SYLLABUS

Minor *in*

BIOMEDICAL TECHNOLOGY

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

Signed By: Devassia V P
Reason: Approved by SJCET Academic Council held on 25.11.2025

CURRICULUM

Minor in Biomedical Technology											
Sl. No	Semester	Course Code	Course Title	Credit Structure			SS	Total Marks		Credits	Hrs./ Week
				L	T	P		CIA	ESE		
1	3	24SJMNECT329	ELECTRICAL AND ELECTRONICS INSTRUMENTS IN BIOMEDICAL ENGINEERING*/ MOOC#	3	1	0	5	40	60	4	4
2	4	24SJMNECT429	MICROCONTROLLERS AND APPLICATIONS*/ MOOC#	3	1	0	5	40	60	4	4
3	5	24SJMNECT529	MEDICAL EMBEDDED SYSTEMS*/ MOOC#	3	1	0	5	40	60	4	4
4	6	24SJMNECT629	HOSPITAL SAFETY AND MANAGEMENT* /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)

MICROCONTROLLERS AND APPLICATIONS

Course Code	**24SJMNECT429**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Logic Circuit Design	**Course Type**	Theory

Course Objectives:

1. To learn Microcontroller architecture and its programming
2. To learn embedded system design to develop a product.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Microcontroller Architecture – General internal architecture, Address bus, Data bus, control bus. The Microcontroller 8051: Features of 8051 microcontroller, Block diagram of 8051- program status word (PSW), accumulator, programcounter. Memory organization – RAM & ROM, register banks and stack, Special Function Registers (SFRs), I/O port organization, Interrupts.	11
2	Instruction Set of 8051 & Addressing modes: Classification of instruction set - Data transfer group, arithmetic group, logical group, branching group. Addressing modes - Types. Accessing the data from internal and external memory. Programming 8051 Using Assembly Language: Introduction to 8051 assembly language programming. Data types & directives, Concept of subroutine. Software delay programming.	11
3	Interfacing with 8051 using Assembly language programming: LED, Seven segment LED display. Programming 8051 Using Embedded C Language- Simple examples – delay generation, Interfacing of – LCD display, Stepper Motor. Timer / Counter in 8051: Timer registers - Timer0, Timer1. Configuration of timer registers. Timer mode programming Serial Communication in 8051: Serial communication – modes and protocols, RS-232 pin configuration and connection. Serial port programming –transmitting and receiving.	11

4	Microcontroller families used in biomedical devices: Basics of PIC16 and PIC18 series, ARM Cortex-M series. Selection criteria for biomedical microcontrollers: ADC resolution and sampling rate, power consumption and battery life, required interfaces such as UART, SPI and I²C. Biomedical sensor interfacing: temperature sensors (digital/analog), pressure sensors, pulse/PPG sensors for pulse rate and SpO_2 measurement and basic ECG signal acquisition and sampling. Microcontroller-based biomedical devices: digital thermometer, pulse oximeter, ECG monitor and digital blood pressure (NIBP) monitor.	**11**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment or microproject	Internal Ex-1	Internal Ex-2	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 onefull 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	Describe the architecture & memory organization of 8051 microcontroller.	**K2**
CO2	Discuss the addressing modes, instruction set and assembly language program of 8051 microcontroller	**K2**
CO3	Develop and implement assembly or embedded C programs for interfacing various peripherals such as LEDs, displays, keyboards, motors, and ADC/DAC with the 8051 microcontroller for real-time embedded applications.	**K3**
CO4	Design and implement embedded control solutions by programming microcontroller timers, counters, and serial interfaces, and by applying modern communication standards and IoT-based platforms to real-world applications.	**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	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C	Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay	Prentice Hall -Inc	Second, 2007
2	The 8051 Microcontroller Architecture, Programming and Applications	Kenneth J Ayala Dhananjay V Gadre	Cengage Learning	2010
3	Electronics in Medicine and Biomedical Instrumentation	Nandini K. Jog	PHI Learning	Second Edition 2013
4	Bio-Medical Instruments and Its Applications	Dr. Chetan D. M. and Dr. Bommegowda K. B.	IP Innovative Publication Pvt. Ltd	First Edition,2023

