Scheme & Syllabus

K.D.K. College of Engineering, Nagpur 440024

V- Semester Scheme and Syllabus for

Bachelor of Technology (Electronics and Telecommunication Engineering)

Submitted by

Board of Studies in Electronics and Telecommunication Engineering

2025-26

Institute Vision:

Transforming Society through excellence in Education, Innovation and Research.

Mission:

- To deliver quality, outcome-based education that provides strong technical knowledge and lifelong learning.
- To promote innovation and impactful research addressing real-world and societal challenges.
- To develop competent, ethical and socially responsible professionals through industry interaction and holistic development.

Department Vision:

To be a center of excellence in Electronics and Telecommunication Engineering by imparting quality education, fostering innovation and research, and producing competent professionals for societal advancement.

Mission:

M1: To deliver outcome-based education with strong fundamentals in Electronics and Telecommunication Engineering, enabling lifelong learning.

M2: To promote innovation, research, and industry interaction for developing practical skills and solutions to real-world problems.

M3: To nurture competent, ethical, and socially responsible engineers with leadership qualities and holistic development.

Program Educational Objectives (PEOs):

PEO1: Graduates will apply strong fundamentals of Electronics and Telecommunication Engineering to analyze and solve real-world engineering problems.

PEO2: Graduates will pursue higher education, research, and adapt to emerging technologies through continuous learning and innovation.

PEO3: Graduates will demonstrate ethical practices, social responsibility, teamwork, and leadership in their professional careers.

Knowledge and Attitude Profile (WK) as per NBA guidelines

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to

public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

PROGRAM OUTCOMES (POs):

PO1: **Engineering Knowledge:** Apply knowledge of mathematics, natural science computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: **Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to design and analyze electronic circuits and communication systems using modern engineering tools.

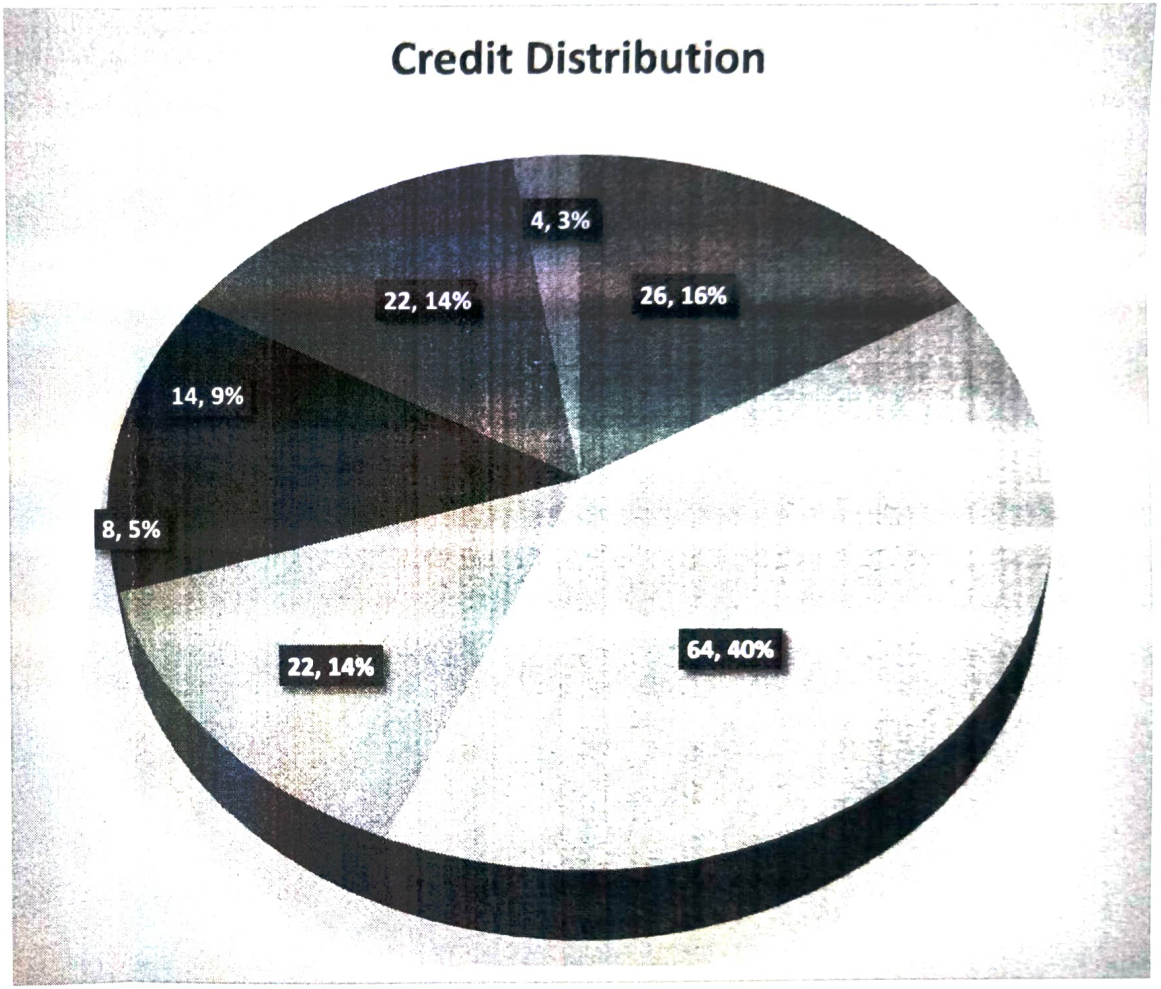
PSO2: Ability to apply embedded systems, IoT, and networking concepts to develop solutions for real-world industrial and societal problems.

