of feedback-FET-construction and characteristics of JFET & MOSFET-Comparison of BJT & FET. Oscillators-Barkhausen criteria-Classification- Working of RC phase shift oscillators and Hartley Oscillator (no analysis required). Op-amp –ideal characteristics –offset voltage & offset current – frequency response-Inverting & non inverting amplifier	11
2	Integrator & Differentiator- Comparator-inverting, non-inverting; zero crossing detector, S/H, Isolation amplifier. Active Filters- First order LPF & HPF filter- Band Pass & Band stop Filters- (no analysis required) .Astable and Monostable multivibrator.	11

Department of Electronics and Communication Engineering

3	Logic gates-De-Morgan's theorem –Minimization of Boolean function using K-Map Combinational Circuits- Adder, Subtractor, Code converters (gray to binary & binary to gray). Encoders(3x8), Decoders(8x3), Multiplexers (1x8), De-multiplexers (8x1).	11
4	Flip Flop –SR, D, JK, T and master slave flip flop- Shift Registers- SISO, SIPO, PIPO, PISO, Counters –3 bit Synchronous and asynchronous- Modulo 3 Counter- Ring Counter, Sequence detector	11

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> ● 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Department of Electronics and Communication Engineering

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the operation of BJT and FET-based amplifiers and compare their characteristics and applications.	K2
CO2	Familiarisation of Op-amp and its different applications	K2
CO3	Interpret the functions and characteristics of operational amplifier circuits and active filters in analog signal processing.	K2
CO4	Design combinational circuits, sequential circuits, and various flip- flops used in digital systems.	K3

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

CO-PO Mapping Table:

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

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	“Electronic Devices and Circuit Theory”,	Robert L.Boylestad and Louis Nashelsky,	Prentice Hall,	Tenth Edition 2009.
2	“Op-amps and Linear Integrated Circuits”,	Ramakant A Gayakward,	Pearson Education,	IV edition, 2002
3	“Digital Logic and Computer Design”,	M.Morris Mano	Pearson Education	2002

Department of Electronics and Communication Engineering

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	“Electronic Devices and Circuits:An Introduction”	Allen Mottershead	Prentice Hall of India	2013
2	“Linear Integrated Circuits”	D.Roy Choudhury, Shail B Jain	New Age	Fifth edition, 2018
3	“Digital Fundamentals”	Thomas L Floyd	Pearson Education	Eleventh edition, 2011
4	“Fundamentals of Digital Circuits”	A.Anand Kumar	PHI	Second Edition, 2009



Department of Electronics and Communication Engineering

SEMESTER 5 (S5)

EMBEDDED SYSTEMS

Course Code	24SJMNMR509	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic concepts of microprocessor and microcontroller, C/C++ programming	Course Type	Theory

Course Objectives:

1. To mould students into high calibre embedded real time application designers by enhancing their knowledge and skills in various system design aspects of embedded real time system.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Embedded system overview- Design challenges: optimizing design metrics, IC technology: Full custom/VLSI, Semi-custom ASIC, PLD. RT- level combinational components, RT level sequential components, custom single purpose processor design, RT level custom single purpose processor design Optimizing custom single purpose processors, FSM, Datapath and FSM.	11
2	General purpose processors Basic architecture, Datapath, control unit, memory, pipelining, superscalar and VLIW architecture, Application-Specific Instruction Set Processor (ASIP), DSP, selecting a microcontroller r/general purpose processor design.	11
3	PIC Microcontroller Basic concept of PIC microcontroller and architecture, Instruction Set, Addressing mode, Timers, Interrupt logic, CCP modules, ADC.	11

Department of Electronics and Communication Engineering

4	Advanced communication principles Parallel, serial, wireless communication; serial protocols: I2C Bus, CAN Bus, firewire Bus, USB; Parallel protocols: PCI Bus, AMBA Bus; wireless protocols: IrDA, Bluetooth, and IEEE802.11.	11
----------	--	-----------

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
<ul style="list-style-type: none">● 2 Questions from each module.● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none">● 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Department of Electronics and Communication Engineering

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand about the overview, design challenges and optimization process evolved in embedded system design	K2
CO2	Understand about the basic architecture of different types of embedded processors	K2
CO3	Apply the concepts of PIC microcontroller architecture to develop and implement embedded C programs.	K3
CO4	Understand about various protocols associated with an Embedded system.	K2

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

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									1
CO2	3	1									1
CO3	3		1	2							1
CO4	3		1	2							1