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	8051 hardware Description	Datasheet	Intel Corporation	1992
2	Microprocessors and Microcontrollers	Lyla B. Das	Pearson Education	2011
3	Embedded System-Architecture, programming, Design	Rajkamal	Tata McGraw Hill	2011

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	Microprocessors and Microcontrollers - https://nptel.ac.in/courses/106108100
2	Microcontrollers and Applications - https://nptel.ac.in/courses/117104072

SEMETER 5 (S5)

MEDICAL EMBEDDED SYSTEMS

Course Code	**24SJMNECT529**	**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)	C programming, Microcontrollers	**Course Type**	Theory

COURSE OBJECTIVES:

- Acquire knowledge and understand fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
- Understand the hardware architecture and features of embedded microcontrollers and peripherals.
- Understand programming aspects of embedded system design.
- Understand IoT architecture and Build simple IoT Systems using embedded target boards for healthcare applications.

SYLLABUS

Module No.	**Syllabus Description**	**Contact Hours**
1	INTRODUCTION TO EMBEDDED SYSTEM DESIGN: Introduction to embedded processors- Application Areas- Categories of embedded processors- Challenges in Embedded System Design, Design Process- Requirements- Specifications- Hardware architecture- Software architecture-Introduction to Harvard & Von Neuman architectures- CISC & RISC Architectures. CPU BusBus Protocols- Bus Organisation, Memory Devices, and their Characteristics- RAM, EEPROM-Flash Memory- DRAM. BIOS, POST, Device Drivers	**11**

2	PERIPHERAL INTERFACING: I/O Devices-Timers and Counters- Watchdog Timers, Interrupt Controllers- A/D and D/A, InterfacingMemory interfacing with a case study- I/O Device Interfacing with case Study- Programmed IO- Memory Mapped IO, Interfacing Protocols-SPI, I2C, USB, CAN, Ethernet/WiFi, Bluetooth	**11**
3	EMBEDDED SYSTEM SOFTWARE DESIGN DEVELOPMENT OF IOT Application Software, System Software, Design techniques – State diagrams, sequence diagrams, flowcharts, etc. Use of High-Level Languages- embedded C / C++ Programming, Integrated Development Environment tools- Editor- Compiler- Linker-. DESIGN AND DEVELOPMENT OF IOT Definition and characteristics of IoT, Technical Building blocks of IoT, Physical design of IoT - system building blocks - sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), Benefits and impact of IoMT	**11**
4	INTERNET OF MEDICAL THINGS Case studies – Novel Symmetrical Uncertainty Measure (NSUM) Technique for Diabetes Patients, Healthcare Monitoring system through Cyber-physical system, An loT Model for Neuro sensors, AdaBoost with feature selection using loT for somatic mutations evaluation in Cancer, A Fuzzy- Based expert System to diagnose Alzheimer's Disease, Secured architecture for loT enabled Personalized Healthcare Systems.	**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
• 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 fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.	K2
CO2	Describe the hardware architecture and features of embedded microcontrollers and peripherals.	K2
CO3	Apply appropriate software design tools and follow systematic embedded system programming phases to design and implement IoT architectures.	K3
CO4	Exhibit understanding of IoMT infrastructure for healthcare applications.	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	1	1								1
CO2	3	1	1								1
CO3	3	2	1								1
CO4	3	1	1								1

Text Books [1]				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Embedded Systems – A Contemporary Design Tool	James K Peckol, John Weily	2008, ISBN: 0-444-51616-6	2008
2	loT Fundamentals: Networking Technologies, Protocols and Use Cases for lnternet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry.	Cisco Press, 2017	2017
3	"lnternet of Things and Personalized Healthcare Systems", Springer Briefs in Applied Sciences, and Technology,	Venkata Krishna, Sasikumar Gurumoorthy, Mohammad S. Obaidat.	Springer Briefs in Applied Sciences, and Technology, Forensic and Medical Bioinformatics, 2019	2019

