Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Structure and Detailed Syllabus

for UG Degree

Minor in Electronics Engineering

in line with New Education Policy 2020

(Effective from Academic year 2025-26 for Affiliated Colleges Only)

Bucket for Minor in Electronics Engineering

Offered by

Electronics and Computer Engineering / Electronics and Computer Science Engineering

Case I: B. Tech degree with Minor in Electronics Engineering (160-176 credits)

The Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. "**B. Tech in chosen Engg./ Tech. Discipline with Minor in Electronics Engineering**" (160-176 credits) enables students to take up four-six or required additional courses of 14 credits in the discipline other than **chosen Engg./ Tech. Discipline** distributed over semesters III to VIII.

Case II: Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor (Multidisciplinary and Specialization Minor 180-194 credits)

The **Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in chosen Engg./ Tech. Discipline with minor in *other selected discipline in* Engineering (as MDM) with Specialization Minor in Electronics Engineering**" (180-194 credits) enables students to take up four-six additional courses of 14 credits in the discipline other than **chosen Engg./ Tech. Discipline** (for completion of multidisciplinary minor) and 18 to 20 extra credits in the **Electronics Engineering** distributed over semesters III to VIII. Here, the ***other selected discipline* in Engineering should be different from Specialization Minor i.e. Electronics Engineering**. This enables students to take up four-six or required additional courses of 18 to 20 credits in the discipline of **Electronics Engineering** distributed over semesters III to VIII, which are over and above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, prescribed for the duration of four years will be taken by respective BoS. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

List of Courses for

Minor in Electronics Engineering

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	SEM-III	25AF1844MD306	Analog and Digital Electronics	2	0	0	20	20	60	100	2
2	SEM-IV	25AF1844MD406	Microcontroller and Applications	2	0	0	20	20	60	100	2
3	SEM-V	25AF1844MD506	Embedded Systems	3	0	0	20	20	60	100	3
4	SEM-VI	25AF1844MD605	Internet of Things	3	0	0	20	20	60	100	3
5	SEM-VII	25AF1844MD705	Industry 4.0	2	0	0	20	20	60	100	2
	SEM-VIII	25AF1844MD802	Industrial Automation	2	0	0	20	20	60	100	2
										600	**14**

24AF1844MD306	Analog and Digital Electronics	03 Credits

Course Objectives:

The objective of this course is to provide students with

1. Concepts of Semiconductor devices like BJT and MOSFET, its characteristics, parameters & applications
2. Knowledge of Operational amplifier, concept, parameters & applications
3. Boolean algebra, Karnaugh-Maps and its application to the design and characterization of combinational logic Circuits.
4. The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.

Course Outcomes:

After completing this course, students will be able to

CO1: Analyze the MOSFET based amplifiers with and without feedback.

CO2: Explore and deploy basic configurations of Op-amp and explain relevant parameters.

CO3: Apply the knowledge of number systems and Boolean algebra for simplification of logic equations.

CO4: Design and implement combinational logic circuits.

CO5: Design and implement Sequential logic circuits.

Unit-I: MOSFET Circuits and applications **06 Hours**

Types of MOSFETs, Construction, working, and characteristics. Common Source amplifier, CS/CD/CG Configurations, Common source amplifier, MOSFET as switch, MOSFET as resistor/diode. Concept of Feedback – Types of Negative Feedback amplifiers, Oscillators: Barkhausen Criterion, Wein Bridge & Phase shift oscillator.

Unit-II: Operational Amplifier **06 Hours**

Block diagram of Op-Amp, Op-amp characteristics (AC & DC), and Op-amp parameters. Inverting amplifier, non-inverting amplifier, Voltage follower, Summing amplifier, Differential amplifier, Comparator, Schmitt trigger, Square & triangular wave generator, Precision rectifiers.

Unit-III: Basics of Digital Electronics **06 Hours**

Number system & codes: Binary Number base conversion, Octal & hexadecimal numbers, complements, signed binary numbers, binary codes-BCD codes, gray codes, ASCII Character Code. Boolean algebra: Basic Theorems, Sum-of-Product, Product-of-Sum, up to 4 variable K-map. Don't care condition, Code convertors.

Unit-IV: Combinational Circuit Design **06 Hours**

NAND and NOR Implementation, Adders and Subtractors, look ahead carry, BCD Adder, Digital Comparator, Parity generators/checkers, Multiplexers, Encoders, De-multiplexers and Decoders and their use in combinational logic designs.

Unit-V: Sequential Circuit Design **06 Hours**

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops. Application of Flip- flops: Registers, Shift registers, Sequence Generators, ripple counters, up/down counters, synchronous counters, Basics of State Machines

Text Books:

1. Donald Neaman, "Electronic Circuits – Analysis and Design" Third edition, McGraw Hill. 2019.
2. R.P. Jain, Kishor Sarawadekar, "Modern Digital Electronics", Fifth edition, McGraw Hill, 2022.

Reference Books:

1. Jacob Millman, Christos Halkias, Chetan Parekh "Integrated Electronics", Second Edition, McGraw Hill, 2018
2. Ramakant Gayakwad, "Op Amps & Linear Integrated Circuits", Pearson Education. Fourth Edition, 2015.
3. Anand Kumar, "Fundamentals of Digital Circuits", Fourth Edition, Prentice Hall of India, 2016

25AF1844MD406	Microcontroller and Applications	03 Credits

Course Objectives:

The objective of this course is to provide students with

1. Comprehensive understanding of microcontroller architectures
2. Learn 8051 and STM32 platforms and programming using embedded c.
3. Explore internal structures, development environments, peripheral interfacing, and real-time programming techniques using industry-standard protocols
4. Develop working skills to use tools for application-based embedded system design.

Course Outcomes:

After completing this course, students will be able to:

CO1: Describe the architecture, features, and selection criteria of 8051 microcontrollers.

CO2: Implement interrupt programming for Timer/Counter, Serial communication and external and internal interrupts.

CO3: Interface various peripheral devices with 8051 microcontroller for real world applications.

CO4: Understand STM32 architecture and develop programs for STM32 microcontrollers

CO5: Interface and program the STM32 microcontroller with various peripherals and develop embedded C programming.

Unit-I: Introduction to 8051 Microcontroller **06 Hours**

Brief History, Classification of MCS-51family based on their features (8051, 8052, 8031, 8751, AT89C51), Pin configuration, Processor Architecture and Instruction Set: Registers of 8051, Inbuilt RAM, Register banks, stack, on-chip and external program code memory ROM, power reset and clocking circuits, I/O port structure, GPIO Programming using embedded C.

Unit-II: Timer/Counter, Serial Port and Interrupts of 8051 **06 Hours**

Basics of Timers & Counters, Timer Types and Modes of Operation, Interrupt vs Polling, Types of interrupts, Register used for interrupts initialization, External interrupts, Timer interrupts. Introduction to serial communication, RS232 standard, RS422 Standard, 1488 and 1489 standard, Max 232/233 Driver, Serial Communication Interrupts, [Timer/Counter, Serial Communication and Interrupt programming using embedded C].

Unit-III: I/O Port and Peripheral Interfacing with 8051 **06 Hours**

LEDs, Relays and Opt-isolators interfacing, DC motor interfacing Stepper motor interfacing, and PWM using 8051. 7-Segment and LCD Interfacing, Analog to Digital converters (ADC) & Digital to Analog Converter (DAC) basics. ADC, DAC and Temperature Sensor interfacing.

Unit-IV: STM32 Architecture and Programming **08 Hours**

STM32 MCU family, ARM architecture, Difference between STM32F1, F4, L series, STM32F411: - Features, Functional Overview: - ARM Cortex-M with FPU core, Memory & Bus Architecture, Power Controller, Reset & Clock control, Direct Memory Access (DMA) controller, Interrupts, Timers and Watchdogs. ARM Thumb, Instruction Set. Language support (Assembly, C, C++ and Micro Python). Programming: - GPIO, Serial monitor, generate time delay using timer.

Unit-V: Interfacing Applications with STM32 **06 Hours**

Interfacing with STM32 and its programming: - LCD Interfacing, transfer and receive data from PC, read analog voltage and display on serial port, signal generator using DAC, IR sensor interfacing, control AC device using relay module with STM32, control servo motor angle using PWM.

Textbooks:

1. Mazidi, M. A., Mazidi, J. G., & McKinlay, R. D. (2006). The 8051 microcontroller and embedded systems: using Assembly and C (Vol. 626). Pearson/Prentice Hall.
2. Predko, M. (1999). Programming and customizing the 8051 microcontroller. McGraw-Hill, Inc.
3. Muhammad Ali Mazidi, STM32 ARM Programming, McGraw Hill.

Reference Books

1. Ayala, K. J. (2010). The 8051 Microcontroller and Embedded Systems: Using Assembly and C. Cengage Learning.
2. Ayala, K. J. (1995). The 8051 microcontroller. Penram, India.
3. Beginning STM32, William Grey, Apress

NPTEL Courses:

1. Microprocessors And Microcontrollers, IIT Kharagpur Prof. Santanu Chattopadhyay https://nptel.ac.in/courses/108105102
2. Microcontrollers and Applications, IIT Kanpur by Dr. S. P. Das https://nptel.ac.in/courses/117104072