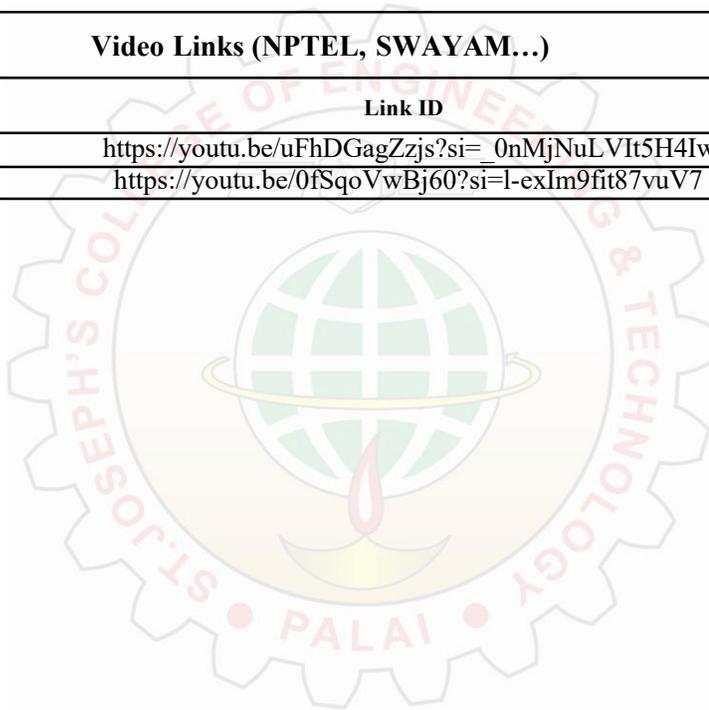
Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition & Year
1	“Embedded System- Architecture, programming, Design”	Rajkamal	Tata McGraw Hill	2011
2	“Design with PIC Microcontroller”	John B. Peatman	Prentice Hall	2003
3	“Embedded System Design - A Unified Hardware/Software Introduction”	Frank Vahid And Tony Givargis	John Wiley & Sons	2002

Department of Electronics and Communication Engineering

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	“Embedded System Design”	Steve Health	Newner	Second edition, 2002
2	“Specification and Design of Embedded System”	Daniel D Gajski and Frank Vahid	Pearson Education	1994

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://youtu.be/uFhDGagZzjs?si=_0nMjNuLVIt5H4Iw
2	https://youtu.be/0fSqvVwBj60?si=l-exIm9fit87vuV7



SEMESTER 6 (S6)

INTRODUCTION TO ROBOTICS & AUTOMATION

Course Code	24SJMNECT619	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basics of Electronics, Sensors and Actuators	Course Type	Theory

Course Objectives:

1. The objective of this course is to provide students with a foundational understanding of robotics and automation, including the principles, design, and application of robotic systems.
2. The course aims to introduce key concepts such as robot kinematics, sensors and actuators, control systems, programming, and industrial automation technologies.
3. students should be able to analyze, design, and implement basic robotic and automated systems for real-world applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Robotics –Introduction –Basic Structure-Classification of Robot and Robotic System-Law of Robotics Robot Motion-Wrist Configuration-Motion – Roll –Pitch-Yaw-Drives-Hydraulic Motors-DC Motor Stepper Motor-Power Transmission Systems Sensors in Robotics: Position Sensor-Potentiometer-Encoders-LVDT-Velocity Sensor-Acceleration Sensor-Force-Pressure and Torque Sensor-Touch and Tactile Sensor-Proximity –Range and Sniff Sensor-Robot End Effectors-Types of End Effectors.	9

Department of Electronics and Communication Engineering

2	Position Orientation-Frames-Mapping-Changing Description from Frames to Frames. Transformation arithmetic's -Translation-rotation-transformation- transforms equations- transformation of the vectors- Introduction to manipulations Forward Kinematics and Inverse Kinematics - D-H representation-Method of Robotic Programming (Qualitative Treatment Only).	9
3	Basics of PLC-Advantage- Capabilities of PLC-Architecture of PLC- Scan Cycle-Types of PLC-Types of I/O Modules-Configuring of PLC – PLC wiring	9
4	Simple process control program using ladder logic- PLC arithmetic functions- Timer and Counters Data transfer-comparison and manipulation instructions -Interlocks and Alarms - Requirement of communication networks in PLC –connecting PLC to computer.	9

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Department of Electronics and Communication Engineering

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand about robotic sensors, actuators and their controls	K2
CO2	Understand the kinematics of robots and adaptive control	K2
CO3	Understand the basics of Programming Logic Circuits	K2
CO4	Acquire proficiency in programming Programmable Logic Circuits	K3

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

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1		2						2
CO2	3	1	2	2	2						2
CO3	3	2	3		2						2
CO4	3	2	3	2	3						3

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Industrial Robotics- Technology, Programming and Applications	M.P Groover	McGraw-Hill USA	1986
2	Introduction to Robotics	John Craig	Macmillan	1985
3	Programmable Controllers	Petruzella	McGraw Hills	1989

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Linear Integrated circuits	D. Roy Choudhury and Shail B. Jain	New age international Pvt. Ltd	2003
2	Mechatronics	W. Bolton	Pearson Education	2009

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://youtu.be/j0kmlMDcObE?si=T1YCa_TgQj4b1WSJt
2	https://youtu.be/xrwz9IxpMJg?si=ONUBY0yakxAwSpQw
3	https://youtu.be/x7gr0rctsrE?si=Tbx9Kgt_1Yz6ZJvd
4	NPTEL :: Electrical Engineering - Industrial Automation and Control