Reference Books[2]				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Embedded Systems	Shibu K V, Tata McGraw Hill Education Private Limited.	2009, ISBN: 10: 0070678790 3.	2009
2	"The Internet of Things – Key applications and Protocols",	Olivier Hersent, David Boswarthick, Omar Elloumi.	Wiley, 2012	2012
3	From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle.	Elsevier, 2014.	2014

SEMESTER 6 (S6)

HOSPITAL SAFETY AND MANAGEMENT

Course Code	**24SJMNECT629**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Mins
Prerequisites (if any)	Nil	**Course Type**	Theory

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Introduction to Hospital Systems**: Classification of hospitals – Structure and functions of clinical, administrative, and support departments – Workflow in OP, IP, ICU, OT, and Emergency units. **Safety Standards**: Patient safety, staff safety and environmental safety – National and international standards (NABH, JCI, WHO). **Safety Documentation**: Incident reporting, safety audits, checklists – Legal and ethical responsibilities in hospital safety.	9
2	**Risk Management in Hospitals:** Types of risks – Clinical, biomedical, infrastructural, electrical, mechanical, fire and chemical hazards – Risk identification, evaluation and mitigation strategies. **Facility and Fire Safety:** Fire safety norms – Evacuation routes – Electrical load safety – Building service safety (HVAC, water, medical gas lines). **Cyber & Data Safety:** Electronic health records – Data privacy – Cybersecurity threats – Access control and backup procedures.	9
3	**Biomedical Equipment Safety:** Installation and operational safety – Grounding, leakage current, electrical protection – Safety standards for diagnostic and life-support equipment. **Infection Control:** Hospital-acquired infections – Transmission modes – Sterilization and disinfection – PPE, hand hygiene, biomedical waste segregation. **Environmental Safety:** OT/ICU environmental parameters – Air quality, temperature, humidity control – Cleanroom classifications.	9

4	**Hospital Operations**: Patient flow, scheduling, triage, and emergency handling – Coordination of clinical and support services. **Quality and Accreditation**: ISO and NABH standards – SOPs, documentation, audits, continuous quality improvement (CQI). **Disaster Preparedness**: Emergency planning for natural disasters, pandemics, and chemical/radiological incidents – Hospital Incident Command System (HICS) – Resource management and communication protocols.	**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
• 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 Outcomes		Bloom's Knowledge Level (KL)
CO 1	Explain the structure and functioning of hospital systems, including patient safety principles and regulatory frameworks.	**K2**
CO 2	Identify and assess clinical, biomedical, infrastructural, fire, and cyber risks within the hospital environment.	**K2**
CO 3	Apply safety protocols related to biomedical equipment, infection control, sterilization, and environmental monitoring.	**K3**
CO 4	Demonstrate understanding of hospital operations, quality management systems, accreditation processes, and disaster preparedness.	**K3**

CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hospital Administration	L. C. M. Francis and M. C. de Souza	Jaypee Brothers Medical Publishers, New Delhi	2015
2	Hospital Administration and Management: Theory and Practice	S. L. Goel,R. Kumar	Deep & Deep Publications, New Delhi	2014
3	Quality Management in Hospitals	A. K. Agarwal	Jaypee Brothers Medical Publishers, New Delhi	2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Risk Management in Health Care Institutions	F. Kavaler and A. D. Spiegel	Jones & Bartlett Learning, Burlington	2011
2	Textbook of Patient Safety and Clinical Risk Management	L. Donaldson, W. Ricciardi, S. Sheridan and R. Tartaglia (Eds.)	Springer, Cham	2021
3	Health and Safety Management: Principles and Best Practice	C. Fuller and L. H. Vassie	Prentice Hall / Financial Times, Harlow (UK)	2004