Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road,Nagpur-441108
NAAC Accredited (A+ Grade) & NBA Accredited
An Autonomous Institute affiliated to RTMNU Nagpur

Third Year (Semester V) B.Tech. Electronics & Communication Engineering

BEC33521: Introduction to Embedded Systems Design (Minor Subject)

Teaching Scheme	
Lectures	3 Hrs./week
Tutorial	0 Hrs./week
Total Credit	
Duration of ESE:03Hrs.	

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks

Course Outcomes (CO)

Students will be able to

CO1: Understand basic concepts and architecture of embedded systems
CO2: Analyze hardware components and interfacing techniques
CO3: Apply memory and I/O concepts in embedded design
CO4: Develop simple embedded programs using C/RTOS
CO5: Design basic embedded systems for real-world applications

Course Contents

Unit I	**Basics of Embedded Systems:** Definition and characteristics of embedded systems, Classification: Stand-alone, real-time, networked systems, Embedded system architecture, Microcontroller vs microprocessor, Embedded system design flow Applications: Consumer electronics, automotive, healthcare, IoT
Unit II	**Embedded Hardware Components:** Basic building blocks, CPU, memory, I/O devices, Microcontroller architecture (8051 / ARM overview), Registers, instruction sets, Interfacing concepts: Sensors and actuators, Communication protocols: UART, SPI, I2C, Timers, counters, watchdog timer.
Unit III	**Memory and Input/Output Systems: Memory types:** RAM, ROM, EEPROM, Flash, Memory organization and mapping, I/O programming techniques, Interrupts and handling mechanisms, Data transfer techniques: Polling, interrupt-driven, DMA.
Unit IV	**Embedded Software & Programming:** Embedded C programming basics, Development tools: Compiler, assembler, debugger, Build systems and toolchains, Embedded software development lifecycle, Introduction to RTOS: Tasks, scheduling, IPC, State machine modeling.
Unit V	**Embedded System Design & Applications:** Design methodology: Specification, design, implementation, testing, Hardware–software co-design, Power and performance optimization, Debugging and testing techniques, Case studies: Smart home system, IoT-based applications, Automotive embedded systems.

Text Books

T.1	Raj Kamal – *Embedded Systems: Architecture, Programming and Design*, McGraw Hill
T.2	Frank Vahid & Tony Givargis – *Embedded System Design: A Unified Hardware/Software Introduction*, Wiley

Reference Books

R.1	Shibu K.V – *Introduction to Embedded Systems*, McGraw Hill
R.2	Wayne Wolf – *Computers as Components: Principles of Embedded Computing System Design*

Useful Links

L.1	http://digimat.in/nptel/courses/video/108102169/L21.html
L.2	https://www.youtube.com/watch?v=CDmE8CYG7L0