CREDIT FRAMEWORK STRUCTURE

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits		Course Category
Basic Science Course	BSC/ESC	3*2=6	4*2=8	....	....	....	....	....	....	14	26	BSC/ESC
Engineering Science Course		4*2=8	04	....	....	....	....	....	....	12		
Program Core Course (PCC)	Program Courses	....	02	4*2=8	4*2=8	4*2+2=10	4*2=8	4*2=8	....	44	64	Program Courses
Program Elective Course (PEC)		....	....	....	....	04	4+3=7 $	3*2=6 #	03 #	20		
Multidisciplinary Minor (MDM)	Multidisciplinary Courses	....	....	03	02	03	03	03	...	14	22	Multi-disciplinary Courses
Open Elective (OE) Other than a particular program		....	....	03	02	03	...	....	....	8		
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	02	....	02	....	02	...	....	8	8	Skill Courses
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	02	....	....	02	....	....	....	....	4	14	Humanities Social Science and Management (HSSM)
Entrepreneurship/Economics/Management Courses		....	....	02	02	....	....	....	....	4		
Indian Knowledge System (IKS)		....	02	....	....	....	....	....	....	2		
Value Education Course (VEC)		....	....	02	02	....	....	....	....	4		
Research Methodology	Experiential Learning Courses	....	....	....	....	....	....	03 #	01	4	22	Experiential Learning Courses
Comm. Engg. Project (CEP)/ Field Project (FP)		....	....	02	....	....	....	....	....	2		
Project		....	....	....	....	....	....	04	....	4		
Internship/OJT		....	....	....	....	....	....	....	12	12		
Co-curricular Courses (CC)	Liberal Learning Courses	02	02	....	....	....	....	....	....	4	4	Liberal Learning Courses
Total Credits (Major)		**20**	**20**	**20**	**20**	**20**	**20**	**24**	**16**	**160**	**160**	
	No. of Theory courses	5	5	6	7	6	5	6	1	**41**	**61.2**	
	No. of Practicals Courses	5	4	3	3	3	3	3	2	**26**	**38.8**	
								Total number of courses		**67**	**100**	

# denotes NPTEL/MOOCS Courses

Course Category	Credits
BSC/ESC	26
Program Courses- **PCC& PEC**	64
Multidisciplinary Courses **MDM & OE**	22
Skill Courses- **VSEC**	8
Humanities Social Science and Management (HSSM)-**AEC, EEM, IKS, VEC**	14
Experiential Learning Courses- **RM, CEP, FP, Project, Internship &OJT**	22
Liberal Learning Courses-**CC**	4
Audit Course-**DM**	0
Total credits to earn B. Tech. degree	**160**



K.D.K. College of Engineering, Nagpur

B. Tech. Semester-V (Electronics and Telecommunication Engineering -Major)

	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs.)			Total Credit	Examination Scheme					
									Theory				Practical	
					(Th)	TU	P		Exam Hrs.	MSE	CA	ESE	CA	ESE
1	PCC-VI	5BET01T	Embedded System Design	ETC	3	-	-	3	3	30	20	50	-	-
2	PCC-VI	5BET01P	Embedded System Design Lab	ETC	-	-	2	1	-	-	-	-	25	25
3	PCC-VII	5BET02T	Analog System Design	ETC	2	-	-	2	2	15	10	25	-	-
4	PCC-VII	5BET02P	Analog System Design Lab	ETC	-	-	2	1	-	-	-	-	25	25
5	PCC-VIII	5BET03T	Electromagnetic Waves	ETC	3	-	-	3	3	30	20	50	-	-
6	PEC-I	5BET04T	Refer **PEC-I** Basket	ETC	3	-	-	3	3	30	20	50	-	-
7	PEC-I	5BET04P	Refer **PEC-I** Basket	ETC	-	-	2	1	-	-	-	-	25	25
8	MDM-III	5BETMD03T	Refer **MDM-III** Basket	ETC	3	-	-	3	3	30	20	50	-	-
9	OE-III	5BOE03T	Refer OE-III Basket	ASH	3	-	-	3	3	30	20	50	-	-
Total					**18**	**-**	**6**	**20**		**165**	**110**	**275**	**75**	**75**
Total Marks (Theory & Practical)										**550**			**150**	
Total Marks (V Semester)										**700**				

K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester :V	Subject Code: 5BET01T	Name of Subject: PCC-VI: Embedded System Design (Theory)		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	Understand the fundamentals, architecture, characteristics, classifications, and design metrics of embedded systems along with processor and IC technologies.
2	Explain ARM processor architecture, ARM/THUMB instruction sets, registers, pipeline operations, interrupts, exceptions, and vector table mechanisms.
3	Analyze and implement ARM instruction sets including data processing, load-store operations, conditional execution, and software interrupt handling.
4	Develop knowledge of component interfacing techniques and embedded communication protocols such as UART, SPI, I2C, CAN, USB, PCI, Bluetooth, Zigbee, and Wi-Fi.
5	Understand RTOS concepts including task management, scheduling algorithms, synchronization, inter-process communication, deadlocks, and priority inversion handling techniques.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Identify and compare different embedded system architectures, processor organizations, and design methodologies for real-time applications.
2	Demonstrate understanding of ARM processor architecture, ARM/THUMB programming model, pipeline, interrupts, and exception handling mechanisms.
3	Apply ARM instruction sets and programming techniques to develop basic embedded system applications.
4	Interface memory and peripheral devices using standard embedded communication protocols and networking technologies.
5	Analyze and implement RTOS-based embedded solutions using scheduling, synchronization, and inter-process communication techniques for real-time systems.

Course Competencies:

1. Students will be able to understand microprocessor and microcontroller architectures.
2. Students will be able to apply knowledge to design interfacing with peripherals.
3. Students will be able to develop assembly programs and debug systems.
4. Students will be able to analyze microcontroller-based embedded systems.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	1	-	1	1	1	1	2	2
CO2	3	3	3	2	3	1	-	1	1	1	1	2	3
CO3	3	3	3	3	3	1	-	1	2	2	1	2	2
CO4	3	3	3	2	3	2	-	1	2	2	2	3	3
CO5	3	3	3	3	3	2	-	2	2	2	2	3	3

Syllabus

Unit	Details of Topic	Hours	COs
I	**Introduction to Embedded System:** Embedded systems Overview, Characteristics of embedded computing applications. Classification of Embedded systems, Application Areas of Embedded Systems. Purpose of Embedded Systems, Differences between RISC and CISC, Harvard V/s Von-Neumann, Big-endian V/s Little-endian processors, Design Challenges, Common Design Metrics, