D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

NBA Accredited

Accredited by NAAC with 'A' Grade

D Y PATIL
COLLEGE of
ENGINEERING & TECHNOLOGY
(AN AUTONOMOUS INSTITUTE)
KASABA BAWADA, KOLHAPUR

Structure and Syllabus

(As per NEP 2020)

for

Third Year B. Tech in
Electronics & Telecommunication Engineering

Department of Electronics & Telecommunication Engineering
Kasaba Bawada, Kolhapur-6

Department of Electronics & Telecommunication Engineering

w. e. f. 2025–26

Program Coordinator | HOD | Academic Dean | Principal

SEMESTER V												
			Teaching Scheme				Theory			Practical		Total Marks
Course Code	Course Type	Course Name	Credits	L	P	T	ISE	MSE	ESE	INT	OE/PoE	
231ETPCCL301	PCC	Linear Integrated Circuit	3	3	-	-	20	30	50	-	-	100
231ETPCCL302		Microprocessor and Microcontroller	3	3	-	-	20	30	50	-	-	100
231ETPCCL303		Cellular & Mobile Communication	3	3	-	-	20	30	50	-	-	100
231ETPCCP301		Linear Integrated Circuit Lab	1	-	2	-	-	-	-	25	25	50
231ETPCCP302		Microprocessor and Microcontroller Lab	1	-	2	-	-	-	-	25	25	50
231ETPCCP303		Cellular & Mobile Communication Lab	1	-	2	-	-	-	-	25	-	25
231ETMDML301	MDM-3	Microcontrollers(RISC)(ODL ONLY)	4	$ 2		-	20	30	50	25	-	125
231ETOECL301	OEC-III	Biomedical Instrumentation	2	2	-	-	-	-	50	-	-	50
231ETOECL302		Electronics Automation		2								
231ETPECL301	PEC- 1	Fiber Optic Communication	4	4	-	-	20	30	50	25	-	125
231ETPECL302		Fundamentals of Semiconductor Devices		4								
231ETPECL303		Information Theory & Coding		4								
231ETMCL301	MC	Finishing School Training V	Audit	3 *	-	-	50	-	-	-	-	Grade
231ETCCAL301	CCA	Liberal Learning-I (Garuda)	Audit	2#	-	-	50	-	-	-	-	Grade
		Liberal Learning-II (Robotics)		2#								
		Liberal Learning-III (IoT)		2#								
		Liberal Learning-IV (PSoC)		2#								
		Total	**22**	**27**	**6**	**-**	**200**	**150**	**300**	**125**	**50**	**725**
231ETHONL301	HC (Optional)	Honors Paper- II (ODL) Semiconductor Device Modelling and Simulation	04	3	2	-	20	30	50	25	-	125

*** - Values not included in total, # - 2 contact hrs per club, $- 2 contact hrs per week**

SEMESTER VI												
			Teaching Scheme				Theory			Practical		Total Marks
Course Code	Course Type	Course Name	Credits	L	P	T	ISE	MSE	ESE	INT	OE/PoE	
231ETPCCL304	PCC	Embedded Systems	3	3	-	-	20	30	50	-	-	100
231ETPCCL305		Fundamentals of Digital Signal Processing	3	3	-	-	20	30	50	-	-	100
231ETPCCL306		Electromagnetic Engineering	2	2	-	-	-	-	50	-	-	50
231ETPCCP304		Embedded Systems Lab.	1		2	-	-	-	-	25	25	50
231ETPCCP305		Fundamentals of Digital Signal Processing Lab.	1		2	-	-	-	-	25	25	50
231ETMDML303	MDM-4	Control System	2	2	-	-	-	-	50	-	-	50
231ETPECL304	PEC-2	Antenna & Wave Propagation	4	4	-	-	20	30	50	25	-	125
231ETPECL305		CMOS VLSI Design		4								
231ETPECL306		Wireless Sensor Network		4								
231ETPECL307	PEC-3	Microwave Theory	3	3	-	-	20	30	50	-	-	100
231ETPECL308		ASIC Design		3								
231ETPECL309		Satellite Communication		3								
231ETPECP307	PEC-3	Microwave Theory Lab.	1		2	-				25	-	25
231ETPECP308		ASIC Design Lab.			2							
231ETPECP309		Satellite Communication Lab.			2							
231ETVSECL301	VSEC	Data Structures & Algorithms using C++	1	1		-	25	-	-	-	-	25
231ETVSECP301	VSEC	Data Structures & Algorithms using C++ Lab	1		2					25		25
231ETMCL302	MC	Finishing School Training VI	Audit	3*	-	-	50	-	-	-	-	Grade
231ETCCAL302	CCA	Liberal Learning-I (Garuda)	Audit	$2^{\#}$	-	-	50	-		-	-	Grade
		Liberal Learning-II (Robotics)		$2^{\#}$								

		Liberal Learning-III (IoT)		2#								
		Liberal Learning-IV (PSoC)		2#								
		Total	**22**	**32**	**12**	**-**	**225**	**120**	**300**	**125**	**50**	**700**
231ETHONL302	HC (Optional)	Honors Paper-III Digital IC Design	04	3	2	-	20	30	50	25	-	125

*** - Values not included in total, # - 2 contact hrs per club, $- 2 contact hrs per week**

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Linear Integrated Circuit	
Course Code: 231ETPCCL301	**Semester : V**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description: This course aims to provide the basic knowledge of operational amplifiers, active filters, and various applications using operational amplifier.

Course Objectives:

1.	To study the fundamental principles of operational amplifier and its parameters
2.	To Understand concepts of op-amp configurations and their frequency response
3.	To Realize importance of op-amp in the various applications
4.	To design different types of Active filters.
5.	To Analyse and design of various waveform generators.

Course Outcomes (COs):

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

231ETPCCL301.1	Explain basic concept of operational amplifier with its parameters
231ETPCCL301.2	Classify different configuration of op-amp
231ETPCCL301.3	Identify and describe different applications of op-amp
231ETPCCL301.4	Design and implement various filters
231ETPCCL301.5	Analyse different waveform generator circuits
231ETPCCL301.6	Apply knowledge of op-amp in various industrial applications

Prerequisite:	Basic knowledge of electronics components & its parameters

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
231ETPCCL301.1	3	2	1	1	-	-	-	-	-	-	-	-	1	-	II
231ETPCCL301.2	2	2	1	1	-	-	-	-	-	-	-	-	1	-	II
231ETPCCL301.3	2	2	1	1	-	-	-	-	-	-	-	-	1	-	II
231ETPCCL301.4	2	2	2	1	-	-	-	-	-	-	-	-	1	-	III
231ETPCCL301.5	2	2	1	1	-	-	-	-	-	-	-	-	1	-	III
231ETPCCL301.6	2	2	2	1	-	-	-	-	-	-	-	-	1	-	III

Course Contents	Hrs
Unit 1 :– Introduction to Operational amplifier Block diagram of op-amp, Dual input balanced output differential amplifier (DC & AC analysis), Op-amp equivalent circuit, voltage transfer characteristics of op amp, ideal and practical parameters of op-amp.	7
Unit 2 :-Op-Amp Configurations & Frequency Response Open loop configuration, closed loop configuration, Virtual ground concept, unity gain amplifier, frequency response of both configurations, Slew rate and its effect.	6
Unit 3 :–Applications of Op-amp Summing Amplifier, Differential amplifier, instrumentation amplifier, Integrator, differentiator, Precision Rectifiers, Log & Anti-log Amplifier, Comparator, Schmitt Trigger, Binary Weighted Resistor and R-2R ladder Digital-to-Analog Converter.	9
Unit 4:-Active Filters Introduction to active filters, analysis & design of Butterworth filters: Low Pass filter & High Pass filter (First & Second order), Band Pass filter, Band Stop filter, All Pass Filter**.**	7

Unit 5: - Waveform Generators Square wave generator, Triangular & Saw-tooth wave generator, RC phase shift oscillator, Wien bridge oscillator.	7
Unit 6:- Monolithic IC Applications IC 555 (Timer): Block diagram, Multi-vibrators and Applications. PLL - Introduction, Block diagram, IC 566 VCO , IC 565 PLL & Applications, IC 8038	7

Text BookS:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education
2. David Bell, “Operational Amplifiers and Linear IC’s”, Oxford University Press

Reference Books:

1. Sergio Franco “Design with Oparational amlifiers and Analog integrated circuits ’’
2. Robert Coughlin, Fredric Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Pearson Education
3. B. Somanathan Nair, “Linear Integrated Circuits- Analysis, Design & Applications”, Wiley India.
4. S. Salivahanan & Bhaskaran, “Linear Integrated Circuits”, TMH

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Microprocessor and Microcontroller	
Course Code: 231ETPCCL302	**Semester : V**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course introduces students to the basics of microprocessor and microcontroller architecture, programming, and interfacing techniques. It covers both theoretical and practical knowledge of 8051 and PIC microcontrollers, assembly language programming, embedded systems design, and real-world applications of microcontroller systems. The course also emphasizes communication system design using embedded microcontroller platforms.

Course Objectives:

1.	To introduce the fundamentals of microprocessors and microcontrollers.
2.	To understand the architecture and instruction set of the 8051 and PIC microcontrollers.
3.	To design embedded systems and write assembly language programs.
4.	To interface external devices like LEDs, motors, and sensors with microcontrollers.
5.	To explore the use of timers, interrupts, and serial communication in embedded Systems.
6.	To apply embedded microcontroller systems for real-world applications.

Course Outcomes (COs):

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

231ETPCCL302.1	Explain the architecture and components of microcontrollers
231ETPCCL302.2	Explain the instruction set and assembly programming of the 8051 microcontroller
231ETPCCL302.3	Design and implement embedded programs for 8051 and PIC microcontrollers
231ETPCCL302.4	Interface external devices like LEDs, sensors, and motors with microcontrollers
231ETPCCL302.5	Analyze the working of timers, interrupts, and serial communication in microcontroller systems
231ETPCCL302.6	Evaluate and justify microcontroller-based solutions for real-world applications

Prerequisite:	Digital Electronics and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETPCCL302.1	2	3	2	-	1	2	-	-	-	-	-	-	2	1	II
231ETPCCL302.2	2	3	3	-	1	2	-	-	-	-	-	-	2	2	II
231ETPCCL302.3	3	3	3	2	2	3	2	2	2	2	2	1	2	3	III
231ETPCCL302.4	3	3	3	2	2	3	2	2	2	2	2	2	2	2	III
231ETPCCL302.5	3	3	3	3	2	3	-	-	2	2	1	1	2	2	IV
231ETPCCL302.6	3	3	3	3	2	3	2	2	2	3	2	2	2	2	V

Course Contents	**Hrs**
Unit 1:– Introduction to Microprocessors: Introduction to microprocessors, Evolution and classification, 8085 architecture, ALU and control unit, Registers, Data, address and control buses, Memory and I/O interfacing basics, Machine cycle and instruction cycle, Instruction set classification, Simple assembly programming examples, Applications	7
Unit 2:-8051 Architecture and Programming: Introduction to 8051, Architecture and block diagram, Features and pin diagram, Memory organization – ROM, RAM, SFR, Register set – ACC, B, PSW, SP, DPTR, I/O ports structure, Addressing modes, Instruction set classification, Basic assembly programs	7
Unit 3: 8051 Programming and Interfacing: GPIO programming, LED and push button interfacing, 7-segment display interfacing, LCD (16x2) interfacing, Embedded C basics for 8051, Timer and counter operation, Delay generation using timers, ADC interfacing, DAC interfacing	7
Unit 4: 8051 Advanced Topics and Applications: Interrupt types and structure, Interrupt programming, UART serial communication, SBUF and SCON registers, Stepper motor interfacing, DC motor control, Matrix keypad interfacing, RTC (DS1307) interfacing	7

Unit 5: PIC Microcontroller Basics: Introduction to PIC, PIC16F877A features, Architecture and pin diagram, I/O ports configuration, Memory organization, File registers and SFRs, MPLAB IDE, XC8 compiler, Instruction set overview, Simple programs using Assembly and C , Basic assembly programs	7
Unit 6: PIC Programming and Interfacing: Timers in PIC, Interrupts and configuration, ADC module and sensor interfacing, PWM generation, USART serial communication, LED interfacing, Switch interfacing, LCD interfacing	7

Text Books:

1. Microprocessor Architecture, Programming and Applications with the 8085, 6th Edition, Ramesh Gaonkar, Penram International Publication, 2002
2. 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Muhammad Ali Mazidi, Pearson Prentice Hall, 2012
3. PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18" by Mazidi & Causey, and

Reference Books:

1. Microprocessor & Interfacing, 2nd Edition, Douglas Hall, TMH, 2006
2. The 8051 Microcontroller, 3rd Edition, Kenneth J. Ayala, Cengage Learning Publication, 2007
3. "Design with PIC Microcontrollers" by John B. Peatman.

Web Resources:

1. Nptel Web course on Microprocessor by Dr. Pramod Agarwal, IITRoorkee.

https://nptel.ac.in/courses/108/107/108107029/

2. Nptel Web course on Microcontrollers and Applications by Dr. . P. Das, IITKanpur.

https://nptel.ac.in/courses/117/104/117104072/

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Cellular and Mobile Communication	
Course Code: 231ETPCCL303	**Semester : V**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

Cellular communication is a form of communication technology that enables the use of mobile phones. Cellular communication is based on the geographic division of the communication coverage area into cells, and within cells. This course is useful for better understanding of cellular communication..

Course Objectives:

1.	To understand the evolution of Mobile communication and cell concept to improve capacity of the system
2.	To study the concepts of wireless transmission and to study different types of Equalizers and Diversity techniques.
3.	To study and understand the concept of multiple access techniques
4.	To understand the types of channel coding techniques, data transmission modes and services of GSM & CDMA.

Course Outcomes (COs):

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

231ETPCCL303.1	Demonstrate cellular concepts like frequency reuse, fading, equalization, mobile radio propagation
231ETPCCL303.2	Apply various concepts of Wireless transmission
231ETPCCL303.3	Apply the concept of multiple access techniques
231ETPCCL303.4	Apply the concept of GSM in real time applications.

231ETPCCL303.5	Implement the emerging technology of telecommunication.
231ETPCCL303.6	Understand and apply the evolution of GSM

Prerequisite:	Basic knowledge of analog and digital communication

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPCCL303.1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	II
231ETPCCL303.2	2	2	2	3	-	-	-	-	-	-	-	-	3	3	III
231ETPCCL303.3	3	3	2	3	-	-	-	-	-	-	-	-	2	2	III
231ETPCCL303.4	2	2	3	2	-	-	-	-	-	-	-	-	2	2	III
231ETPCCL303.5	3	3	2	3	-	-	-	-	-	-	-	-	2	2	III
231ETPCCL303.6	2	2	3	2	-	-	-	-	-	-	-	-	2	2	III

Course Contents	Hrs
Unit 1: Introduction to Mobile Communication Evolution of Mobile Radio Communication, Paging system, Cordless telephone systems, Cellular telephone Systems, Cellular concept: Frequency reuse, Channel Assignment strategies, Handoff strategies. Interference and System capacity.	7
Unit 2: Wireless transmission Signal propagation, Three basic propagation mechanisms, Reflection, Diffraction, Scattering, Large scale fading, small scale fading, Signal Multiplexing, Spread Spectrum, Equalization & Diversity Techniques.	8
Unit 3: Multiple Access Techniques FDMA, TDMA, CDMA Systems, FDM / TDM Cellular systems, Cellular CDMA, comparison of FDM / TDM systems and Cellular CDMA	6

Unit 4: GSM System Overview GSM: GSM Network architecture, identifiers used in GSM system, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM hand-off procedures, GSM services and features	7
Unit 5: GSM Evolution GPRS And EDGE- architecture, radio specifications, channels. IS-95: Architecture of CDMA system, CDMA air interface, power control in CDMA system, power control, handoff, rake receive	7
Unit 6: Telecommunications system DECT: System architecture, Protocol architecture, TETRA, UMTS and IMT-2000: UMTS releases and standardization, UMTS system architecture, UMTS radio interface, UTRAN, Core network, UMTS Handover	7

Text Books:

1. Mobile Communications, 2nd Edition, Jochen H. Schiller, Pearson Education, 2007
2. Wireless Communications Principles and Practice, 2nd Edition, Theodore S. Rappaport, Pearson Education, 2003

Reference Books:

1. Wireless Communications, 2nd Edition, Andreas F. Molisch, John Wiley, 2006
2. Mobile Cellular Communications, 2nd Edition, W.C.Y. Lee, McGraw Hill, 1995

Useful Link /Web Resources:

https://www.youtube.com/watch?v=oBiGDhnRl8M

https://www.youtube.com/watch?v=Qgm7LsIuYfY

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title : Linear Integrated Circuit Lab	
Course Code : 231ETPCCP301	**Semester : V**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : INT Marks : 25	**POE Marks: 25**

Course Description:

This lab course includes experiments based on knowledge of operational amplifiers. This course will help students to get practical exposure on actual working of Opamp for various applications and Monolithic IC applications which uses internally op amp.

Course Objectives:

1	Understand the working of operational amplifier and its parameters
2	Use of Op-amps for different applications.
3	Design and implement various Active filters.
4	Design & Analyze different waveform generator.

Course Outcomes (COs):

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

231ETPCCP301.1	Analyse Parameters of operational amplifier.
231ETPCCP301.2	Apply &Classify different configuration of op-amp
231ETPCCP301.3	Apply knowledge of op amp & monolithic IC's for different applications.
231ETPCCP301.4	Design and implement various filters, different waveform generator.

Prerequisite:	Basic knowledge of electronics components& Instruments

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
231ETPCCP301.1	3	2	-	-	1	-	-		1	-	1	1	1	-	III
231ETPCCP301.2	2	1	-	-	1	-	-		1	-	1	1	1	-	II
231ETPCCP301.3	2	1	-	-	1	-	-		1	-	1	1	1	-	III
231ETPCCP301.4	2	1	-	-	1	-	-		1	-	1	1	1	-	IV

	List of Experiments		
S.No	Name of Experiment	Type	Hours
1.	Perform experiment to analyse Op-Amp parameters	S	2
2.	Inverting amplifier / Non-Inverting for DC & AC inputs	O	2
3.	Frequency Response of Inverting & Non-Inverting amplifier	O	2
4.	Observe Op-Amp in terms of Summing, Scaling, & Averaging amplifier	O	2
5.	Observe performance of Comparator , Schmitt Trigger	O	2
6.	Integrator & Differentiator	O	2
7.	Binary Weighted Resistor / R-2R ladder Digital-to-Analog Converter.	O	2
8.	Design active Filters	O	2
9.	Design & Implement Triangular & square wave generator using OP amp	O	2
10.	Design & Implement Astable amplifier using 555 Timer	O	2
11.	Design & Implement Wien Bridge Oscillator	O	2
12.	Mini project	O	2
13.	Mini project	O	2
14.	Mini project	O	2

S: indicates Study type and O: Operational type

*Minimum 10 experiments should be performed to cover the curriculum of course

* Few experiment should be performed using simulator.

* Note: One small project based on OPAMP applications in group of 3-5 students.

Text Books:

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education
2. David Bell, "Operational Amplifiers and Linear IC's", Oxford University Press

Reference Books:

1. Robert Coughlin, Fredric Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PE, 2006.
2. B. Somanathan Nair, "Linear Integrated Circuits- Analysis, Design & Applications", Wiley India. India.
3. S. Salivahanan & Bhaskaran, "Linear Integrated Circuits", TMH

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Microprocessor and Microcontroller Lab	
Course Code: 231ETPCCP302	**Semester: V**
Teaching Scheme: L-T-P: 0-0-2	**Credit: 1**
Evaluation Scheme: ISE Marks: 25	**ESE Marks: 25**

Course Description: This lab course offers practical experience in programming and interfacing microprocessors (8085) and microcontrollers (8051, PIC). Students will write assembly and embedded C programs, interface devices like LEDs, LCDs, sensors, and motors, and build simple real-time applications, enhancing their skills in embedded system design and debugging.

Course Objectives:

1.	Demonstrate the programming skills using 8085 microprocessor and 8051 microcontroller.
2.	Interface peripheral devices to microcontroller-based systems
3.	Develop embedded C programs using simulation or real-time development kits.
4.	Debug and test microprocessor/microcontroller-based applications.
5.	Understand serial communication and interrupt handling in microcontrollers
6.	Build real-time interfacing projects using sensors and actuators.

Course Outcomes (COs):

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

231ETPCCP302.1	Develop and simulate assembly language programs for 8085 and 8051
231ETPCCP302.2	Interface 8051 microcontroller with LEDs, switches, LCDs, and other peripherals
231ETPCCP302.3	Write embedded C programs for microcontroller applications
231ETPCCP302.4	Analyze real-time interfacing issues with microcontroller-based systems
231ETPCCP302.5	Debug and test interfacing programs for serial communication and interrupts
231ETPCCP302.6	Construct basic embedded projects using microcontroller and sensors

Prerequisite:	Digital Electronics and C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BTL**
231ETPCCP302.1	3	2	2	-	-	-	-	-	-	1	-	-	2	2	III
231ETPCCP302.2	3	2	3	-	2	-	-	-	-	1	-	-	3	3	III
231ETPCCP302.3	2	2	3	-	2	-	-	-	-	1	-	-	2	3	III
231ETPCCP302.4	3	3	2	2	2	-	-	-	-	2	-	-	2	3	IV
231ETPCCP302.5	2	2	2	3	3	-	-	-	-	2	-	-	2	3	IV
231ETPCCP302.6	3	3	3	2	3	-	-	-	2	3	2	2	3	3	V

	List of Experiments		
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	Arithmetic operations using 8085: Addition, Subtraction, Multiplication, Division using Assembly language.	O	2
2	Data transfer and sorting: Write an 8085 program for block data transfer and sorting a set of numbers.	O	2
3	LED Blinking using 8051 (Assembly and C): Toggle LEDs connected to port pins using delay logic.	O	2
4	Interfacing Switches and Relays with 8051: Read input from switches and control output to relays.	O	2
5	LCD Display Interfacing: Display a message and dynamic values using 16x2 LCD.	O	2
6	Timer Programming: Generate time delays using Timer0 and Timer1 in 8051.	O	2
7	Interrupt Handling: Implement external and timer interrupts using 8051.	O	2
8	Serial Communication (UART): Transmit and receive characters between 8051 and a PC using serial communication.	O	2
9	LED Blinking and Delay using PIC: Write a C program to blink LEDs with variable delays.	O	2
10	ADC Interfacing: Interface an analog temperature sensor (like LM35) and display digital output on LCD.	O	2
11	DC Motor/Stepper Motor Control: Control motor speed/direction using PIC output ports.	O	2
12	Serial Communication: Implement UART communication between two PIC microcontrollers or with PC.	O	2
13	Mini Project:	O	6

	Develop a basic real-time embedded application using either 8051 or PIC (e.g., temperature-based fan controller, automatic street light system, security lock system, etc.).		

S: indicates Study type and O: Operational type

* Minimum ten (10) experiments and one Mini project should be completed to teach the entire curriculum of course.
* Note: One small project in group of 3-5 students.

Text Books:

4. Microprocessor Architecture, Programming and Applications with the 8085, 6th Edition, Ramesh Gaonkar, Penram International Publication, 2002
5. 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Muhammad Ali Mazidi, Pearson Prentice Hall, 2012
6. PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18" by Mazidi & Causey, and

Reference Books:

4. Microprocessor & Interfacing, 2nd Edition, Douglas Hall, TMH, 2006
5. The 8051 Microcontroller, 3rd Edition, Kenneth J. Ayala, Cengage Learning Publication, 2007
6. "Design with PIC Microcontrollers" by John B. Peatman.

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Cellular and Mobile Communications -Lab	
Course Code: 231ETPCCP303	**Semester : V**
Teaching Scheme : L-T-P : 0-0-2	**Credit: 1**
Evaluation Scheme : INT: 25	**ESE Marks :**

Course Description:

Cellular communication is a form of communication technology that enables the use of mobile phones. Cellular communication is based on the geographic division of the communication coverage area into cells, and within cells. This course is useful for better understanding of cellular communication this course is useful.

Course Objectives:

1.	To understand the evolution of Mobile communication and cell concept to improve capacity of the system
2.	To study the concepts of wireless transmission and to study different types of Equalizers and Diversity techniques.
3.	To study and understand the concept of multiple access techniques
4.	To understand the types of channel coding techniques, data transmission modes and services of GSM& CDMA.

Course Outcomes (COs):

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

231ETPCCP303.1	Demonstrate cellular concepts like frequency reuse, fading, equalization, mobile radio propagation, GSM, CDMA.
231ETPCCP303.2	Apply various concepts of Wireless transmission
231ETPCCP303.3	Apply the concept of multiple access techniques
231ETPCCP303.4	Apply the concept of GSM & CDMA in real time applications.

Prerequisite:	Basic knowledge of analog and digital communication

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PS O2**	**BTL**
231ETPCCP303.1	3	2	1	1	2			2	1			2	2	3	II
231ETPCCP303.2	3	2	1	2	1			1	1				2	2	III
231ETPCCP303.3	3	1	2	1	2			2	1			1	2	1	III
231ETPCCP303.4	2	2	2	2	2			2	1				2	2	III

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Develop a mobile application for wireless technology using any wizards	O	2
2	Transfer an image, audio and video file using Bluetooth protocol with varying distance between two devices and analyse the performance	O	2
3	Configure Wi-Fi setting in mobile devices using mobile tethering	O	2
4	Simulate the Binary Phase shift keying using MATLAB and Simulink.	O	2
5	Simulate the Direct Sequence Spread Spectrum using MATLAB and Simulink	O	2
6	Study of Multiple Access Techniques	O	2
7	Study & Observe Transmitted & Received IQ Signals	O	2
8	Study & Measurement Voltage & Power Management Unit	O	2
9	Study of switch faults in battery management Systems	O	2
10	Study & Observe LCD display Section	O	2
11	Study & Observe Key pad Section	O	2
12	Study & Observe sound section	O	2

S: indicates Study type and O: Operational type

Text Books:

1. Mobile Communications, 2nd Edition, *Jochen H. Schiller*, Pearson Education, 2007.
2. Wireless Communications Principles and Practice, 2nd Edition, *Theodore S. Rappaport*, Pearson Education, 2003.

Reference Books:

1. Wireless Communications, 2nd Edition, *Andreas F. Molisch*, John Wiley, 2006.
2. Mobile Cellular Communications, 2nd Edition, *W.C.Y. Lee*, McGraw Hill, 1995.

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Microcontrollers (RISC) (ODL ONLY) MDM -3	
Course Code: 231ETMDML301	**Semester : V**
Teaching Scheme : L-T-P : $2-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 **INT :25**	**ESE Marks : 50**

Course Description:

This multidisciplinary minor (MDM) course introduces the RISC family of microcontroller. It gives the detailed knowledge of PIC18Fxx2 (typically PIC18F452) series of Microcontrollers, its on-chip resources & assembly language Programming.

Course Objectives:

1.	To understand the architecture & features of PIC18F452 microcontroller.
2.	To demonstrate the skills of PIC18F452 assembly programming.
3.	To demonstrate the use of addressing modes of PIC18F452for memory access.
4.	To understand the on chip resources of PIC18F452 such as interrupt & I/O ports.
5.	To identify the capabilities of on chip resources of PIC18F452 such as timers, CCP & PWM.
6.	To understand the MSSP & USART module of PIC18F452.

Course Outcomes (COs):

At the end of the course, the student should be able to:

231ETMDML301.1	To understand the architecture & features of PIC18F452 microcontroller.
231ETMDML301.2	To demonstrate the skills of PIC18F452 assembly programming.
231ETMDML301.3	To apply the various addressing modes of PIC18F452 for memory access.
231ETMDML301.4	To understand on chip resources of PIC18F452 such as interrupt & I/O ports.
231ETMDML301.5	To identify the capabilities of timers, CCP & PWM modules of PIC18F452.

231ETMDML301.6	To understand the MSSP & USART module of PIC18F452.

Prerequisite:	Microprocessors & Microcontrollers

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETMDML301.1	2	1	2	1	-	-	-	-	-	-	-	-	-	-	II
231ETMDML301.2	1	2	2	1	-	-	-	-	-	-	-	-	-	-	III
231ETMDML301.3	1	2	2	2	-	-	-	-	-	-	-	-	-	-	III
231ETMDML301.4	1	2	2	2	-	-	-	-	-	-	-	-	-	1	II
231ETMDML301.5	2	2	2	1	-	-	-	-	-	-	-	-	-	1	II
231ETMDML301.6	1	2	2	1	-	-	-	-	-	-	-	-	1	2	II

Course Contents	Hrs
Unit 1: Introduction to PIC18Fxx2 family Introduction to RISC, basic features of PIC18F452 microcontroller, device overview, block diagram, pin diagram & description, oscillator configurations, PLL block diagram, OSCCON register, power-up delays, reset- simplified block diagram of on-chip reset circuit, external power-on reset circuit, power up timer, OST timer, RCON register bit format.	6
Unit-2: Instruction Set of PIC18F452 Byte oriented, bit oriented, literal, control operations, Introduction to programming in assembly language (ALU operations- addition, subtraction, multiplication, division etc.)	7
Unit 3: Memory Organization Program Memory Organization, Return Address Stack, STKPTR register, PCL,	8

PCLATH and PCLATU, Clocking Scheme/Instruction Cycle, Instruction Flow/Pipelining, Data Memory Organization, data memory map, SFR map, Bank Select Register (BSR), direct addressing, indirect addressing, STATUS register, FLASH program memory-able read/ write operations, Data EEPROM memory-SFRs, EECON1 register.	
Unit 4: On-chip System Resources 8 X 8 hardware multiplier, interrupts, interrupt logic diagram, INTCON Registers, I/O ports- PORT-A block diagram of RA3:RA0 AND RA5 pins, introduction to ports-B, C, D, E, PSP port.	6
Unit 5: On-chip Peripheral Resources Timer-0 block diagram, operation, SFRs (T0CON), Timer-1 block diagram, operation, T1CON, Timer-2 block diagram, operation, T2CON, Timer-3 block diagram, operation, T3CON, capture mode block diagram, operation, CCP1CON SFR, compare mode block diagram, operation, PWM mode block diagram, operation, PWM output, registers associated with PWM and timer2.	7
Unit 6: On-chip Communication Resources Overview, control registers, MSSP block diagram (SPI mode),SFRs, operation, SPI master/slave connection, MSSP block diagram(I2C mode), SFRs, operation, Addressable Universal Synchronous Asynchronous Receiver Transmitter (USART), TXSTA,RCSTA registers, USART Asynchronous Mode, USART transmit block diagram, asynchronous transmission timing diagram, compatible 10-bit ADC module-A/D block diagram, Operation.	8

INT:- Internal Assessment/ Evaluation will be based on Assignment/Programming problems.

Text Books:

1. MICROPROCESSORS from Assembly Language to C Using the PIC18Fxx2, Robert B. Reese, DA VINCI Engineering Press, Library of Congress Cataloguing-in-Publication Data, 2005

2. PIC 18FXX2 data sheet, www.microchip.com

Reference Books:

1. Embedded Design with the PIC18F452, John B. Peatman, Pearson, 1st Edition

2. Designing Embedded Systems with PIC Microcontrollers-Principles and applications, Tim Wilmshurst, Elsevier (Newnes), 2007.

3. Microcontroller Theory and Applications with the PIC18F (2nd ed.), M. Rafiquzzaman, Wiley, 2017

Web Resources:-

https://nptel.ac.in/translation

https://youtu.be/sUkgUQ9mpcg

https://youtu.be/WGcierfsSNo

https://tinyurl.com/ycw8dsfh

https://tinyurl.com/yc7t7adr

https://tinyurl.com/56zuap4v

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Biomedical Instrumentation (OEC-III)	
Course Code: 231ETOECL301	**Semester : V**
Teaching Scheme : L-T-P :2-0-0	**Credits: 2**
Evaluation Scheme : ISE + MSE Marks :	**ESE Marks : 50**

Course Description: The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of Advanced mobile communication. The course provides advanced knowledge in a number of transmission techniques and technologies in mobile communications. It covers the fundamentals communications in contemporary mobile communication standards.

Course Objectives:

1	To introduce basic concepts of bio signals and their characteristics.
2	To understand the instrumentation details of the simple measuring biomedical instruments
3	To describe the fundamentals of medical imaging systems
4	To explain the principle of operation of therapeutic and prosthetic devices

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETOECL301.1	To introduce basic concepts of bio signals and their characteristics.
231ETOECL301.2	To understand the instrumentation details of the simple measuring biomedical instruments
231ETOECL301.3	To describe the fundamentals of medical imaging systems
231ETOECL301.4	To explain the principle of operation of therapeutic and prosthetic devices

Prerequisite:	Physics, Theoretical Physics, Material Science

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETOECL301.1	1	2	2	2	1	2	2	1	2	1	-		1	1	II
231ETOECL301.2	1	1	1	2	2	2	2	2	2	1	-		1	2	II
231ETOECL301.3	1	2	2	2	2	2	2	2	2	1	-		1	1	III
231ETOECL301.4	1	2	2	2	2	2	2	2	2	1	-		1	1	II

Course Contents	Hrs
Unit 1:Biosignal: Physiological system - Bioelectric potentials - Electrodes - Transducers - System approach to biological systems - Physiological signal amplifiers Medical preamplifier design - Analysis of periodic and aperiodic signals – Analysis of random signals	7
Unit 2: Measurements and Monitoring Systems: ECG, EMG, EEG recording units - Measurement of Blood Pressure & Blood flow – Plethysmography - Measurement of Heart Sounds - Patient Monitoring Instrumentation - Respiratory system measurements - Measurement from Nervous System - Psychophysiological measurements – Testing motor responses – Experimental analysis of behavior – Biofeedback Instrumentation - Test on Blood Cells – Chemical tests and Automation	8

Unit 3: Medical Imaging System: Information content of an image - radiography - computed radiography - computed tomography - magnetic resonance imaging - nuclear medicine - single-photon emission computed tomography positron emission tomography - ultrasonography.	7
Unit 4: Therapeutic and Prosthetic Devices: cardiac pacemaker - defibrillators - hemodialysis - lithotripsy - ventilator incubators drug delivery device - artificial heart valve - heart-lung machine - application of laser.	6

Text Books:

1. L. Cromwell, F. J. Weibell and E. A. Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice-Hall of India, 1995.

2. R. S. Khanpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 1990.

Reference Books:

1. John G. Webster, "Medical Instrumentation – Application and Design", John Wiley & Sons, Inc, Third Edition, 1999

2. Richard Aston, "Principles of Biomedical Instrumentation and Measurements", Merrill Publishing Company, London, 1990.

3. Tatsuo Togawa, Toshiyo Tamura and P. Ake Oberg, " Biomedical Transducers and Instruments", CRC Press, 1997

4. J. J. Carr and J. M. Brown, "Introduction to Biomedical Equipment Technology", John Wiley & Sons, Inc., 1981.

5. D. Jennings, A. Flint, B. C. H. Turton, and L. D. M. Nokes, "Introduction to Medical Electronics Applications", Edward Arnold, Hodder Headline PLC, London, 1995.

6. Joseph D. Bronzino, The Biomedical Engineering Handbook, Second Edition, Boca Raton: CRC Press LLC, 2000

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Open Elective (Electronic Automation)(OEC-III)	
Course Code: 231ETOECL302	**Semester : V**
Teaching Scheme : L-T-P :2-0-0	**Credit: 2**
Evaluation Scheme :	**ESE Marks : 50**

Course Description: This course aims to acquaint students with vital components of automation such as motor control circuits, typical input/output devices , programmable logic controller(PLC),Distributed control circuit ,supervisory control and data acquisition and Human machine interface. This will facilitate students to develop understanding and skills related with operation and maintenance of basic building of electronic automation, which will turn enable them to effectively upkeep the automated systems in industry.

Course Objectives:

1	Analyze different types of sensors and basic fundamentals used in electronic automation
2	Analyze to develop a PLC program for an automatic control system
3	Analyze to develop a PLC program for an automatic control system and its applications
4	Understand the applications of DCS and SCADA

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETOECL302.1	Analyze different types of sensors and basic fundamentals used in electronic automation
231ETOECL302.2	Analyze to develop a PLC program for an automatic control system
231ETOECL302.3	Analyze to develop a PLC program for an automatic control system and its applications
231ETOECL302.4	Understand the applications of DCS and SCADA

Prerequisite:	Basics of Electronics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETOECL302.1	2	2	-	-	-	-	-	-	-	-	-	1	2	2	II
231ETOECL302.2	3	3	2	-	3	-	-	-	-	-	-	1	3	3	II
231ETOECL302.3	2	3	2	2	3	-	-	-	-	-	-	1	2	2	III
231ETOECL302.4	2	3	3	3	3	-	3	-	-	-	-	1	2	3	II

Course Content	Hrs
Unit 1 : : Sensors used in electronic automation: motion sensors, velocity and acceleration sensor, force and pressure sensors, position, displacement and level sensors, temperature and Acoustic sensor	7
Unit No.2: Automation Fundamentals of industrial automation, need and role of automation, evolution of automation. PLC introduction :types of processes, comparison, evolution of PLC, definition, functions, advantages, Architecture, DI-DO-AI-AO examples and ratings, I/O module, working of PLC, scan time	8
Unit 3: PLC Programming: PLC programming: Development of Relay Logic Ladder Diagram, Introduction to PLC Programming, Programming devices .	6
Unit 4 : SCADA System : Concept of SCADA systems, Programming techniques for : Creation of pages, Sequencing of pages, Creating graphics & animation, Dynamos programming with variables, Trending, Historical data storage & Reporting	7

Text Books:

1.John Webb, “Programmable Logic Controllers”, Prentice Hall of India.

2 Gary Dunning, “Introduction to Programmable Logic Controllers”, Delmar Thomson Learning.

3 Popovik -Bhatkar, “Distributed Computer Control for Industrial Automation”, Dekkar Publications.

4.Automation and advanced manufacturing systemsn,Dr..K.C.JAIN and Sanjay jain

5.Robotics and Industrial automation by R.K.Rajput

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w.e.f. 2025-2026

Course Title: Fiber Optic Communication (PEC-I)	
Course Code: 231ETPECL301	**Semester : V**
Teaching Scheme : L-T-P : 4-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20+30	**ESE Marks : 50 INT: 25**

Course Description:

The aim of introducing this course is to provide the knowledge of optical communication through optical fibers and to carry out fast, large bandwidth and low interference communication in real world communication, This course plays vital role & also emphasizes on SONET/SDH, EDFA amplifiers and optical CDMA.

Course Objectives:

1.	Describe the basics of optical communication along with optical fiber structure and light propagating mechanism in detail.
2.	Analyze the signal degradation mechanisms in optical fiber
3.	Develop Knowledge of optical signal sources.
4.	Explain the construction and working of optical sources and detectors
5.	To under the design of optical systems and WDM.

Course Outcomes (COs):

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

231ETPECL301.1	Understand and analyze the constructional parameters of optical fibers.
231ETPECL301.2	Classify and describe working of optical fiber with different modes of signal propagation.
231ETPECL301.3	Estimate the losses due to attenuation, absorption, scattering and bending.
231ETPECL301.4	Understand the construction and working of optical sources.
231ETPECL301.5	Compare various optical detectors and choose suitable one for different applications
231ETPECL301.6	Apply knowledge of WDM in advancement of optical Fibre system applications

Prerequisite:	Basic knowledge of Fundamentals of Electromagnetic Theory, Principles of Communication System

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BTL**
231ETPECL301.1	2	3	2	2	2								2	-	III
231ETPECL301.2	2	2	2	2	2								1	-	I
231ETPECL301.3	2	2	2	2	2								1	-	II
231ETPECL301.4	2	2	2	2	2								1	-	III
231ETPECL301.5	2	2	2	2	2								1	-	III
231ETPECL301.6	2	2	2	2	2								1	-	III

Course Contents	**Hrs**
Unit 1: Overview of Optical Fiber Communication Motivation for light wave communication, Optical spectral bands, Network Information Rates, Evolution of Optic System, Key Elements of Optical Fiber communication Link. The Nature of Light, Basic Optical Laws and Definitions.	9
Unit 2: Optical Fibers: Structures and Wave guiding Optical fiber modes: Single Mode Fibers, multimode fibers and Graded Index fiber structures., Fiber Materials, Fiber fabrication , Fiber Optic cables.	9
Unit 3: Transmission Characteristics of Optical Fibers: Attenuation, Material absorption losses, Scattering losses, Bending losses, Signal	9

dispersion in Fibers: overview of dispersion origins, Polarization, Nonlinear Effects: over view of non linearities, effective length and area.	
Unit 4: Optical Sources: Semiconductor physics of optical sources, Types of optical sources: Light Emitting Diodes (LEDs), LASER diodes, Light source linearity. Reliability considerations.	9
Unit 5: Optical Detectors: Physical Principle of Photodiode, Photo detector Noise, Detector Response Time, Structure for InGaAs APDs, Temperature effect of Avalanche Gain, Comparison of Photo detectors, Fundamental Receiver Operation	9
Unit 6: Advances in Optical Fiber System: Over view of WDM, Passive Optical Couplers, Isolators and circulators Tunable Light Sources, Optical Switching, SONET/SDH, Performance of EDFA Amplifiers, Optical CDMA	9

Text Books:

1. Optical Fiber Communication, 5th Edition, *Gerd Keiser*, Tata McGraw Hill Publication, 2017.
2. Optical Fiber Communications, 3rd Edition, *John M. Senior*, Pearson Education, 2007.

Reference Books:

1. Optical Fiber Communication, 3rd Edition, *Govind P. Agarwal*, Wiley, 2008.
2. Optical Networks, *Ramaswami Rajiv*, Elsevier Science & Technology.
3. Fiber Optic Communications, *Singh R. K.*, Wiley India Pvt. Ltd.
4. Fiber Optics and Optoelectronics, *R. P. Khare*, Oxford University Press.

Useful Link /Web Resources:

https://archive.nptel.ac.in/courses/108/106/108106167/

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Fundamentals of Semiconductor Devices (PEC-I)	
Course Code: 231ETPECL302	**Semester : V**
Teaching Scheme : L-T-P : 4-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 **INT: 25**	**ESE Marks : 50**

Course Description:

This course introduces students to the fundamental concepts of semiconductor physics and power semiconductor devices. It covers the principles of operation, characteristics, applications, and advancements in semiconductor technology. The course also incorporates NPTEL content to enhance learning through digital resources.

Course Objectives:

1.	To understand the basic principles of semiconductor materials and charge transport.
2.	To analyze the working principles of fundamental semiconductor devices like diodes, BJTs, and MOSFETs.
3.	To study the construction, operation, and characteristics of power semiconductor devices.
4.	To explore the applications of semiconductor devices in power electronics and switching circuits.
5.	To introduce emerging trends in semiconductor technology and materials.
6.	To develop analytical and problem-solving skills in semiconductor device applications.

Course Outcomes (COs):

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

231ETPECL302.1	describe the fundamental properties of semiconductor materials using energy band concepts.
231ETPECL302.2	analyze the characteristics and working principles of diodes, BJTs, and MOSFETs using semiconductor theory.
231ETPECL302.3	evaluate the design and operation of power semiconductor devices like SCR,
231ETPECL302.4	apply the knowledge of semiconductor devices in power electronic circuits and

231ETPECL302.5	compare and assess the performance of different semiconductor devices in industrial applications.
231ETPECL302.6	justify advancements in semiconductor technology, including wide-bandgap

Prerequisite:	Engineering Physics and Chemistry, Basic Electronics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	BTL
231ETPECL302.1	3	2	2	2	-	-	-	-	-	-	-	2	2	II
231ETPECL302.2	3	3	3	3	-	-	-	-	-	-	-	2	2	III
231ETPECL302.3	2	2	3	3	2	-	-	-	-	-	-	2	2	V
231ETPECL302.4	2	2	2	2	2	-	-	-	-	-	-	2	2	III
231ETPECL302.5	2	2	3	3	2	1	-	-	-	-	-	2	2	IV
231ETPECL302.6	2	2	2	2	2	2	2	2	-	-	2	2	2	VI

Course Contents	Hrs
Unit 1: Introduction to Semiconductor Physics: Energy Bands in Solids: Conductors, Semiconductors, and Insulators, Concept of Valence and Conduction Bands. Types of Semiconductors: Intrinsic and Extrinsic, Effect of Doping, N-Type and P-Type Semiconductors. Carrier Transport Mechanisms: Drift Current, Diffusion Current, Mobility, and Recombination. PN Junction Theory: Formation of Depletion Region, Biasing Effects, and Current Flow Mechanisms. Variety of Diodes and Their Semiconductor Theory: Zener Diodes, Schottky Diodes, LED, and Photodiodes with Applications.	7
Unit 2: Fundamentals of BJT and MOSFET Semiconductor Theory: Semiconductor Materials and Their Properties. Carrier Transport in BJT and MOSFET: Minority and Majority Carrier Flow, Base Transport Factor. Energy Band Diagrams of BJT and MOSFET: Concept of Band Bending, Threshold Voltage. Semiconductor Theory Behind BJT Operation: Emitter, Base, and Collector Functions, Current Gain and Base Width Modulation. Semiconductor Theory of MOSFET: Channel Formation, Charge Control Model, Body Effect. Fabrication of BJT and MOSFET Devices: Planar Technology, Ion Implantation, and Oxidation Techniques.	7

Unit 3: Introduction to Power Semiconductor Devices: Introduction to Power Electronics and High-Power Semiconductor Devices. Silicon-Controlled Rectifier (SCR): Structure, Characteristics, Triggering Methods, and Protection Circuits. TRIAC and DIAC: Working Principles, Characteristics, and Industrial Applications. Power MOSFETs and IGBTs: Operation, Switching Characteristics, and Efficiency Considerations.	7
Unit 4: Advanced Semiconductor Devices: GaN and SiC Power Devices: Structure, Advantages, and Applications in High-Frequency Power Conversion. Thyristors and Gate Turn-Off Thyristors (GTOs): Working Principles and Industrial Applications. Semiconductor Manufacturing and Fabrication Techniques: Lithography, Doping, and Etching. Reliability and Failure Mechanisms of Semiconductor Devices: Thermal Runaway, Aging, and Defects.	7
Unit 5: Applications of Power Semiconductor Devices: Power Semiconductor Devices in Motor Drives and Control Systems. Applications in Renewable Energy Systems: Solar Inverters, Wind Power Converters. Power Electronics for Electric Vehicles: Battery Management, Motor Controllers, and Charging Systems. Industrial Applications and Efficiency Considerations.	7
Unit 6: Emerging Trends and Future of Semiconductor Devices: Future of Semiconductor Materials: Graphene, Carbon Nanotubes, and 2D Materials. Flexible and Wearable Electronics: Printable Semiconductors and Organic Transistors. Quantum Computing and Semiconductor Devices: Qubits, Quantum Dots. Advances in Semiconductor Packaging: 3D Integration and Chiplet Architectures. Impact of AI and Machine Learning on Semiconductor Industry. Next-Generation Semiconductor Technologies and Challenges.	7

Text Books:

1. S. M. Sze, "Semiconductor Devices: Physics and Technology," Wiley, 3rd Edition, 2012.
2. B. G. Streetman, S. Banerjee, "Solid State Electronic Devices," Pearson, 7th Edition, 2015.

Reference Books:

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications," Pearson, 4th Edition, 2013.
2. Robert F. Pierret, "Semiconductor Device Fundamentals," Pearson, 2nd Edition, 2006.
3. NPTEL Course on "Power Semiconductor Devices" by IIT Kharagpur.
4. Y. Tsividis, "Operation and Modeling of the MOS Transistor," Oxford University Press, 2nd Edition, 2011.
5. Baliga, "Fundamentals of Power Semiconductor Devices," Springer, 2010.
6. Online Resources: IEEE Xplore, ScienceDirect, and NPTEL Video Lectures.

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Information Theory and Coding (PEC-I)	
Course Code: 231ETPECL303	**Semester : V**
Teaching Scheme : L-T-P :4-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 INT:25	**ESE Marks : 50**

Course Description:

Information is the source of a communication system, whether it is analog or digital. Information theory is a mathematical approach to study the coding of information along with the quantification, storage and communication of information.

Course Objectives:

1	To understand information theory, estimate the information content of a random variable from its probability distribution.
2	To analyze communication channels, their capacities and develop construct efficient codes for data on imperfect communication channels.
3	To analyze the need & objective of error control coding with encoding & decoding procedure .

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETPECL303.1	Demonstrate basic concepts of information theory and entropy coding.
231ETPECL303.2	Analyze communication channel models & channel capacity.
231ETPECL303.3	Analyze the error detecting and correcting capability of different coding schemes.
231ETPECL303.4	Design encoder and decoder for various coding techniques as per the need and specifications.

Prerequisite:	Digital Communication, Probability & Mathematics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	BTL
231ETPECL303.1	3	2	2	2	2	2							2	2	II
231ETPECL303.2	3	3	3	3	2	2							3	3	IV
231ETPECL303.3	3	3	3	3	2	2							2	2	IV
231ETPECL303.4	2	2	3	2	2	2							2	2	VI

Course Content	**Hrs.**
Unit 1: Information Theory Introduction, Concept of information, Entropy, Mathematical expression, Entropy of Binary Source, Properties and Information Rate, Joint Entropy, Conditional entropy, relation between Joint & Conditional Entropy, Mutual Information: Average Mutual Information, Expression for Mutual information, Relation between Mutual Information & Entropy	6
Unit 2: Channel Capacity And Coding Channel Capacity, Redundancy and Efficiency of channel, Discrete memory less channel – Channel Matrix, Classification of channels: lossless Channel, Deterministic Channel, Noise free channel, Binary Symmetric Channel (BSC), Cascaded Channels and Binary Erasure Channel (BEC), Shannon's fundamental theorem, Entropy Coding: Shannon Fano Coding, Huffman's Coding, Coding Efficiency Calculations.	6
Unit 3: Linear Block Codes Introduction, Error Control Coding: Need, Objectives & Approaches of Error Control Coding, Classification, Error Detection and Error Correction Techniques, Linear Block Code: Structure, Matrix Description of Linear Block Code, Generator and Parity Check Matrices, Encoder and Syndrome decoder for (n, k) block Code.	6

Unit 4: Cyclic Codes Algebraic structure, Properties, Polynomial representation of Code-word, Generator Polynomial, Generation of Code Vector in Nonsystematic and Systematic form, Generator and Parity check matrices in Systematic form, Encoding of Cyclic Code, Syndrome decoding for Cyclic code, Hardware Representation of (n, k) cyclic code. Cyclic Redundancy Check Code	6
Unit 5: BCH & RS Code Binary Field Arithmetic, BCH Code: Properties, Primitive element and primitive polynomial, Primitive BCH Code, Generator Polynomial for BCH Code, Decoding of BCH Code, Reed-Solomon code: Introduction, Error correction capability of RS code, RS code in Non-systematic & Systematic form, Decoding of RS code.	6
Unit 6: Convolutional Code Introduction, Encoding of Convolutional Codes, Generation of Output code sequence : Time Domain Approach, Transform Domain Approach, Generator Matrix, Graphical Approach – Code Tree, State diagram and Trellis Diagram, Decoding of Codes : Maximum Likelihood Decoding -Viterbi Algorithm, Sequential Decoding .	6

Text Books:

1. "Information Theory & Coding" (2nd Edition) by Muralidhar Kulkarni and K. S. Shivprakasha, published by Wiley (India) Publication, 2014.
2. "Information Theory, Coding & Cryptography" (1st Edition) by Arijit Saha and Surajit Mandal, published by Pearson Education, 2013.

Reference Books:

1. "Communication Systems Analog & Digital" (2nd Edition) by R. P. Singh and S. D. Sapre, published by McGraw Hill, 2001.
2. "Information Theory Coding & Cryptography" (2nd Edition) by Ranjan Bose, published by McGraw Hill, 2008.
3. "Introduction to Error Control Codes" (2nd Edition) by Salvatore Gravano, published by Oxford University Press, 2001.

Useful Link /Web Resources:

NPTEL Course: https://nptel.ac.in/courses/117101053

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title : Liberal Learning-I (Garuda)	
Course Code : 231ETCCAL301	**Semester : V**
Teaching Scheme : L-T-P : 2#-0-0	**Credits : Audit Course**
Evaluation Scheme : 50	**ESE Marks : Grade**

 # - 2 contact hrs. per week

Course Description:

1. It imparts knowledge of drone parts and components and the principles of flying applied to the drone technology.
2. It takes the technician through the process of understanding the setting up of drone parameters through the use of a simulator.
3. It also imparts the knowledge related to performing testing and quality check on the drone prior to dispatch and commissioning of the Drone.

Aim:

1. Providing members with opportunities to learn about drone technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative drone projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of drone technology in various domains, encouraging them to work on real-world projects like agro drone, surviliience drone
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for drone projects.

Course Objectives:

1	Understanding the components, operational basics of a Drone
2	Understanding flying principles with a Drone flight Simulation
3	Performing Manufacture
4	To Assembly, Testing and Quality check of the Drone
5	To Testing and Quality check of the Drone
6	Commissioning of the Drone

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETCCAL301.1	Understanding the components, operational basics of a Drone
231ETCCAL301.2	Understanding flying principles with a Drone flight Simulation
231ETCCAL301.3	Performing Manufacture
231ETCCAL301.4	To Assembly, Testing and Quality check of the Drone
231ETCCAL301.5	To Testing and Quality check of the Drone
231ETCCAL301.6	Commissioning of the Drone

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETCCAL301.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL301.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL301.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL301.4	1	2	2	1	2									2	IV

Prerequisite: Basic knowledge of communication System & Circuit Designs

Contents	Hrs
• Operational basics of a Drone • Flying principles with a Drone flight Simulator • Performing Manufacture, Assembly, Testing and Quality check of the Drone • Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	30

Evaluation Guidelines

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate drone design , use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the bootcamps and workshops.
- Complete a basic drone designs project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic drone concepts ,operations & their components

2. Intermediate Level Certification:

- Successfully complete multiple drone design projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining drone technology applications.

3. Advanced Level Certification:

- Lead a team in a major drone technology project or competition.
- Find and work on industrial consultancy & social Projects
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized drone applications topic.

Publish a Research Article in Journal or Conference

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning-II (Robotics)	
Course Code: 231ETCCAL301	**Semester : V**
Teaching Scheme : L-T-P : 2#-0-0	**Credit: Audit Course**
Evaluation Scheme : 50	**ESE Marks : --: Grade**

 # - 2 contact hrs. per week

Course Description:

The Robotics Club envisions a dynamic and collaborative environment where students passionately explore and advance the field of robotics. As a student-led initiative within the Electronics and Telecommunication Engineering Department, our mission is to foster innovation, learning, and competition in robotics. By providing structured activities such as boot camps, awareness sessions, and competitions, we aim to cultivate a profound understanding and practical expertise in robotics technologies among our members. Our ultimate goal is to empower students to become leaders in robotics, contributing to technological advancements and solving real-world challenges.

Aim:

1. Cultivate Interest and Enthusiasm: Inspire a passion for robotics among students.
2. Provide Hands-on Experience: Offer practical training with robotics technologies.
3. Encourage Innovation: Foster creativity in design and manufacturing processes.
4. Bridge Theory and Practice: Connect theoretical knowledge with real-world applications.
5. Build a Community: Create a network of individuals passionate about robotics.

Course Objectives:

1.	Train students in both fundamental and advanced roboties techniques.
2.	Enable experienced members to guide beginners.
3.	Motivate students to undertake cutting-edge projects and research.
4.	Foster teamwork and collaborative problem solving through group projects anttivate Windows peer-to-peer learning sessions

5.	Create connections with industry professionals and academic experts to enhance learning.
6.	Acknowledge outstanding achievements in various robotics challenges.

Course Outcomes (COs):

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

231ETCCAL301.1	Apply foundational knowledge in robotics, programming, and electronics to design and build functional robotic systems.
231ETCCAL301.2	Analyze and solve complex problems through hands-on projects and challenges in robotics.
231ETCCAL301.3	Collaborate effectively with team members, enhancing their communication and teamwork skills through group projects and competitions.
231ETCCAL301.4	Innovative and unique robotic solutions, contributing to advancements in the field.

Prerequisite:	Basic knowledge of Electronics and telecommunication engineering and any programming language

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETCCAL301.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL301.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL301.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL301.4	1	2	2	1	2									2	IV

Course Contents	Hrs
• Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	30

Evaluation Guidelines:

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate lot development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels:

1.Beginner Level Certification:

- Attend at least 75% of the boot camps and workshops.
- Complete a basic robotics project (e.g., designing and assembling a simple robot).
- Demonstrate understanding of basic robotics concepts and equipment operation**.**

2. Intermediate Level Certification:

- Successfully complete multiple roboties projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining roboties equipment.

3. Advanced Level Certification:

- Lead a team in a major robotics project or competition.
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized robotics topic.
- Publish a research article in a journal or conference.
- Publish a Research Article in Journal Conference.

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning-III (IoT)	
Course Code: 231ETCCAL301	**Semester : V**
Teaching Scheme : L-T-P : 2-0-0	**Credit: Audit Course**
Evaluation Scheme :: 50	**ESE Marks : Grade**

Course Description:

The club has vision to provide a platform for learning, networking, staying updated on the latest advancements in IoT technology and explore, innovate, and collaborate on IoT-related projects

Aim:

1. Providing members with opportunities to learn about IoT technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative IoT projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of IoT in various domains, encouraging them to work on real-world projects.
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for IoT development.

Club Objectives:

1.	To better understand IoT technologies, applications, and their implications through workshops, seminars, and knowledge-sharing sessions.
2.	Provide opportunities for members to acquire and enhance technical skills relevant to IoT, including programming, hardware integration, and data analytics.
3.	Encourage members to collaborate on IoT projects, enhancing teamwork and hands-on experience in developing real-world applications.

4.	Promote a culture of innovation by supporting members in exploring new ideas, conducting research, and developing novel IoT solutions.
5.	Create a supportive community where members can share knowledge, seek advice, and collaborate on various IoT-related endeavors.

Course Outcomes (COs):

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

231ETCCAL301.1	Understand IoT Technologies and their applications.
231ETCCAL301.2	Implement the technical skills relevant to IoT
231ETCCAL301.3	Analyze and solve the real world problem with innovative thinking
231ETCCAL301.4	Create the systems by contributing and work as team member

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETCCAL 301.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL 301.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL 301.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL 301.4	1	2	2	1	2									2	IV

Prerequisite: Basic knowledge of analog and digital communication

Course Contents	Hrs
• Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	30

Evaluation Guidelines

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate IoT development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the bootcamps and workshops.
- Complete a basic IoT project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic IoT concepts and operations.

2. Intermediate Level Certification:

- Successfully complete multiple IoT projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining IoT applications.

3. Advanced Level Certification:

- Lead a team in a major IoT project or competition.
- Find and work on industrial consultancy
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized IoT topic.
- Publish a Research Article in Journal or Conference

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning-IV (PSoC)	
Course Code: 231ETCCAL301	**Semester : V**
Teaching Scheme : L-T-P : 2#-0-0	**Credit: Audit Course**
Evaluation Scheme	**ESE Marks : 50 (Grade)**

 # - 2 contact hrs per club

Course Description:

This course aims to provide the exposure to the concepts of memory addressing & considerations in System on chip (SoC) and the operating system for SoC. It also introduces system level interconnection and models. It introduces various programmable SoC families & their features.

Aim:-

1. Providing members with opportunities to learn about SoC technologies and its applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of SoC in various domains, encouraging them to work on real-world projects.
5. Enhancing members' skills in embedded C programming, hardware integration, and other relevant areas.

Course Objectives:

1.	To understand the memory examples & operating system for SoC.
2.	To understand system on chip (SoC) standard buses.
3.	To understand the programmable SoC architecture and use it’s features.

Course Outcomes (COs):

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

231ETCCAL301.1	To understand the memory examples & operating system for SoC.
231ETCCAL301.2	To understand system on chip (SoC) standard buses.
231ETCCAL301.3	To understand the programmable SoC architecture and use its capabilities.

Prerequisite:	Microprocessors & Microcontrollers, C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
231ETCCAL301.1	1	2	1	1	-	-	-	-	-	-	-	-	-	1	II
231ETCCAL301.2	2	2	1	1	-	-	-	-	-	-	-	-	-	-	II
231ETCCAL301.3	1	2	2	1	-	-	-	-	-	-	-	-	-	2	II

Course Contents	Hrs
• Operational basics of Programmable System on Chip (PSoC) • Operating systems for SoC design, • Interconnection models for different SoC examples • Interconnect, Block Diagram of SoC module, bus basic architecture • Programmable SoC (PSoC) • Introduction to PSoC3, PSoC4 and PSoC5, • Introduction to PSoC4 MCU CY8C42xx-BL • Seminars • Workshops • Short term courses (blended mode) • Certifications • Project competitions • Research and Development	**30**

Evaluation Guidelines

- Attendance: Regular attendance in teaching sessions, Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.

- Technical Proficiency: Ability to operate SoC,use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the boot camps and workshops.
- Complete a basic SoC project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic SoC concepts ,operations & their components

2. Intermediate Level Certification:

- Successfully complete application based projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining SoC technology applications.

3. Advanced Level Certification:

- Lead a team in a major SoC technology based project or competition.
- Find and work on industrial consultancy & social Projects.
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized PSoC applications topic.
- Publish a Research Article in peer-reviewed research Journal or Conference.

Text Books:

1. Computer System Design: System on Chip, Michael J. Flynn, Wayne Luk, A John Wiley & Sons, Inc., Publication, 2011

2. Multiprocessors systems-on-chips, Ahmed Jerrya Wayne Wolf, Morgan Kaufman Publishers

Reference Books:

1. The definitive guide to ARM Cortex-M3, Joseph Yiu, Elsevier, 2nd Edition

Online resources:-

www.cypress.com

www.infineon.com

www.chips.ibm.com/products/coreconnect

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Semiconductor Device Modelling and Simulation (Honors Paper- II (ODL))HC Optional	
Course Code: 231ETHONL301	**Semester : V**
Teaching Scheme : L-T-P : 3-0-2	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 **INT:25**	**ESE Marks : 50**

Course Description:

This course is a foundation level course on semiconductor devices. The course consist of three broad topics Semiconductors properties, Devices and governing equations along with their boundary conditions. Course objective is to develop a sound physical and intuitive understanding of semiconductor devices and achieve ability to make some key decisions while designing applications specific semiconductor devices.

Course Objectives:

1.	To understand the crystal structure, band theory, doping mechanisms, carrier transport phenomena, and statistical properties of semiconductors.
2.	To analyze the carrier transport, energy band diagrams, and operational principles of BJT and MOSFET, along with their fabrication techniques.
3.	To study the working principles, current-voltage characteristics, breakdown mechanisms, and applications of p-n junctions and metal-semiconductor contacts.
4.	To explore the different types of FETs, MOS capacitors, MOSFET characteristics, short-channel effects, and CMOS technology.
5.	To examine transport mechanisms, drift-diffusion models, recombination-generation processes, hydrodynamic modeling, and numerical simulation techniques.
6.	To investigate quantum transport phenomena, Schrödinger equation solutions, transfer matrix methods, quantum effects in nanoscale devices, and semiconductor device

	simulation tools.

Course Outcomes (COs):

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

231ETHONL301.1	explain the fundamental properties of semiconductor materials, crystal structures, band theory, doping mechanisms, carrier transport, and semiconductor statistics.
231ETHONL301.2	analyze the working principles of BJT and MOSFET, including carrier transport, energy band diagrams, operational characteristics, and fabrication techniques.
231ETHONL301.3	evaluate the behavior of p-n junctions and metal-semiconductor contacts by understanding equilibrium conditions, I-V characteristics, breakdown mechanisms, and practical applications.
231ETHONL301.4	demonstrate the operation of various field-effect transistors, MOS capacitors, MOSFET characteristics, short-channel effects, and CMOS technology.
231ETHONL301.5	apply semiconductor transport models, including drift-diffusion, recombination-generation processes, hydrodynamic modeling, and numerical simulation techniques.
231ETHONL301.6	interpret quantum transport phenomena, solve Schrödinger equations, apply transfer matrix methods, and utilize commercial semiconductor device simulation tools.

Prerequisite:	Engineering Physics and Chemistry, Basic Electronics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	BTL
231ETHONL301.1	2	2	1	1	-	-	-	-	-	-	-	2	2	II
231ETHONL301.2	2	2	2	1	1	-	-	-	-	-	-	2	2	III
231ETHONL301.3	1	2	2	2	1	-	-	-	-	-	-	2	2	V
231ETHONL301.4	1	1	2	1	2	-	-	-	-	-	-	1	2	III
231ETHONL301.5	1	2	2	2	2	1	-	-	-	-	-	2	2	IV
231ETHONL301.6	2	2	2	2	2	1	1	1	-	-	1	2	2	IV

Course Contents	Hrs
Unit 1: Fundamentals of Semiconductor Physics Semiconductor Materials and Crystal Structure: Crystal lattices, unit cells, Miller indices, and their significance in semiconductor properties. Band Theory and Doping: Band structure formation, intrinsic and extrinsic semiconductors, doping mechanisms, and carrier concentration. Carrier Transport Mechanisms: Carrier drift and diffusion, mobility, and recombination-generation processes. Effective Mass and Density of States: Concept of effective mass, calculation of density of states, and their impact on semiconductor behavior. Semiconductor Statistics: Fermi-Dirac distribution function, carrier distribution in equilibrium, and temperature dependence of carrier concentration.	7
Unit 1: Fundamentals of BJT and MOSFET Semiconductor Materials and Their Properties: Characteristics of silicon and compound semiconductors used in BJT and MOSFET fabrication. Carrier Transport in BJT and MOSFET: Mechanisms of majority and minority carrier transport, base transport factor, and current flow dynamics. Energy Band Diagrams of BJT and MOSFET: Band bending concepts, threshold voltage derivation, and its dependence on doping and gate control. Semiconductor Theory Behind BJT Operation: Role of emitter, base, and collector, current gain, base width modulation, and Early effect. Semiconductor Theory of MOSFET: Channel formation, charge control model, threshold voltage dependence, and body effect. Fabrication of BJT and MOSFET Devices: Planar technology, ion implantation techniques, oxidation processes, and lithography steps in device fabrication.	7

Unit 2: p-n Junctions and Metal-Semiconductor Contacts p-n Junction Theory: Equilibrium conditions, depletion region, built-in potential, and junction capacitance. Current-Voltage Characteristics: Derivation of diode I-V relationship, ideal diode equation, and impact of temperature. Breakdown Mechanisms and Non-Idealities: Zener and avalanche breakdown, recombination-generation currents, and series resistance effects. Metal-Semiconductor Contacts: Schottky and ohmic contacts, Fermi-level pinning, and thermionic emission theory. Applications of p-n Junctions: Photodiodes, LEDs, solar cells, and rectifier circuits.	7
Unit 4: Field Effect Transistors (FETs) and MOS Devices Types of Field Effect Transistors: JFET, MESFET, HEMT, and their structural and operational differences. MOS Capacitor and C-V Characteristics: Energy band diagram of MOS structures, threshold voltage, and interface charge effects. MOSFET Operation and I-V Characteristics: Gradual channel approximation, subthreshold behavior, and mobility degradation effects. Short Channel Effects in MOSFETs: Drain-induced barrier lowering (DIBL), velocity saturation, hot carrier effects, and impact ionization. CMOS Technology: Basic CMOS inverter operation, advantages of CMOS scaling, and its impact on power consumption.	7
Unit 5: Semiconductor Transport Models and Device Simulations Carrier Transport Mechanisms: Boltzmann Transport Equation (BTE), relaxation-time approximation, and impact of scattering. Drift-Diffusion Model (DD): Derivation of drift and diffusion currents, dielectric relaxation time, and numerical methods. Generation-Recombination Mechanisms: Shockley-Read-Hall (SRH) model, Auger recombination, and radiative recombination. Hydrodynamic Transport Model: Carrier energy balance, momentum balance equations, and Monte Carlo simulation techniques. Numerical Techniques for Device Simulation: Gummel's iteration method, Newton's method, finite difference and finite element methods.	7
Unit 6: Quantum Transport and Advanced Modeling Quantum Transport Phenomena: Tunneling, quantum confinement, and quantum mechanical corrections in semiconductor devices. Schrödinger Equation in Semiconductor Devices: Solutions for free particles, potential steps, and barriers. Transfer Matrix Approach: Application to quantum transport problems and band-to-band tunneling. Quantum Effects in Nanoscale Devices: Quantum wells, quantum dots, and impact of scaling on device characteristics. Simulation of Semiconductor Devices: Use of commercial device simulators for DD, hydrodynamic, and quantum transport models.	7

Textbooks:

1. S. M. Sze, "Semiconductor Devices: Physics and Technology," Wiley, 2rd Edition, 1011.
2. B. G. Streetman, S. Banerjee, "Solid State Electronic Devices," Pearson, 7th Edition, 1015.

References:

1. J. S. Yuan, "Semiconductor Device Physics and Simulation," Springer, 1st Edition, 1010.
2. Mark Lundstrom, "Fundamentals of Carrier Transport," Cambridge University Press, 1nd Edition, 1000.
3. C. Snowden, "Introduction to Semiconductor Device Modeling," World Scientific, 1st Edition, 1988.
4. Y. Tsividis, C. McAndrew, "MOSFET Modeling for Circuit Simulation," Oxford University Press, 2rd Edition, 1011.
5. Dragica Vasileska, Stephen M. Goodnick, Gerhard Klimeck, "Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation," Taylor & Francis, 1st Edition, 1010.
6. NPTEL Course on "Semiconductor Device Modeling and Simulation" by IIT

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Embedded Systems	
Course Code: 231ETPCCL304	**Semester : VI**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This is a core course, which gives the introduction of Embedded Systems. It gives the detailed knowledge about the design of embedded systems. It also gives the exposure of assembly language programming for ARM Processor and Embedded C programming for ARM LPC 2148 Microcontroller. It also introduces RTOS (real time operating system).

Course Objectives:

1.	To understand the characteristics of Embedded systems and its Architectures.
2.	To demonstrate the skills of ARM programming.
3.	To introduce devices and buses used for embedded networking.
4.	To study key features of Microcontroller LPC214X.
5.	To develop skills of programming on chip resources of LPC214X.
6.	To understand the concept of real time operating systems.

Course Outcomes (COs):

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

231ETPCCL304.1	Apply important attributes of Embedded system.
231ETPCCL304.2	Demonstrate the skills of assembly language programming using the ARM programmer's model.
231ETPCCL304.3	Analyse the small applications of UART, I^2C, SPI.
231ETPCCL304.4	Demonstrate the use of on chip resources of LPC 2148.
231ETPCCL304.5	Analyse the applications of ON- CHIP resources of LPC 2148 using embedded
231ETPCCL304.6	Understand the concepts of RTOS useful in the Embedded system design.

Prerequisite:	Microprocessors & Microcontrollers, C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPCCL304.1	2	1	1	1	-	-	-	-	-	-	-	-	-	2	III
231ETPCCL304.2	2	2	3	2	-	-	-	-	-	-	-	-	-	2	III
231ETPCCL304.3	1	1	2	2	-	-	-	-	-	-	-	-	-	2	IV
231ETPCCL304.4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	III
231ETPCCL304.5	1	1	2	2	-	-	-	-	-	-	-	-	-	2	IV
231ETPCCL304.6	1	1	1	1	-	-	-	-	-	-	-	-	-	-	II

Course Contents	Hrs
Unit 1: Introduction Introduction to Embedded Systems, Classification of Embedded System, processor selection in Embedded System, Components of Embedded systems, Hardware and Software Systems Development tools: Assembler, cross compiler, Simulator, ICE, IDE, Programmer, Logic Analyser	7
Unit 2: Introduction to ARM Processor ARM Core data flow model, registers, operating modes, pipeline, exceptions, interrupts & the vector table, ARM processor families ARM instruction set: conditional execution. Branch and Load/Store, software interrupt instruction, program status register instruction, Thumb instruction set introduction. Exception handling schemes	7
Unit 3: Embedded Networking Serial Bus communication protocols: RS232 standard, RS485, Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), CAN Bus	7
Unit 4: ARM7TDMI-S Microcontroller LPC 2148 Features, LPC 214X Device Information, Block Diagram, Memory Maps, Memory Acceleration Module-Block Diagram & Operation, System Control Block(SCB)-	7

Register Description, Fosc. Selection Algorithm, external interrupt logic, power control, Reset- Block Diagram& RSI register.	
Unit 5: LPC 2148 On Chip Resources Features, Block diagram and SFR planning: Pin connect block, GPIO, UART & Architecture, I2C, SPI, Timer, PWM, ADC & DAC, Real time clock, Watchdogtimer, Vectored interrupt controller, features of on chip USB	7
Unit 6: Introduction to RTOS Architecture of kernel, task and task scheduler, ISR, Semaphores, Mutex, Mailboxes and Pipes, Message Queues, Timers, Memory Management.	7

Text Book:

1. Embedded Systems Architecture, Programming and Design, Rajkamal, TMH, Third edition, 2017

2. ARM system developers guide, Sloss, Symes, Wright, Morgan Kaufman (Elsevier)

Publication, 2004

Reference Books:

1. ARM assembly language: fundamentals and Technique, William Hohl, Christopher Hinds, CRC Press, Taylor & Francis group, Second edition, 2015

2. ARM Architecture Reference Manual, ARM,

3. LPC214x User Manual, Philips/ NXP semiconductor, 2006

4. An Embedded Software Primer, David E. Simon, Pearson Education, Eight edition, 2009

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Fundamentals of Digital Signal Processing	
Course Code: 231ETPCCL305	**Semester : VI**
Teaching Scheme : L-T-P :3-0-0	**Credits: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description: This is prerequisite course for Image and Speech Processing. In this students will learn FFT algorithms. The Digital filter design and multi-rate digital signal processing will be studied as the application of digital signal processing

Course Objectives:

1	To impart the knowledge to classify FFT algorithms
2	To Implementation of it for linear filtering of signal.
3	To expose the students about the Digital filter design
4	To impart the skill for realization of digital filters.
5	To understand about Multi-rate signal processing
6	To understand about applications Multi-rate signal processing

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETPCCL305.1	To impart the knowledge to classify FFT algorithms
231ETPCCL305.2	To Implementation of it for linear filtering of signal.
231ETPCCL305.3	To expose the students about the Digital filter design
231ETPCCL305.4	To impart the skill for realization of digital filters.
231ETPCCL305.5	To understand about Multi-rate signal processing
231ETPCCL305.6	To understand about applications Multi-rate signal processing

Prerequisite	Signals and Systems

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPCCL305.1	2	2	-	-	-	-	-	-	-	-	-	1	2	2	IV
231ETPCCL305.2	3	3	2	-	3	-	-	-	-	-	-	1	3	3	IV
231ETPCCL305.3	2	3	2	2	3	-	-	-	-	-	-	1	2	2	III
231ETPCCL305.4	2	3	3	3	3	-	3	-	-	-	-	1	2	3	II
231ETPCCL305.5	3	3	2	2	2	2	-	3	-	-	-	1	3	1	III
231ETPCCL305.6	3	2	2	2	2	-	-	-	1	1		1	2	3	III

Course Content	Hrs
Unit 1. Efficient computation of the DFT Fast Fourier Transform Algorithms Radix -2 DIT and DIF for DFT and IDFT computations, Circular convolution, Fast Convolution : Overlap-Add and Overlap-save algorithm.(Numerical)	7
Unit 2. Design of FIR Filter Symmetric and anti symmetric FIR filters, Design of FIR filter by Fourier series method, windowing method , frequency sampling method	7
Unit 3. Design of IIR Filter Analog filters approximations, mapping of S-plane to Z-plane, Design of IIR filter using Impulse Invariance Method, Bilinear Transformation method, Frequency Transformation, Filter design methods: Butterworth filters, Chebyshev filters and its conversion to digital filter	7
Unit 4. Realization of Digital filters FIR and IIR filter realization in cascade form and parallel form, Effect of finite word length on realization.	7
Unit 5. Multi-rate digital signal processing Need of Multi-rate digital signal processing , decimation by factor D, two stage decimator, interpolation by factor I , two stage Interpolator , sampling rate conversion by rational factor I/D	7
Unit 6. Applications of Multi-rate signal processing Digital phase filter, Interfacing of digital systems with different sampling rate, Implementations of narrowband low pass filters, Implementation of digital filter bank , Subband coding of speech signals	7

Text Books:

1. John G.Proakis and Dimitris G.Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall India,3rd Edition
2. Salivahanam, A Vallavaraj, C. Guanapriya, “Digital Signal Processing”, Tata McGraw Hill Publication

Reference Books:

1. Anand Kumar, “ Digital Signal Processing”, PHI Publications
2. P. Ramesh Babu, “Digital Signal Processing” , SciTech Publication

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Electromagnetic Engineering	
Course Code: 231ETPCCL306	**Semester : VI**
Teaching Scheme : L-T-P : 2-0-0	**Credit: 2**
Evaluation Scheme : ISE + MSE Marks :	**ESE Marks : 50**

Course Description:

This course aims to provide the basic knowledge of electronic device operation and the characteristics for various devices along with the basic designing parameters for different applications..

Course Objectives:

1.	To explain basic of vector calculus & co-ordinate systems.
2.	To define & derive different laws in steady electric & magnetic fields.
3.	To define & derive different laws in steady magnetic fields.
4.	To apply Maxwell's equations in different forms to develop wave equations.

Course Outcomes (COs):

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

231ETPCCL306.1	Apply the fundamentals of mathematical skills related with differential,
231ETPCCL306.2	Apply and analyze the concepts of steady electric & magnetic fields,propagation.
231ETPCCL306.3	Apply and analyze the concepts of steady magnetic fields.
231ETPCCL306.4	Analyse field equations from understanding of Maxwell's Equations.

Prerequisite:	Physics,Fundamentals of Electrical & Electronics Engg.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPCCL306.1	2	3	2	1									2	2	III
231ETPCCL306.2	2	2	2	1									2	2	I
231ETPCCL306.3	2	2	2	1									2	2	II
231ETPCCL306.4	2	2	2	1									2	2	III

Course Contents	Hrs
Unit 1 –Vector Algebra Review of vector Analysis and coordinate systems, Basic vector algebra, Dot product, Cross product, curl, divergence, Gradient.	7
Unit 2 – Electrostatics Coulomb's law & electric field (Numerical Expected) , field due to distributed charges (Numerical Expected), Flux density (Numerical Expected), Gauss's law, divergence theorem, Electrostatic potential, potential gradient, electric dipole	7
Unit 3 - Steady Magnetic Field Biot Savarts law (Numerical Expected), Ampere's circuital law (Numerical Expected), Stoke's Theorem, Magnetic flux density & Vector magnetic potential, Energy stored in magnetic field, Boundary conditions for magneto static field.	7
Unit 4 - Maxwell's Equations Inconsistency of Ampere's law, Faraday's law, Maxwell's equations for static field, time varying field & harmonically varying fields, Comparison of field & circuit theory.	7

Text Books:

1. Electromagnetics, 2nd Edition, *John D. Kraus*, Tata McGraw Hill, 2007.
2. Engineering Electromagnetics, 2nd Edition, *William Hayt*, McGraw Hill, 2003.

Reference Books:

1. Elements of Electromagnetics, 4th Edition, *Sadiku*, Oxford University Press, 2006.
2. Antenna and Wave Propagation, 2nd Edition, *G.S.N. Raju*, Pearson Education, 1995.

Useful Link /Web Resources:

https://archive.nptel.ac.in/courses/115/104/115104088/

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Embedded Systems Lab	
Course Code: 231ETPCCP304	**Semester: VI**
Teaching Scheme: L-T-P: 0-0-2	**Credit: 1**
Evaluation Scheme: INT Marks: 25	**OE/POE Marks: 25**

Lab Course Description: This lab-oriented course introduces the assembly language programming of ARM processor & Embedded C programming of ARM LPC 2148 Microcontroller useful for the design & development of Embedded System.

Course Objectives:

1.	To understand the characteristics of Embedded systems and its Architectures.
2.	To demonstrate the skills of ARM programming.
3.	To introduce devices and buses used for embedded networking.
4.	To study key features of Microcontroller LPC214X.
5.	To develop skills of programming on chip resources of LPC214X.

Course Outcomes (COs):

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

231ETPCCP304.1	Understand the important attributes of Embedded system.
231ETPCCP304.2	Demonstrate the skills of assembly language programming using the ARM programmer's model.
231ETPCCP304.3	Analyse the small applications of UART, I^2C and SPI.
231ETPCCP304.4	Demonstrate the use of on-chip resources of LPC 2148.
231ETPCCP304.5	Analyse the applications of on-chip resources of LPC 2148 using

Prerequisite:	Microprocessors & Microcontrollers, Embedded C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPCCP304.1	1	1	1	1	-	-	-	-	-	-	-	-	-	1	II
231ETPCCP304.2	2	2	2	2	2	-	-	-	-	-	-	-	-	-	III
231ETPCCP304.3	1	1	2	1	2	-	-	-	-	-	-	-	-	2	IV
231ETPCCP304.4	1	1	1	1	-	-	-	-	-	-	-	-	-	-	III
231ETPCCP304.5	1	1	1	1	1	-	-	-	-	-	-	-	-	1	IV

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hrs**
1	To demonstrate and simulate the assembly code for ALU operations for ARM Processor.	O	2
2	To demonstrate and simulate the assembly code for block move operations for ARM Processor.	O	2
3	To demonstrate and simulate the assembly code for block exchange operations for ARM Processor.	O	2
4	To demonstrate and simulate the assembly code to find largest of data words for ARM Processor.	O	2
5	To demonstrate and simulate the assembly code for Pre-index with write-back addressing mode.	O	2
6	To demonstrate and simulate the assembly code for ascending order sorting for ARM Processor.	O	2
7	To design, simulate and demonstrate the embedded C code for LED blinking using GPIO of ARM LPC 2148.	O	2
8	To design, simulate and demonstrate the embedded C code for key pad interface using GPIO of ARM LPC 2148.	O	2

9	To design, simulate and demonstrate the embedded C code for stepper motor interface using GPIO of ARM LPC 2148.	O	2
10	To design, simulate and demonstrate the embedded C code for relay interface using GPIO of ARM LPC 2148.	O	2
11	To design, simulate and demonstrate the embedded C code for Buzzer interface using GPIO of ARM LPC 2148.	O	2
12	To design, simulate and demonstrate the embedded C code for On chip I2C interface of ARM LPC 2148.	O	2
13	To design, simulate and demonstrate the embedded C code for On chip ADC interface of ARM LPC 2148.	O	2
14	To design, simulate and demonstrate the embedded C code for On chip DAC interface of ARM LPC 2148.	O	2
15	To design, simulate and demonstrate the embedded C code for On chip Timer interface of ARM LPC 2148.	O	2
16	Mini project based on above experiments.	O	2

S: indicates Study type and O: Operational type

* Minimum twelve (12) experiments should be performed to teach the entire curriculum of course.

Text Book:

1. Embedded Systems Architecture, Programming and Design, Rajkamal, TMH, Third edition, 2017

2. ARM system developers guide, Sloss, Symes, Wright, Morgan Kaufman (Elsevier)

Publication, 2004

Reference Books:

1. ARM assembly language: fundamentals and Technique, William Hohl, Christopher Hinds, CRC Press, Taylor & Francis group, Second edition, 2015

2. ARM Architecture Reference Manual, ARM,

3. LPC214x User Manual, Philips/ NXP semiconductor, 2006

4. An Embedded Software Primer, David E. Simon, Pearson Education, Eight edition, 2009

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Fundamentals of Digital Signal Processing	
Course Code: 231ETPCCP305	**Semester : VI**
Teaching Scheme : L-T-P :0-0-2	**Credits: 1**
Evaluation Scheme : ISE + MSE Marks : 25	**ESE Marks : 25**

Course Description: This is prerequisite course for Image and Speech Processing. In this students will learn FFT algorithms. The Digital filter design and multi-rate digital signal processing will be studied as the application of digital signal processing

Course Objectives:

1	To impart the knowledge to classify FFT algorithms
2	To Implementation of it for linear filtering of signal.
3	To expose the students about the Digital filter design
4	To impart the skill for realization of digital filters.
5	To understand about Multi-rate signal processing
6	To understand about applications Multi-rate signal processing

Course Outcomes (COs):

At the end of the course the student will be able to:

31ETPCCP305.1	To impart the knowledge to classify FFT algorithms
31ETPCCP305.2	To Implementation of it for linear filtering of signal.
31ETPCCP305.3	To expose the students about the Digital filter design
31ETPCCP3056.4	To impart the skill for realization of digital filters.
31ETPCCP3056.5	To understand about Multi-rate signal processing
31ETPCCP305.6	To understand about applications Multi-rate signal processing

Prerequisite	Signals and Systems

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
31ETPCCP305.1	2	2	2	2	2	-	-	-	-	-	-	1	2	2	IV
31ETPCCP305.2	3	3	2	3	3	-	-	-	-	-	-	1	3	3	IV
31ETPCCP305.3	2	3	2	2	3	-	-	-	-	-	-	1	2	2	III
31ETPCCP3056.4	2	3	3	3	3	-	-	-	-	-	-	1	2	3	II
31ETPCCP3056.5	3	3	2	2	2	-	-	-	-	-	-	1	3	1	III
31ETPCCP305.6	3	2	2	2	2	-	-	-	1	1		1	2	3	III

List of Experiments			
Expt.No.	**Name of Experiments**	**S/O**	**Hrs**
1	Generation of DT signals a) Study of Unit impulse sequence b) Study of Unit step sequence c) Study of Exponential sequence d) Study of Sinusoidal sequence	O	2
2	Convolution and correlation of signals	O	2
3	Computation of DFT & IDFT using standard formula	O	2
4	Computation of DFT using FFT algorithms	O	2
5	Computation of circular convolution	O	2
6	Design of FIR LPF, HPF, BPF, BRF filter using Kaiser window	O	2
7	Design of FIR LPF, HPF, BPF, BRF filter using Hamming window	O	2
8	Design of FIR filter using frequency sampling method	O	2
9	Design of IIR LPF, HPF, BPF, BRF filter using impulse invariance method	O	2
10	Design of IIR LPF, HPF, BPF, BRF filter using bilinear transformation method	O	2
11	Design of Multi-rate FIR filter	O	2
12	Study of FIR & IIR filter using TMS320C67XX processor	S	2

S: Study, O: Operational

Text Books:

3. John G.Proakis and Dimitris G.Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall India,3rd Edition
4. Salivahanam, A Vallavaraj, C. Guanapriya, “Digital Signal Processing”, Tata McGraw Hill Publication

Reference Books:

3. Anand Kumar, “ Digital Signal Processing”, PHI Publications
4. P. Ramesh Babu, “Digital Signal Processing” , SciTech Publication

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Control System (MDM-4)	
Course Code: 231ETMDML303	**Semester : VI**
Teaching Scheme : L-T-P : 2-0-0	**Credit: 2**
Evaluation Scheme : ISE Marks :	**ESE Marks : 50**

Course Description:-

Typically it covers the fundamental concepts of control systems, including the definition, classification (open loop vs closed loop), feedback mechanisms ,block diagram reduction technique, SFG,time & frequency response of various systems & the importance of analyzing system stability and performance in both time and frequency domains, often using examples from real-world applications to illustrate the principles involved.

Course Objectives:

1.	To study the fundamental concepts of Control systems.
2.	To study the concept of time response of the system.
3.	To study the concept of frequency response of the system.
4.	To study the basics of stability analysis of the system.

Course Outcomes (COs):

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

231ETMDML303.1	Analyze and identify open loop & closed loop control systems.
231ETMDML303.2	Analyze the LTI system in time domain
231ETMDML303.3	Analyze the LTI system in frequency domain
231ETMDML303.4	Test the stability of LTI system using conventional methods.

Prerequisite:	Students should know the differential mathematics, Laplace transform and basic electronic components

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETMDML303.1	2	2	2	2	2	-	-	-	-	-	-	-	-	2	IV
231ETMDML303.2	2	2	2	3	2	-	-	-	-	-	-	-	-	2	IV
231ETMDML303.3	2	3	2	3	2	-	-	-	-	-	-	-	-	2	IV
231ETMDML303.4	2	2	3	3	2	-	-	-	-	-	-	-	1	2	V

Course Contents	Hrs
Unit 1 :- Introduction to Feedback Control System Classification of Various Control Systems, Difference Between Closed Loop And Open Loop Control Systems, Block Diagram Representation and Signal Flow Graphs: Basic definitions, advantages and disadvantages of block diagram, Block diagram reduction rules, Examples based on block diagram reduction techniques Important definitions related to SFG, comparison of block diagram and SFG methods, Mason's gain Formula for SFG, Formation of SFG from equations and electrical networks.	7
Unit 2: Time Response Analysis: Time response of first order & second order system using standard test signal, steady state errors and error constants, Root locus techniques- Basic concept, rules of root locus, application of root locus techniques for control system.	7
Unit 3: Frequency Response Analysis: Introduction, correlation between time & frequency Response , Bode plots, gain margin, phase margin, effect of addition of poles & zeros on bode plots, Polar plots, stability using Bode plot.	7

	7

Unit 4:Stability Analysis:

Definition of Stability, Analysis of stable, unstable, critically stable and conditionally stable Relative Stability, Root locations in S-plane for stable and unstable system ,analysis by Hurwitz criterion and Routh array, determining range of K for stable operation. Illustrative examples.

Text Books:

1. Modern Control Engineering, 5th Edition, by Ogata Katsuhiko, published by PHI, 2009.
2. Modern Control System Theory, 6th Edition, by Dr. M. Gopal, published by New Age International Publishers, 2024.

Reference Books:

1. Feedback Control Systems, 9th Revised Edition (Technical), by Dr. S. D. Bhide and R. A. Barapate, published by Max Publications, 2018.
2. Control System Engineering, by Ramesh Babu and R. Ananda Natarajan, published by SCITECH Publications, 2018.
3. Control Systems Engineering, First Edition, by S. K. Bhattacharya, published by Pearson Education, 2011.

Useful Link /Web Resources:

Web Materials: http://www.wikipedia.org

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Antenna Wave Propagation (PEC-2)	
Course Code: 231ETPECL304	**Semester : VI**
Teaching Scheme : L-T-P : 4-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20+30 **INT: 25**	**ESE Marks : 50**

Course Description:

This Course will cover the fundamentals of Antenna, Dipole Antennas, Monopole Antennas, Loop Antennas, Slot Antennas, Linear and Planar Arrays, Microstrip Antennas (MSA), MSA Arrays, Helical Antennas, Horn Antennas, Yagi-Uda & Log-Periodic Antennas, Reflector Antennas.

Course Objectives:

1	To develop understanding of various types of antenna radiation mechanism.
2	To provide the basic knowledge to calculate array factor of array antennas
3	To provide the knowledge of basic understanding frequency of different types of antennas.
4	To introduce the students radiation of electromagnetic waves.
5	To introduce concept of ground wave propagation.
6	To understand the basics of RADAR system

Course Outcomes (COs):

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

231ETPECL304.1	Understand the basic types of antennas and their radiation patterns.
231ETPECL304.2	Design and analyze different antennas and antenna arrays
231ETPECL304.3	Interpret the relationships between antenna parameters.
231ETPECL304.4	Analyze the power radiated by different antennas and their radiation characteristics.
231ETPECL304.5	Understand the wave propagation mechanism at different frequencies.
231ETPECL304.6	Understand different applications of RADAR system applications

Prerequisite:	Analog and Digital Communication System

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPECL304.1	3	2	3		2					2	1	1	1	3	II
231ETPECL304.2	3	2	3		2					2	1	1	1	3	II
231ETPECL304.3	3	2	3		2					2	1	1	1	3	II
231ETPECL304.4	3	2	3		2				1	2	1	1	1	3	II
231ETPECL304.5	3	2	3		2				2	2	1	1	2	3	II
231ETPECL304.6	3	2	3		2				2	2	1	1	2	3	II

Course Contents	Hrs
Unit 1: Introduction To Antenna Basic antenna parameters, pattern, beam area, radiation inversity, beam efficiency, directivity , gain and resolution, antenna aperture, effective height the radio communication link, field from oscillating dipole, antenna field zone, shape-impendance consideration, linear elliptical polarization poynting vector for elliptically and circularly polarized waves, The polarization ellipse & the poincare sphere, loops, dipoles and slots, opened-out coaxial line antennas, opened-out-2conductor antennas, opened out waveguide antennas, flat-sheet reflector antennas, parabolic dish and dielectric lens antennas, end fire antennas, Broad bandwidth antennas, the patch antennas..	9
Unit 2: Antenna Arrays:: Array of two isotropic point sources, nonisotropic but similar point source and the principle of pattern multiplication, examples of pattern synthesis by pattern multiplication, nonisotropic and dissimilar point sources, linear array of n isotropic point source of equal amplitude and spacing, null directions for array of n isotropics point sources of equal amplitude and spacing effect.	9
Unit 3: Broadband & Frequency Independent Antenna : Broadband basics, infinite and finite biconical antennas, directional biconicals, conicals, disk cones and bow ties, the frequency-independent concept: rumesay's principle, the Illinois story, the frequency independent planner log-spiral antenna, frequency independent conical-spiral antenna, the log periodic antenna, the composite yagi-uda corner-log-periodic array.	9
Unit 4: Radiation: Potential functions and the electromagnetic field, potential functions for sinusoidal oscillations, the alternating current element, power radiated by current element, application to short antennas, assumed current distribution, radiation from a quarter wave monopole and the half wave dipole, sine integral and cosine integral, electromagnetic field close to an antenna, solution of the potential equations, far field approximation.	9
	9

Unit 5: Ground Wave Propagation: Plane earth reflection, space wave and the surface wave, the surface wave, elevated dipole antennas above a plane earth, wave tilt of the surface wave, spherical earth propagation, tropospheric wave.	
Unit 6: RADAR System: Fundamentals, RADAR performance factors, basic pulsed radar system, antennas and scanning, display methods, pulsed radar systems, moving target indication, radar beacons, CW Doppler radar, frequency modulated CW radar, phase array radars, plannar array radars.	9

Text Books:

1. Antenna for All Applications, 3rd Edition, by John D. Kraus, published by TMH Publication.
2. Electronics Communication System, 4th Edition, by Kennedy Davis, published by TMH Publication.
3. Electromagnetic Waves and Radiating Systems, by Jordan and Balmain, published by PHI Publication.

Reference Books:

1. Foundations of Antenna Theory and Techniques, by Vincent F. Fusco, published by Pearson.
2. Antennas and Wave Propagation, by G. S. N. Raju, published by Pearso

Useful Link /Web Resources:

https://www.nptelvideos.com/communications/?pn=6

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: CMOS VLSI Design (PEC –II)	
Course Code: 231ETPECL305	**Semester : VI**
Teaching Scheme : L-T-P : 4-0-0	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 INT: 25 Marks	**ESE Marks : 50**

Course Description:

The course focuses on basics of VLSI design. This creates an integrated circuit (IC) by combining millions of MOS (Metal Oxide Silicon transistor) transistors over a single chip.

Course Objectives:

1.	To understand VLSI design and challenges in VLSI technology
2.	To understand the fabrication steps involved in the MOS transistor.
3.	To analyse modes of operation of MOS transistor and its basic electrical properties.
4.	To measure the performance parameters like threshold voltage, noise margins, time Delays etc. of CMOS inverter.
5.	To design static CMOS combinational logic at the transistor level.
6.	To design static CMOS sequential logic at the transistor level.

Course Outcomes (COs):

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

231ETPECL305.1	Understand VLSI design and challenges in VLSI technology.
231ETPECL305.2	Understand the fabrication steps involved in the MOS transistor.
231ETPECL305.3	Analyse modes of operation of MOS transistor and its basic electrical
231ETPECL305.4	Measure the performance parameters like threshold voltage, noise margins, time delays etc. of CMOS inverter.
231ETPECL305.5	Demonstrate the ability to design static CMOS combinational logic at the
231ETPECL305.6	Demonstrate the ability to design static CMOS sequential logic at the

Prerequisite:	Basic Electronics, MOSFET properties and logic circuits.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPECL305.1	3	2	2	2	2	-	-	-	-	-	-	-	-	-	II
231ETPECL305.2	3	2	2	2	2	-	-	-	-	-	-	-	-	-	II
231ETPECL305.3	2	2	2	2	2	-	-	-	-	-	-	-	-	-	IV
231ETPECL305.4	3	2	3	2	2	-	-	-	-	-	-	-	1	-	III
231ETPECL305.5	3	3	3	2	3	-	-	-	-	-	-	-	1	1	III
231ETPECL305.6	3	3	3	2	3	-	-	-	-	-	-	-	1	1	III

Course Content	Hrs.
Unit 1: Introduction to VLSI design Introduction to VLSI Design; Moore's Law; Scale of Integration; Types of VLSI Chips; Design principles (Digital VLSI); Design Domains(Y-Chart), Challenges of VLSI design- power, timing area, noise, testability reliability, and yield; CAD tools for VLSI design.	7
Unit 2: Introduction to VLSI Technology VLSI Technology-An Overview-Wafer Processing, Oxidation, Epitaxial Deposition, Ion-implantation and Diffusion; The Silicon Gate Process- Basic CMOS Technology; basic n-well CMOS process, p-well CMOS process; Twin tub process.	7
Unit 3: Introduction To MOS Transistor Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models – Scaling Theory .	7

Unit 4: MOS Inverters Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations**,** Switching Characteristics of CMOS Inverter	7
Unit 5: Combinational MOS Logic Circuits CMOS Logic Circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates), Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic and CMOS Domino logic.	7
Unit 6: Sequential MOS Logic Circuits Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop. Subsystem design process- design of 4-bit shifter, arithmetic building blocks like adders, Multipliers and ALU.	7

Text Books:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Dougles, A. Pucknell, PHI. 2005
2. Modern VLSI Design – Wayne Wolf, 3 Ed., Pearson Education, 1997

Reference Books:

1. Basic VLSI Design, Pucknell, Prentice Hall of India Publication, 1995.
2. Modern VLSI Design System on chip, Wayne Wolf, Pearson Education, 2002.
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson, 2009.

The internal Evaluation of 25 Marks will be based on the performance of students in Tutorials/Assignments.

List of Tutorials/Assignments		
Sr. No.	**Name of Tutorial/Assignments**	**Unit No.**
1	Design Domain & challenges of VLSI Design	1
2	CAD tools for VLSI Design	1
3	VLSI technology	2
4	Basic CMOS technology	2
5	Introduction to MOS transistor	3
6	Short Channel effects & Scaling theory	3
7	MOS inverter characteristics	4
8	Design of MOS inverter	4
9.	Design of CMOS logic circuits	5
10	CMOS Logic Structure	5
11	Design of CMOS latches and flip-flops	6
12	Subsystem Design	6

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Wireless Sensor Network	
Course Code: 231ETPECL306	**Semester : VI**
Teaching Scheme : L-T-P :4-0-0	**Credits: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 INT :25	**ESE Marks : 50**

Course Description: This course introduces Wireless Sensor Networks (WSNs) and their fundamental concepts. It covers wireless communication basics, sensor network architectures, protocols, and energy-efficient design. Students will also learn about security challenges, attacks, and countermeasures in WSNs. Additionally, the course explores sensor network platforms like TinyOS, nesC, and ContikiOS for hands-on implementation.

Course Objectives:

1	To introduce wireless communication basics and channel characteristics.
2	To explore WSN architecture, hardware, and energy consumption
3	To study MAC protocols and low-duty cycle techniques.
4	To understand networking protocols for energy-efficient routing.
5	To examine security threats and solutions in WSNs.
6	To familiarize with sensor network platforms like TinyOS and nesC.

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETPECL306.1	Explain wireless communication basics.
231ETPECL306.2	Analyze WSN architecture, hardware components, and energy consumption
231ETPECL306.3	Compare MAC protocols and low-duty cycle techniques in WSNs

231ETPECL306.4	Evaluate networking protocols for energy-efficient routing in WSNs.
231ETPECL306.5	Identify security threats and possible solutions in wireless sensor networks
231ETPECL306.6	Demonstrate sensor network platforms like TinyOS, nesC, and ContikiOS.

Prerequisite:	Basic Computer network concept

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPECL306.1	3	2	-	-	-	-	-	-	-	-	-	3	3	2	II
231ETPECL306.2	3	3	2	-	3	-	-	-	-	-	-	3	3	3	IV
231ETPECL306.3	3	3	2	2	3	-	-	-	-	-	-	3	2	3	IV
231ETPECL306.4	3	3	3	3	3	-	3	-	-	-	-	3	3	3	V
231ETPECL306.5	3	3	-	3	3	3	-	3	-	-	-	3	3	1	III
231ETPECL306.6	3	-	3	3	3	-	-	-	3	3	3	3	2	3	III

Course Content	Hrs
Unit 1: Introduction Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - wireless sensor networks (WSNs)	8
Unit 2: Sensor Networks – Introduction & Architectures Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.	9
Unit 3: WSN Networking Concepts MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts .	7
Unit 4: WSN Networking Protocols The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.	8
Unit 5: Sensor Network Security Network Security Requirements, Issues and Challenges in Security Provisioning Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack.	8
Unit 6: Sensor Network Platforms And Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, MagnetOS, Mantis OS	8

Text Books:

1. Ad Hoc wireless Networks – Architecture and Protocols by C.S.R.Murthy & B.S. Manoj, Pearson Education

Reference Books:

1. Ad Hoc Wireless Networks – A communication Theoretic perspective by O.K.Tonguz & G.Ferrari, Wiley India
2. Ad Hoc Mobile Wireless Networks – Protocols and Systems by C. K. Toh (Pearson Education)
3. Ad Hoc Networking by Charles E. Perkins (Pearson Education)
4. Introduction to Wireless and Mobile Systems, 3rd Edition, by Dharma Prak

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Microwave Theory (PEC-3)	
Course Code: 231ETPECL307	**Semester : VI**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course provides an in-depth understanding of microwave engineering, covering waveguides, microwave components, microwave tubes, solid-state devices, microwave integrated circuits, and antenna systems. The course emphasizes both theoretical and practical aspects, including microwave measurements and applications. It equips students with the knowledge of modern microwave devices, circuits, and systems used in communication, radar, and industrial applications.

Course Objectives:

1.	To understand the principles of wave propagation in rectangular waveguides, including TE and TM modes, power transmission, and losses.
2.	To analyze the working principles of microwave tubes such as klystrons, traveling-wave tubes, and magnetrons.
3.	To examine monolithic microwave integrated circuits (MMICs), their fabrication processes, and electromagnetic compatibility issues.
4.	To explain the characteristics and working mechanisms of various microwave solid-state devices such as Gunn diodes, IMPATT diodes, and microwave FETs.
5.	To perform microwave measurements such as power, wavelength, VSWR, and attenuation using appropriate instruments.
6.	To evaluate the performance of different microwave antennas and apply related equations for gain, directivity, and beamwidth.

Course Outcomes (COs):

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

231ETPECL307.1	describe the propagation of electromagnetic waves in waveguides, power transmission, and losses in microwave systems.
231ETPECL307.2	analyze the working principles and performance of microwave tubes such as klystrons and magnetrons.
231ETPECL307.3	interpret the materials, fabrication techniques, and electromagnetic compatibility in MMICs.
231ETPECL307.4	compare various microwave solid-state devices and their applications.
231ETPECL307.5	measure microwave parameters such as power, VSWR, and attenuation using appropriate measurement techniques.
231ETPECL307.6	compute antenna parameters including gain, directivity, and beamwidth for various microwave antennas.

Prerequisite:	Electromagnetic engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	BTL
PECL307.1	3	2	2	2	-	-	-	-	-	-	-	2	2	II
231ETPECL307.1	3	3	3	3	-	-	-	-	-	-	-	2	2	III
231ETPECL307.2	2	2	3	3	-	-	-	-	-	-	-	2	2	IV
231ETPECL307.3	3	2	3	3	-	-	-	-	-	-	-	2	2	IV
231ETPECL307.4	2	3	3	3	-	-	-	-	-	-	-	2	2	V
231ETPECL307.5	3	2	3	-	-	-	-	-	-	-	-	2	2	IV

Course Contents	Hrs
Unit No.1: Wave Guides and Microwave Components Rectangular waveguides: TE and TM mode wave, power transmission in waveguide, power losses in waveguide, excitation of modes in waveguide. Microwave cavities, microwave hybrid circuits, directional coupler, circulators and isolators, microwave attenuators. (Numerical Expected).	7
Unit No.2: Microwave Tubes Microwave linear beam tubes: Klystrons, reentrant cavities, velocity-modulation process, bunching process in klystrons, reflex klystron, slow wave structures, principle of operation of helix traveling-wave tubes (TWTs). Microwave crossed-field tubes: magnetron oscillators, cylindrical magnetron, forward and backward wave crossed field amplifier (CFA).	7
Unit No.3: Monolithic Microwave Integrated Circuits and Hazards Materials: substrate, conductor dielectric and resistive MMIC growth, thin film formation, hybrid microwave I.C. fabrication, electromagnetic compatibility, plane wave propagation in shielded rooms, anechoic chambers, microwave clean rooms, microwave hazards.	7
Unit No.4: Microwave Solid State Devices Microwave bipolar transistor, microwave FETs, microwave tunnel diodes, Gunn effect diodes, RWH theory, LSA diodes, InP diodes, CdTe diodes, IMPATT diodes, PIN diodes, MESFETs and HEMT.	7
Unit No.5: Microwave Measurements and Microwave Applications Detection of microwave power: measurement of microwave power bridge circuit, thermistor parameters, waveguide thermistor mounts, barretters, theory of operation of barretters, direct reading barretters bridges, measurement of wavelengths: single line cavity coupling system, transmission cavity wavemeter and reaction wavemeter, measurement of VSWR, measurements of attenuation, free space attenuation.	7
Unit No.6: Microwave Antennas Antenna parameters: antenna gain, directivity and beam width, horn antenna, parabolic reflector with all types of feeding methods, slotted antenna, lens antenna, microstrip antennas, corner reflector. Equations for antenna gain, directivity and beam width of all above antenna types. (Numerical Expected).	7

Textbooks

1. David M. Pozar, Microwave Engineering, 4th Edition, Wiley, 2011.
2. Samuel Y. Liao, Microwave Devices and Circuits, 3rd Edition, Pearson, 2003.

Reference Books

1. R. E. Collin, Foundations for Microwave Engineering, 2nd Edition, McGraw-Hill, 2001.
2. Annapurna Das and Sisir K. Das, Microwave Engineering, McGraw-Hill, 2010.
3. R. Ludwig and P. Bretchko, RF Circuit Design: Theory and Applications, Pearson, 2000.
4. K.C. Gupta, Microwave Engineering, Tata McGraw-Hill, 2005.

T. Y. B. Tech. Curriculum

w.e.f.
2025-2026

Course Title: ASIC Design (PEC-3)	
Course Code: 231ETPECL308	**Semester : VI**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course covers ASIC fundamentals, design flow, physical design, logic synthesis, simulation, testing, and FPGA architectures, focusing on industry applications and high-performance ASIC/SoC design.

Course Objectives:

1	To understand ASIC types, design flow, and CMOS logic.
2	To implement ASIC physical design techniques.
3	To apply logic synthesis and HDL-based design.
4	To explore simulation, testing, and fault analysis.
5	To study programmable ASIC and FPGA architectures.
6	To develop high-performance ASIC/SoC solutions

Course Outcomes (COs):

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

231ETPECL308.1	Explain the fundamentals of ASIC types, design flow, and CMOS logic.
231ETPECL308.2	Apply physical design techniques like partitioning, floorplanning, placement, and routing.
231ETPECL308.3	Develop digital circuits using logic synthesis, HDL-based design, and schematic entry
231ETPECL308.4	Analyze simulation and testing methods, including fault models and test pattern generation
231ETPECL308.5	Compare various programmable ASIC and FPGA architectures

231ETPECL308.6	Design ASIC/SoC-based solutions for real-world applications.

Prerequisite:	Digital System Design, HDL

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BTL**
231ETPECL308.1	3	2	1		2					2		3	3	1	II
231ETPECL308.2	3	3	3	2	3					2	2	3	3	3	III
231ETPECL308.3	3	3	3	2	3				2	2	2	3	3	3	III
231ETPECL308.4	3	3	2	3	3				2	2	2	3	3	3	IV
231ETPECL308.5	3	3	3	2	3				2	2	2	3	3	3	IV
231ETPECL308.6	3	3	3	3	3				3	3	3	3	3	3	V

Course Contents	Hrs
Unit 1: Introduction to ASICs Types of ASICs including Full-Custom, Semi-Custom, and Programmable ASICs, ASIC Design Flow covering Specification, RTL Design, Synthesis, Floorplanning, Placement, Routing, Fabrication, and Testing ASIC Cell Libraries including Standard Cells, Custom Cells, and Macro Cells CMOS Logic Cells focusing on Combinational and Sequential Logic, Transistors as Resistors, and Parasitic Capacitance	7
Unit 2: ASIC Physical Design System Partitioning with Methods and Objectives, Interconnect Delay including Delay Models, Wire Resistance, and Capacitance Floorplanning and Placement considering, Design Constraints, Area Optimization, and Power Planning Routing covering Global and Detailed Routing, Clock Tree Synthesis, and Special Routing	7
Unit 3: Logic Synthesis and Design Representation Design Systems comparing FPGA-Based and ASIC-Based Designs, Logic Synthesis covering RTL to Gate-Level Conversion and Optimization Techniques Schematic Entry and Low-Level Design including HDL, Boolean Equations, and PLA Tools ,Standard Representations such as EDIF, CFI, and Netlists	7
Unit 4: Simulation and Testing Types of Simulation including Functional, Timing, and Post-Layout Simulation Fault Models covering Stuck-At Faults, Bridging Faults, and Transition Faults Testing Techniques such as Boundary Scan, Fault Simulation, and Automatic Test Pattern Generation,Built-In Self-Test focusing on Pattern Generation and Fault Detection	7

Unit 5: Programmable ASICs and FPGA Architectures FPGA Technologies including Anti-Fuse, SRAM-Based, EPROM, and EEPROM, FPGA Architectures covering Actel ACT, Xilinx LCA, Altera FLEX, and Altera MAX I/O and Power Management including Clocking, Signal Integrity, and Power Distribution	7
Unit 6: High-Performance ASIC and SoC Design FPGA to ASIC Conversion covering Process, Challenges, and Design Optimization SoC Design including IP-Based Design, Hardware and Software Co-Design, and On-Chip Communication Protocols,Case Studies on Digital Camera Processor, SDRAM Controller, and Automotive ASIC	7

Text Books:

1. J.S. Smith, “Application specific Integrated Circuits”, Pearson Education, 2008
2. Wayne Wolf, “FPGA-Based System Design”, Prentice Hall PTR, 2009.
3. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, Prentice Hall PTR, 2003.

Reference Books:

1. Advanced FPGA Design: Architecture, Implementation, and Optimization" by Steve Kilts (2007)
2. ASIC Design and Synthesis: RTL Design Using Verilog" by Vaibbhav Taraate (2022)

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Satellite Communication (PEC-3)	
Course Code: 231ETPECL309	**Semester : VI**
Teaching Scheme : L-T-P : 3-0-0	**Credit: 3**
Evaluation Scheme : ISE + MSE Marks : 20+30	**ESE Marks : 50**

Course Description:

The course introduces the students to the basic concept in the field of satellite communication. This will enable the students to know how to place a satellite in an orbit and about the earth & space segment. Satellite telecommunication systems with an emphasis on modern systems and their link budgets. Topics will include a historical perspective, orbital mechanics and constellations, choice of orbital parameters, propagation considerations, link budgets, interference issues and other obstacles.

Course Objectives:

1	To understand the basics of satellite orbits..
2	To understand the satellite segment and earth segment
3	To analyse the various methods of satellite access
4	To understand the applications of satellites.
5	To understand the basics of satellite Networks
6	To understand the basics of satellite orbits

Course Outcomes (COs):

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

231ETPECL309.1	Understand Orbital aspects involved in satellite communication.
231ETPECL309.2	Understand various subsystems in satellite communication systempropagation.

231ETPECL309.3	Explain and Analyse Link budget calculation.
231ETPECL309.4	Understand Satellite Network System
231ETPECL309.5	Explain Non Geostationary Satellite Systems applications
231ETPECL309.6	Explain different applications of Satellite Systems applications

Prerequisite:	Analog and Digital Communication System

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPECL309.1	3	2	3		2					2	1	1	1	3	II
231ETPECL309.2	3	2	3		2					2	1	1	1	3	II
231ETPECL309.3	3	2	3		2					2	1	1	1	3	II
231ETPECL309.4	3	2	3		2				1	2	1	1	1	3	II
231ETPECL309.5	3	2	3		2				2	2	1	1	2	3	II
231ETPECL309.6	3	2	3		2				2	2	1	1	2	3	II

Course Contents	Hrs
Unit 1: Introduction Of Satellite Introduction, Basic Concept Of Satellite Communication, Satellite Orbits, Kepler's Laws, Newton's Law, Orbital Parameters Orbital Mechanics, Look Angle Determination, Orbital Perturbation, Orbital Determination Launchers And Launch Vehicles, Orbital Effects in Communication System Performance.	9
Unit 2: Satellite Space Segment Subsystem: Introduction, Attitude And Control System (AOCS), Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystem, Satellite Antennas, Telemetry ,Equipment Reliability And Space Qualification, The Antenna Subsystem.	9
Unit 3: : **Satellite Link Design:** Introduction, Basic Transmission Theory, System Noise Temperature And G/T, Ration, Design Of Downlinks, Uplink Design, Design Of Specified C/N : Combining C/N And C/I Values in Satellite Links. Link Design With And Without Frequency Reuse (Numerical Expected).	9
Unit 4: Satellite Networks: Reference Architecture For Satellite Networks, Basic Characteristics of Satellite Networks, Onboard Connectivity With Transparent Processing, Analogue Transparent Switching, Frame Organization, Window Organization, On Board Connectivity With Beam Scanning.	9
Unit 5: Low Earth Orbit And Non Geo-Stationary Satellite System: Introduction, Orbit Considerations, Coverage And Frequency Consideration, Delay And Throughput Consideration, Operational NGSO Constellation Design: Iridium, Teledesic.	9
Unit 6: Satellite Applications: Communication Satellite-Digital DBS TV, Mobile Satellite Services: GSM, GPS, Inmarsat, LEO, MEO, Satellite Radio Broadcasting, Navigation Satellite, GPS Position Location Principles, GPS Receivers and Codes. Military Satellite-Directed Energy Laser Weapons, Weather Forecasting Satellite Application.	9

Text Books:

1. Satellite Communications, 1st Edition, by Timothy Pratt, Charles Bostian, and Jeremy Allnutt, published by John Wiley & Sons.
2. Satellite Communications, 2nd Edition, by Anil K. Maini and Varsha Agrawal, published by Wiley Publications.

Reference Books:

1. Satellite Communications, 2nd Edition, by Gerard Maral and Michel Bousquet, published by Wiley, 2007.
2. Satellite Communications Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, and Robert A. Nelson, published in 2003.

Useful Link /Web Resources:

https://www.nptelvideos.com/communications/?pn=6

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Microwave Theory Lab	
Course Code: 231ETPECP307	**Semester: VI**
Teaching Scheme: L-T-P: 0-0-2	**Credit: 1**
Evaluation Scheme: INT Marks: 25	**OE/POE Marks:**

Lab Course Description:

The Microwave Engineering Lab provides hands-on experience with microwave components, devices, and test equipment. Students will conduct experiments to analyze the characteristics of microwave sources such as the Reflex Klystron and Gunn diode, measure standing wave ratios (SWR), impedance, and frequency using a microwave test bench, and study waveguide components like the Magic Tee, directional couplers, attenuators and antennas. The lab emphasizes experimental validation of theoretical concepts and practical skills necessary for working with high-frequency microwave systems.

Course Objectives:

1.	To understand the working principles and characteristics of microwave components and devices.
2.	To analyze the performance of microwave sources such as Reflex Klystron and Gunn diode.
3.	To determine the SWR, reflection coefficient, frequency, and wavelength of microwave signals.
4.	To measure unknown impedance using the Smith Chart and interpret microwave circuit behavior.
5.	To study and analyze passive microwave components like Magic Tee, directional couplers, antennas and attenuators.

Course Outcomes (COs):

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

231ETPECP307.1	demonstrate the working principles of microwave components and devices
231ETPECP307.2	analyze the characteristics of Reflex Klystron and Gunn diode.
231ETPECP307.3	Compute SWR, reflection coefficient, and impedance using a microwave test bench.
231ETPECP307.4	Measure and interpret frequency and wavelength of rectangular

231ETPECP307.5	Analyze passive microwave components such as Magic Tee, directional co antennas and attenuators.

Prerequisite:	Electromagnetic Engg.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETPECP307.1	2	1	1	-	-	-	-	-	-	-	-	-	1	1	II
231ETPECP307.2	3	2	2	1	-	-	-	-	-	-	-	-	2	1	III
231ETPECP307.3	3	2	3	2	2	-	-	-	-	-	-	-	3	2	IV
231ETPECP307.4	3	2	3	2	1	-	-	-	-	-	-	-	2	2	III
231ETPECP307.5	3	2	3	3	2	-	-	-	-	-	-	-	3	3	IV

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Study of microwave components & Devices	S	2
2	Characteristics of Reflex Klystron tube	O	2
3	Characteristics of Gunn Diode	O	2
4	Determination of SWR & reflection co-efficient using microwave test bench	O	2
5	Determination of frequency & wavelength of rectangular waveguide	O	2
6	Measurement of unknown impendence using Smith chart	O	2
7	Study of Magic Tee	O	2
8	Study of Multi-Hole Directional Coupler	O	2
9	Study of Attenuator	O	2

10	To plot the Radiation Pattern and Determine the Gain of a Pyramidal Horn Antenna.	O	2

S: indicates Study type and O: Operational type

Textbooks

3. David M. Pozar, Microwave Engineering, 4th Edition, Wiley, 2011.
4. Samuel Y. Liao, Microwave Devices and Circuits, 3rd Edition, Pearson, 2003.

References

5. R. E. Collin, Foundations for Microwave Engineering, 2nd Edition, McGraw-Hill, 2001.
6. Annapurna Das and Sisir K. Das, Microwave Engineering, McGraw-Hill, 2010.
7. R. Ludwig and P. Bretchko, RF Circuit Design: Theory and Applications, Pearson, 2000.
8. K.C. Gupta, Microwave Engineering, Tata McGraw-Hill, 2005.
9. https://me-iitr.vlabs.ac.in/List%20of%20experiments.html

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: ASIC Design Lab.	
Course Code: 231ETPECP308	**Semester: VI**
Teaching Scheme: L-T-P: 0-0-2	**Credit: 1**
Evaluation Scheme: INT Marks: 25	**ESE Marks:**

Lab Course Description: This lab focuses on designing, simulating, and implementing ASICs and FPGA-based systems. Students will work on digital circuits, communication protocols, and hardware design, covering FSMs, ALU, memory, UART, SPI, I2C, PWM, and display interfacing. The course enhances HDL coding, simulation, and hardware implementation skills for industry applications.

Course Objectives:

1.	To understand the fundamentals of ASIC and FPGA design
2.	To develop digital circuits using HDL.
3.	To implement communication protocols like UART, SPI, and I2C.
4.	To design and simulate sequential and combinational logic circuits.
5.	To analyze power, performance, and timing constraints in ASIC design.
6.	To gain hands-on experience in hardware implementation and verification.

Course Outcomes (COs):

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

231ETPECP308.1	Understand the fundamentals of ASIC and FPGA design
231ETPECP308.2	Apply HDL to design and simulate digital circuits.
231ETPECP308.3	Analyze communication protocols like UART, SPI, and I2C.
231ETPECP308.4	Design sequential and combinational logic circuits.

231ETPECP308.5	Evaluate power, performance, and timing constraints in ASIC design.
231ETPECP308.6	Implement hardware-based solutions using FPGA and ASIC tools

Prerequisite:	Digital Electronics, HDL (VHDL/Verilog)

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BTL**
231ETPECP308.1	3	2	2	-	2	-	-	-	-	-	-	2	3	2	II
231ETPECP308.2	3	3	2	2	3	-	-	-	-	2	-	2	3	3	III
231ETPECP308.3	2	3	3	3	3	-	-	-	-	2	-	2	3	2	IV
231ETPECP308.4	3	3	3	3	3	-	-	-	2	2	-	-	3	3	VI
231ETPECP308.5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	V
231ETPECP308.6	3	3	3	3	3	-	-	-	2	2	-	-	3	3	III

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Finite State Machine (FSM) Design – Implement Mealy and Moore state machines for applications like vending machines or traffic light controllers.	O	2

2	ALU (Arithmetic Logic Unit) Implementation – Design an ALU that performs arithmetic and logical operations.	O	2
3	Memory Design – Create and simulate RAM and ROM modules using Verilog/VHDL.	O	2
4	Clock Divider Circuit – Implement a clock divider to generate different frequency signals.	O	2
5	Serial Communication (UART Implementation) – Develop and simulate a UART module for serial data transmission.	O	2
6	7-Segment Display Controller – Design a module to display numbers on a 7-segment display.	O	2
7	PWM Signal Generation – Implement a Pulse Width Modulation (PWM) generator for motor speed control.	O	2
8	SPI (Serial Peripheral Interface) Communication – Implement SPI protocol for data exchange between FPGA and peripheral devices.	O	2
9	I2C (Inter-Integrated Circuit) Communication – Develop an I2C master-slave interface for data transfer	O	2
10	Real-Time Clock (RTC) Implementation – Design a digital clock with adjustable time settings.	O	2
11	Edge Detection Algorithm Using FPGA – Implement a simple edge detection method using Verilog	O	2
12	Traffic Light Controller with Pedestrian Crossing – Enhance the traffic controller with a pedestrian button and timing control.	O	2
13	Temperature Sensor Interface with FPGA – Read temperature values from a sensor and display them on an output module	O	2
14	VGA Display Controller – Implement a simple graphical display on a VGA screen using FPGA logic.	O	2

S: indicates Study type and O: Operational type

* Minimum ten (10) experiments and one Mini project should be completed .

Text Books:

1. J.S. Smith, “Application specific Integrated Circuits”, Pearson Education, 2008
2. Wayne Wolf, “FPGA-Based System Design”, Prentice Hall PTR, 2009.
3. Farzad Nekoogar and Faranak Nekoogar, “From ASICs to SOCs: A Practical Approach”, Prentice Hall PTR, 2003.

Reference Books:

1. Advanced FPGA Design: Architecture, Implementation, and Optimization" by Steve Kilts (2007)
2. ASIC Design and Synthesis: RTL Design Using Verilog" by Vaibbhav Taraate (2022)

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: **Satellite Communication Lab..**	
Course Code: 231ETPECP309	**Semester: VI**
Teaching Scheme: L-T-P: 0-0-2	**Credit: 1**
Evaluation Scheme: INT Marks: 25	**ESE Marks:**

Lab Course Description: This lab focuses on designing, simulating, and implementing satellite communication basic concepts.It helps to analyze signal of transmission and reception. Different types of signals can be transmitted.

Course Objectives:

1.	To understand the fundamentals of satellite communication
2.	To analyze uplink and downlink frequency.
3.	To implement communication protocols.
4.	To analyze transmission and reception.
5.	To analyze the transmission and reception of audio, video signal.
6.	Implement hardware-based solutions using Pc..

Course Outcomes (COs):

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

231ETPECP309.1	Understand the basic concepts of satellite communication
231ETPECP309.2	Apply concepts to design and simulate uplink and downlink frequency.
231ETPECP309.3	Analyze communication protocols.
231ETPECP309.4	Analyze the transmission and reception of signal.

231ETPECP309.5	Analyze the transmission and reception of audio, video signal.
231ETPECP309.6	Implement hardware-based solutions using Pc.

Prerequisite:	Analog and Digital Communication

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETPECP309.1	3	2	2	-	2	-	-	-	-	-	-	2	3	2	II
231ETPECP309.2	3	3	2	2	3	-	-	-	-	2	-	2	3	2	III
231ETPECP309.3	2	3	3	3	3	-	-	-	-	2	-	2	3	2	IV
231ETPECP309.4	3	3	3	3	3	-	-	-	2	2	-	-	3	3	VI
231ETPECP309.5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	V
231ETPECP309.6	3	3	3	3	3	-	-	-	2	2	-	-	3	2	III

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	Understanding Basic concepts of Satellite communication.	O	2
2	To establish a direct communication link between Uplink Transmitter and Down link Receiver using tone signal.	O	2
3	To setup an Active satellite link and demonstrate Link Fail operations. .	O	2
4	To establish an AUDIO-VIDEO satellite link between Transmitter and Receiver. .	O	2
5	To communicate VOICE signal through satellite link. .	O	2
6	To change different combinations of uplink and downlink frequencies and to check the communication link.	O	2
7	To transmit and receive three separate signals (Audio, Video, Tone) simultaneously through satellite link.	O	2
8	To transmit and receive three separate signals (Tone) simultaneously through satellite link.		
9	To transmit and receive function generator waveforms through satellite link.	O	2
10	To transmit and receive PC data through satellite link.	O	2

S: indicates Study type and O: Operational type

* Minimum ten (10) experiments and one Mini project should be completed .

T. Y. B. Tech. Curriculum

w. e. f. 2025-2026

Course Title: Data Structures & Algorithms using C++	
Course Code: 231ETVSECL301	**Semester : VI**
Teaching Scheme : L-T-P : 1-0-0	**Credit: 1**
Evaluation Scheme : ISE Marks : 25, MSE Marks: --	**ESE Marks : --**

Course Description:

This is a vocational skill enhancement core course, which introduces data structures & algorithms using C++. It gives the knowledge about the different types of data structures. It also gives the exposure to programming using C++ to perform different operations on the data structures.

Course Objectives:

1.	To understand the data structure, their types & algorithm complexity.
2.	To understand the C++ programming concept.
3.	To introduce the object oriented design, linear data structure and recursion.
4.	To introduce the stack, queue data structures.
5.	To introduce the nonlinear data structures such as tree & graphs.

Course Outcomes (COs):

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

231ETVSECL301.1	To understand the data structure, their types & algorithm complexity.
231ETVSECL301.2	To apply the concepts of C++ programming on various data structures.
231ETVSECL301.3	To understand the object oriented design, linear data structure and
231ETVSECL301.4	To understand the stack, queue data structures.
231ETVSECL301.5	To understand the nonlinear data structures such as tree & graphs.

Prerequisite:	C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETVSECL301.1	2	1	1	2	-	-	-	-	-	-	-	-	-	-	II
231ETVSECL301.2	1	2	2	1	-	-	-	-	-	-	-	-	-	-	III
231ETVSECL301.3	1	2	1	2	-	-	-	-	-	-	-	-	-	-	II
231ETVSECL301.4	1	2	2	2	-	-	-	-	-	-	-	-	-	-	II
231ETVSECL301.5	1	2	2	2	-	-	-	-	-	-	-	-	-	-	II

Course Contents	Hrs
Unit 1: Introduction Introduction to data structure & Algorithm, complexity, time, space complexity, asymptotic notation, big-O Notation	1
Unit 2: A C++ Primer Basic C++ Programming Elements, A Simple C++ Program, Fundamental Types, Pointers, Arrays, and Structures, Named Constants, Scope, and Namespaces, Expressions- Changing Types through Casting, Control Flow, functions , classes, C++ Program and File Organization, Writing a C++ Program	4
Unit 3: Object Oriented Design Goals, Principles, and Patterns, Inheritance and Polymorphism, Templates, Exceptions, Arrays, Linked Lists, and Recursion, Using Arrays, Singly Linked Lists, Recursion	3
Unit 4: Stacks, Queues & Dequeues Stack as an ADT, array based stack implementation, linked list based stack implementation, queue as an ADT, array based queue implementation, implementing a queue using circular linked list. Deque-as an ADT, Implementing with a doubly linked list.	4
	3

Unit 5: Tree & Graphs General tree, traversal algorithms, binary tree – traversal, graph, graph traversal, directed graph	

Text Book:

1. Data Structures and Algorithms in C++, Michael T. Goodrich, Roberto Tamassia, David M. Mount, Second edition, John Wiley and Sons,Inc. 2011

2. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Press.

3. Data structures and Algorithms in C++, Adam Drozdek, 4th edition, Cengage learning.

Reference Books:

1. Data structures with C++, J. Hubbard, Schaum's outlines, TMH.

2. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss, Pearson.

4. Classic Data Structures, D. Samanta, 2nd edition, PHI.

T. Y. B. Tech. Curriculum

w. e. f. 2025-2026

Course Title: Data Structures & Algorithms using C++ Lab	
Course Code: 231ETVSECP301	**Semester : VI**
Teaching Scheme : L-T-P : 0-0-2	**Credit: 1**
Evaluation Scheme : ISE: -- MSE: -- **INT Marks : 25**	**ESE Marks : --**

Course Description:

This is a vocational skill enhancement lab course, which introduces data structures & algorithms using C++. It gives the exposure to programming using C++ to perform different operations on the data structures.

Course Objectives:

1.	To understand the data structure, their types & algorithm complexity.
2.	To understand the C++ programming concept.
3.	To introduce the object oriented design, linear data structure and recursion.
4.	To introduce the stack, queue data structures.
5.	To introduce the nonlinear data structures such as tree & graphs.

Course Outcomes (COs):

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

231ETVSECP301.1	To understand the data structure, their types & algorithm complexity.
231ETVSECP301.2	To apply the concepts of C++ programming on various data structures.
231ETVSECP301.3	To understand the object oriented design, linear data structure and recursion.
231ETVSECP301.4	To apply the concepts of C++ programming on stack & queue data structures.

231ETVSECP301.5	To demonstrate the handling of nonlinear data structures such as tree & graphs through C++ programs.

Prerequisite:	C programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
231ETVSECP301.1	2	1	1	2	-	-	-	-	-	-	-	-	-	-	II
231ETVSECP301.2	1	2	2	1	1	-	-	-	-	-	-	-	-	-	III
231ETVSECP301.3	1	2	1	2	-	-	-	-	-	-	-	-	-	-	II
231ETVSECP301.4	1	2	2	2	2	-	-	-	-	-	-	-	-	-	III
231ETVSECP301.5	1	2	2	2	2	-	-	-	-	-	-	-	-	-	III

List of Experiments			
Expt. No.	**Name of Experiment**	**Type**	**Hours**
1	To demonstrate and simulate the C++ code for matrix addition and multiplication.	O	2
2	To demonstrate and simulate the C++ code for any of the following recursive functions: • Factorial of a number • N^{th} Fibonacci number • Power function: x^y	O	2
3	To demonstrate and simulate the C++ code for implementation of singly linked lists.	O	2
4	To demonstrate and simulate the C++ code for implementation of doubly linked lists.	O	2

5	To demonstrate and simulate the C++ code for implementation of circular linked lists	O	2
6	To demonstrate and simulate the C++ code for implementation of stack data structure and its operations using arrays.	O	2
7	To demonstrate and simulate the C++ code for implementation of stack data structure and its operations using linked list.	O	2
8	To demonstrate and simulate the C++ code to Convert Prefix expression to Infix and Postfix expressions and evaluate.	O	2
9	To demonstrate and simulate the C++ code to implement queue data structure and its operations using arrays.	O	2
10	To demonstrate and simulate the C++ code to implement queue data structure and its operations using linked lists.	O	2
11	To demonstrate and simulate the C++ code to implement Binary Trees and its traversals.	O	2
12	To demonstrate and simulate the C++ code to implement graph using adjacency matrix.	O	2
13	Mini project based on the application of data structures & programming concepts of C++ to develop a typical application to solve a problem.	O	2
14	Continuation of a Mini project	O	2
15	Continuation of a Mini project	O	2

Text Book:

1. Data Structures and Algorithms in C++, Michael T. Goodrich, Roberto Tamassia, David M. Mount, Second edition, John Wiley and Sons,Inc. 2011

2. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Press.

3. Data structures and Algorithms in C++, Adam Drozdek, 4th edition, Cengage learning.

Reference Books:

1. Data structures with C++, J. Hubbard, Schaum's outlines, TMH.

2. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss, Pearson.

4. Classic Data Structures, D. Samanta, 2nd edition, PHI.

T.Y B. Tech. Curriculum

w.e.f. 2025-2026

Course Title : Liberal Learning-I (Garuda)	
Course Code : 231ETCCAL302	**Semester : VI**
Teaching Scheme : L-T-P : 2-0-0	**Credits : Audit Course**
Evaluation Scheme : 50	**ESE Marks : Grade**

Course Description:

1. It imparts knowledge of drone parts and components and the principles of flying applied to the drone technology.
2. It takes the technician through the process of understanding the setting up of drone parameters through the use of a simulator.
3. It also imparts the knowledge related to performing testing and quality check on the drone prior to dispatch and commissioning of the Drone.

Aim:

1. Providing members with opportunities to learn about drone technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative drone projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of drone technology in various domains, encouraging them to work on real-world projects like agro drone, surviliience drone
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for drone projects.

Course Objectives:

1	Understanding the components, operational basics of a Drone
2	Understanding flying principles with a Drone flight Simulation
3	Performing Manufacture
4	To Assembly, Testing and Quality check of the Drone
5	To Testing and Quality check of the Drone
6	Commissioning of the Drone

Course Outcomes (COs):

At the end of the course the student will be able to:

231ETCCAL302.1	Understanding the components, operational basics of a Drone
231ETCCAL302.2	Understanding flying principles with a Drone flight Simulation
231ETCCAL302.3	Performing Manufacture
231ETCCAL302.4	To Assembly, Testing and Quality check of the Drone
231ETCCAL302.5	To Testing and Quality check of the Drone
231ETCCAL302.6	Commissioning of the Drone

Prerequisite: Basic knowledge of communication System & Circuit Designs

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
231ETCCAL 302.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL 302.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL 302.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL 302.4	1	2	2	1	2									2	IV

Contents	Hours
• Operational basics of a Drone • Flying principles with a Drone flight Simulator • Performing Manufacture, Assembly, Testing and Quality check of the Drone • Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	30

Evaluation Guidelines

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.

- Technical Proficiency: Ability to operate drone design , use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the bootcamps and workshops.
- Complete a basic drone designs project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic drone concepts ,operations & their components

2. Intermediate Level Certification:

- Successfully complete multiple drone design projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining drone technology applications.

3. Advanced Level Certification:

- Lead a team in a major drone technology project or competition.
- Find and work on industrial consultancy & social Projects
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized drone applications topic.

Publish a Research Article in Journal or Conference

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning-II (Robotics)	
Course Code: 231ETCCAL302	**Semester : VI**
Teaching Scheme : L-T-P : 2#-0-0	**Credit: Audit Course**
Evaluation Scheme : ISE Marks : 50	**ESE Marks : --Grade**

 # - 2 contact hrs. per week

Course Description:

The Robotics Club envisions a dynamic and collaborative environment where students passionately explore and advance the field of robotics. As a student-led initiative within the Electronics and Telecommunication Engineering Department, our mission is to foster innovation, learning, and competition in robotics. By providing structured activities such as boot camps, awareness sessions, and competitions, we aim to cultivate a profound understanding and practical expertise in robotics technologies among our members. Our ultimate goal is to empower students to become leaders in robotics, contributing to technological advancements and solving real-world challenges.

Aim:

1. Cultivate Interest and Enthusiasm: Inspire a passion for robotics among students.

2. Provide Hands-on Experience: Offer practical training with robotics technologies.

3. Encourage Innovation: Foster creativity in design and manufacturing processes.

4. Bridge Theory and Practice: Connect theoretical knowledge with real-world applications.

5. Build a Community: Create a network of individuals passionate about robotics.

Course Objectives:

1.	Train students in both fundamental and advanced roboties techniques.
2.	Enable experienced members to guide beginners.
3.	Motivate students to undertake cutting-edge projects and research.
4.	Foster teamwork and collaborative problem solving through group projects anttivate Windows peer-to-peer learning sessions

5.	Create connections with industry professionals and academic experts to enhance learning.
6.	Acknowledge outstanding achievements in various robotics challenges.

Course Outcomes (COs):

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

231ETCCAL 302.1	Apply foundational knowledge in robotics, programming, and electronics to design and build functional robotic systems.
231ETCCAL 302.2	Analyze and solve complex problems through hands-on projects and challenges in robotics.
231ETCCAL 302.3	Collaborate effectively with team members, enhancing their communication and teamwork skills through group projects and competitions.
231ETCCAL 302.4	Innovative and unique robotic solutions, contributing to advancements in the field.

Prerequisite: Basic knowledge of Electronics and telecommunication engineering and any programming language

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETCCAL 302.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL 302.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL 302.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL 302.4	1	2	2	1	2									2	IV

Course Contents	**Hrs**
• Seminars • Workshops	30

• Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	

Evaluation Guidelines:

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate lot development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels:

1.Beginner Level Certification:

- Attend at least 75% of the boot camps and workshops.
- Complete a basic robotics project (e.g., designing and assembling a simple robot).
- Demonstrate understanding of basic robotics concepts and equipment operation.

2. Intermediate Level Certification:

- Successfully complete multiple roboties projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining roboties equipment**.**

3. Advanced Level Certification:

- Lead a team in a major robotics project or competition.
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized robotics topic.
- Publish a research article in a journal or conference.
- Publish a Research Article in Journal Conference.

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning -III(IoT)	
Course Code: 231ETCCAL302	**Semester : VI**
Teaching Scheme : L-T-P : 2-0-0	**Credit: Audit**
Evaluation Scheme : ISE : 50	**ESE Marks :---Grade**

Course Description:

The club has vision to provide a platform for learning, networking, staying updated on the latest advancements in IoT technology and explore, innovate, and collaborate on IoT-related projects

Aim:

1. Providing members with opportunities to learn about IoT technologies, protocols, and applications through workshops, seminars, and online resources.
2. Encouraging members to explore and develop innovative IoT projects, fostering creativity and problem-solving skills.
3. Facilitating collaboration among members to work on joint projects, share ideas, and build a supportive community.
4. Creating a platform for members to connect with industry professionals, researchers, and promoting the practical application of IoT in various domains, encouraging them to work on real-world projects.
5. Enhancing members' skills in programming, data analytics, hardware integration, and other relevant areas crucial for IoT development.

Club Objectives:

1.	To better understand IoT technologies, applications, and their implications through workshops, seminars, and knowledge-sharing sessions.
2.	Provide opportunities for members to acquire and enhance technical skills relevant to IoT, including programming, hardware integration, and data analytics.
3.	Encourage members to collaborate on IoT projects, enhancing teamwork and hands-on experience in developing real-world applications.
4.	Promote a culture of innovation by supporting members in exploring new ideas, conducting research, and developing novel IoT solutions.
5.	Create a supportive community where members can share knowledge, seek advice, and collaborate on various IoT-related endeavors.

Club Outcomes (COs):

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

231ETCCAL302.1	Understand IoT Technologies and their applications.
231ETCCAL302.2	Implement the technical skills relevant to IoT
231ETCCAL302.3	Analyze and solve the real world problem with innovative thinking
231ETCCAL302.4	Create the systems by contributing and work as team member

Prerequisite: Basic knowledge of analog and digital communication

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**BTL**
231ETCCAL 302.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL 302.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL 302.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III
231ETCCAL 302.4	1	2	2	1	2									2	IV

lub Contents	Hrs
• Seminars • Workshops • Short courses • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	30

Evaluation Guidelines

- Attendance: Regular attendance in Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate IoT development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.
- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the bootcamps and workshops.
- Complete a basic IoT project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic IoT concepts and operations.

2. Intermediate Level Certification:

- Successfully complete multiple IoT projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining IoT applications.

3. Advanced Level Certification:

- Lead a team in a major IoT project or competition.
- Find and work on industrial consultancy
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized IoT topic.
- Publish a Research Article in Journal or Conference

T.Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Liberal Learning-IV (PSoC)	
Course Code: 231ETCCAL302	**Semester : VI**
Teaching Scheme : L-T-P : 2#-0-0	**Credit: Audit Course**
Evaluation Scheme : ISE Marks : 50 , MSE: --	**ESE Marks : Grade**

 # - 2 contact hrs. per week

Course Description:

This course aims to provide the exposure to the EDA tools useful in the design of PSoC based application. It also introduces advanced PSoC5 family. The course also provides exposure to demonstrate the programming skills as well as helps to analyse the device specifications.

Course Objectives:

1.	Apply the EDA tools useful for the design of PSoC based embedded system.
2.	Analyse the capabilities of PSoC5 family.
3.	Demonstrate the programming skills of PSoC5 family.

Course Outcomes (COs):

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

231ETCCAL302.1	Apply the EDA tools useful for the design of PSoC based embedded system.
231ETCCAL302.2	Analyse the capabilities of PSoC5 family.
231ETCCAL302.3	Demonstrate the programming skills of PSoC5 family.

Prerequisite:	PSoC Architecture, Embedded C programming

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BTL**
231ETCCAL302.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1	III
231ETCCAL302.2	1	2	2	1	1	-	-	-	-	-	-	-	-	1	IV
231ETCCAL302.3	1	1	2	1	1	-	-	-	-	-	-	-	-	2	III

Course cContents	**Hrs**
• EDA tools for PSoC • PSoC 5LP: CY8C56LP Family- Overview • PSoC 5LP: CY8C56LP Family- Programming • Seminars • Workshops • Short courses (blended mode) • Certifications • Hackathons • Project competitions • Industrial Projects • Research and Development	**30**

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Evaluation Guidelines

- Attendance: Regular attendance in learning sessions, Expert lectures, workshops, and club meetings.
- Engagement: Active participation in discussions, Q&A sessions, and group activities.
- Teamwork: Collaboration with peers on projects and challenges.
- Technical Proficiency: Ability to operate PSoC development boards, use relevant software and troubleshoot common issues.
- Project Execution: Successful completion of assigned projects and tasks within the given timeframe.
- Innovation: Demonstration of creativity and innovative thinking in project design and implementation.
- Event Participation: Involvement in organizing and participating in competitions, workshops, and awareness campaigns.

- Community Building: Contribution to building a supportive and collaborative club environment.
- Competition Performance: Participation and performance in internal and external competitions.
- Project Showcase: Presentation of completed projects during club meetings or events.
- Awards and Accolades: Recognition received for outstanding work and contributions.

Certification Levels

1. Beginner Level Certification:

- Attend at least 75% of the bootcamps and workshops.
- Complete a basic PSoC project (e.g., designing and implementing simple projects).
- Demonstrate understanding of basic PSoC concepts and operations.

2. Intermediate Level Certification:

- Successfully complete multiple PSoC projects, including a complex design.
- Participate in at least one internal competition or challenge.
- Show proficiency in troubleshooting and maintaining PSoC applications.

3. Advanced Level Certification:

- Lead a team in a major PSoC project or competition.
- Find and work on industrial consultancy.
- Organize or contribute significantly to a club event or workshop.
- Conduct a presentation or seminar on a specialized PSoC topic.
- Publish a Research Article in Journal or Conference.

Text Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	Computer System Design: System on Chip	--	Michael J. Flynn, Wayne Luk	A John Wiley & Sons, Inc., Publication	2011

Reference Books:

Sr. No	Title	Edition	Author(s)	Publisher	Year
1	The definitive guide to ARM Cortex-M3	2nd Edition	Joseph Yiu,	Elsevier	--

Online resources:-

www.infineon.com

https://www.infineon.com/dgdl/Infineon-PSoC_5LP_CY8C56LP

T. Y. B. Tech. Curriculum

w.e.f. 2025-2026

Course Title: Honors Paper- III Digital IC Design (Honors Paper- III) HC (Optional)	
Course Code: 231ETHONL302	**Semester : V**
Teaching Scheme : L-T-P : 3-0-2	**Credit: 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30 **INT: 25**	**ESE Marks : 50**

Course Description:

This course focuses on the principles and design techniques of Digital Integrated Circuits (ICs) using CMOS technology. It covers CMOS inverter characteristics, power dissipation, delay analysis, combinational and sequential logic circuits, and arithmetic circuit design. The course emphasizes power optimization, delay estimation, and performance improvement strategies, making it essential for VLSI designers and digital circuit engineers.

Course Objectives:

1.	To understand the fundamental concepts of CMOS inverter characteristics, noise margins, and robustness.
2.	To analyze power dissipation components such as dynamic, leakage, and short-circuit power, along with power optimization techniques.
3.	To evaluate MOSFET resistance, capacitance, and delay in MOS circuits using various delay models.
4.	To design combinational logic circuits with an emphasis on gate sizing, buffer insertion, and delay-power trade-offs.
5.	To implement sequential logic circuits, including flip-flops and timing analysis techniques.
6.	To develop efficient arithmetic circuits such as adders and multipliers to optimize speed and power consumption in digital designs.

Course Outcomes (COs):

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

231ETHONL302.1	characterize CMOS inverters in terms of voltage transfer characteristics (VTC), noise margins, and robustness.
231ETHONL302.2	calculate delay in MOS circuits using resistance-capacitance models and logical effort analysis.
231ETHONL302.3	optimize the performance of combinational logic circuits by evaluating delay-power trade-offs and drive strength considerations.
231ETHONL302.4	apply sequential circuit design principles to analyze setup/hold time constraints and improve timing efficiency.
231ETHONL302.5	design advanced logic circuits, including asymmetric, skewed, and domino logic gates, for high-speed operations.
231ETHONL302.6	implement efficient arithmetic circuits such as carry-skip, carry-select, and carry-save adders and multipliers.

Prerequisite:	Engineering Physics and Chemistry, Basic Electronics

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSO)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	BTL
231ETHONL302.1	2	2	1	1	-	-	-	-	-	-	-	1	2	II
231ETHONL302.2	2	2	2	1	1	-	-	-	-	-	-	1	2	III
231ETHONL302.3	1	2	2	2	1	-	-	-	-	-	-	1	2	V
231ETHONL302.4	1	1	2	1	2	-	-	-	-	-	-	1	2	III
231ETHONL302.5	1	2	2	2	2	1	-	-	-	-	1	1	2	IV
231ETHONL302.6	2	2	2	2	2	1	1	-	-	-	1	1	2	IV

Course Contents	Hrs
Unit 1: CMOS Inverter and Power Dissipation CMOS inverter structure, Voltage transfer characteristics (VTC),Noise margins and robustness, Static and dynamic behavior, Dynamic, short-circuit and leakage power, Power optimization techniques, Stacking effect and its impact on leakage, Energy-efficient circuit design,	7
Unit 2: Resistance, Capacitance, and Delay Analysis MOSFET resistance and capacitance, Delay estimation, Transient response of MOS circuits, RC delay models, Parasitic capacitance effects, Logical effort and electrical effort	7
Unit 3: Combinational Logic Circuit Design Logic gates and fan-in/fan-out considerations, Delay optimization in combinational circuits, Impact of gate sizing on performance, Buffer insertion strategies, Delay and power trade-offs, Drive strength considerations	7
Unit 4: Sequential Circuits and Timing Analysis Basics of sequential circuits, Feedback and stability analysis, Static and dynamic D flip-flop designs, Setup and hold time constraints, Timing analysis of latch/flop-based systems	7
Unit 5: Advanced Logic Design Asymmetric and skewed gates, Ratioed logic circuits, Dynamic gates and domino logic, Static timing analysis	7
Unit 6: Adders and Multipliers in Digital Design Mirror adder, Carry-skip adder, Carry-select and square-root adders, Signed and unsigned arithmetic, Carry-save multiplier implementation	7

Textbooks:

1. John F. Wakerly – Digital Design: Principles and Practices, Pearson Education.
2. S. Kang and Y. Leblebici – CMOS Digital Integrated Circuits: Analysis and Design, Tata McGraw Hill.
3. Wayne Wolf – Modern VLSI Design: System-on-Chip Design, 4th Edition, Pearson Education.

References:

1. NPTEL Course – Digital IC Design (IIT Madras), NPTEL Digital IC Design
2. MIT Open Course Ware – Digital Integrated Circuits, MIT OCW Digital IC

Program Coordinator HOD Academic Dean Principal