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Electronic System Design and Embedded System — Complete Syllabus

BTEUP Diploma in Electronics Engineering • 5th Semester • Session 2026-27
Subject 5.3 (Practicum) • Total 100 Marks • 3 Credits • L 2 - P 2

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
5.3	Electronic System Design and Embedded System	Practicum	2 - 2	3	Theory 40	Theory 60 (3 hrs)	100
Electronic System Design and Embedded System Total				3	40	60	100

What This Subject Aims To Do

To understand the fundamentals of electronic system design and apply them to develop complete electronic systems — selecting sensors and actuators for interfacing with the real world — and to learn modern embedded systems (operating system concepts, real-time design) starting with the 8051 microcontroller and the Arduino platform for real-time embedded applications.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
1	Basics of Electronic Systems Design	5	17%

2	Sensors and Actuators	6	22%
3	Embedded System	6	22%
4	8051 Microcontroller	6	22%
5	Communication with Arduino Uno	5	17%

Unit 1 — Basics of Electronic Systems Design (5 Periods, 17%)

Topics: Definition, Purpose and Scope; System Architecture for Electronic Product Designs; Breakdown of an Electronic System Design; Requirements; Electromagnetic Interference in Electronic Systems and Its Impact; Concept of Grounding and Its Significance, PCB designing principals, Etching process, Types of etching.

In simple words: How a complete electronic product is designed: system architecture, requirements, electromagnetic interference, grounding, and PCB design and etching.

Unit 2 — Sensors and Actuators (6 Periods, 22%)

Topics: Sensor: Definition: Sensor Characteristics - Sensitivity, Linearity, Range, Resolution, Accuracy, Repeatability, and Hysteresis. Types of Sensors: Temperature Sensor, Ultrasonic Sensor, Gas Sensor, Level Sensor, Ph Sensor, Flow Sensor, Humidity Sensor, Proximity Sensor, Pressure Sensor, etc. Actuator: Definition: Actuator Principles and Classification, Energy Source-Based Actuators (i.e., Pneumatic Actuator, Hydraulic Actuator, Electric Actuator, Thermal Actuator, Magnetic Actuator, and Piezoelectric Actuator). Classification of Actuators by Motion: Linear, Rotary, and Semi-Rotary.

In simple words: Sensors that measure the world and actuators that act on it: their types, characteristics and classifications.

Unit 3 — Embedded System (6 Periods, 22%)

Topics: Embedded system architecture Types of Architecture of Embedded Processors: Von Neumann, Harvard, Super Harvard, RISC, CISC, DSP, Multi core processor, factors affecting embedded systems, Types of embedded O.S: Non real time O.S, Real time O.S, Mobile O.S

In simple words: Embedded systems: processor architectures (Von Neumann, Harvard, RISC, CISC, DSP, multicore) and the operating systems that run on them — real-time and otherwise.

Unit 4 — 8051 Microcontroller (6 Periods, 22%)

Topics: Introduction to 8051 Pin Diagram and Description, Memory Organization, Special Function Registers, Addressing Modes, Interrupts, Timers, Serial Communication. Difference between the C language and Embedded C language,

In simple words: The 8051 microcontroller: its pins, memory, special-function registers, addressing modes, interrupts, timers and serial communication.

Unit 5 — Communication with Arduino Uno (5 Periods, 17%)

Topics: Arduino Uno specifications including power ratings, digital and analog peripherals. Arduino Uno Ports, Pins, Digital and Analog Peripherals, Familiarizing with the Arduino IDE, Arduino I/O functions, Arduino Interrupts, Serial Peripheral Interface and Communication and their programming.

In simple words: The Arduino Uno: its specifications, pins and peripherals, the Arduino IDE, and programming its I/O, interrupts and serial communication.

Practical Work

- Familiarization with different types of PCB'S Materials and their key specifications. (Bakelite,FR4 etc).
- Schematic creation and PCB Layout for simple circuits using open source software.
- Creating a PCB that is fully prepared for component installation with PCB grounding techniques.
- Identifying various types of sensors and analyzing their specifications through datasheets.
- Identifying various types of actuators and analyzing their specifications through datasheets.
- Familiarization with different types of microcontrollers and their specifications and IC packages (ESP8266/32, Arduino Classic, MKR, Nano and Mega family, Raspberry pi).
- Template for embedded C program for 8051 (using reg.51).
- Write a program to load a number into Accumulator.
- Write a program to load three numbers into Accumulator and send them to port 1.
- Write a program to explain different logical operations.
- Write a program for LED blinking with 1s delay.
- Write a program for handling two LEDs blinking alternatively with a delay of 2s.
- Write a program to read digital states of a push button and print in IDE serial monitor.
- Write a program to send a message using serial communication.

Reference Books (as listed in the syllabus)

- John F. Wakerly, Digital Design: Principles and Practices, 5th edition, Pearson Publications, 2018
- Charles Kitchin and Lew Counts, A Designer's Guide to Instrumentation Amplifiers, 3rd edition, Analog Devices, 2006
- Eamon Nash, Errors and Error Budget Analysis in Instrumentation Amplifier Applications, 3rd edition, Analog Devices, 2006
- Lyla B. Das, Embedded systems: An Integrated Approach, 1st edition, Pearson Education, 2013
- Steve Furbe, ARM System on chip Architecture, 2nd Edition, Pearson Education, 2015

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Source: BTEUP 3rd Year curriculum (folder2627), approved in C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.

Please confirm with your own polytechnic for any local changes.

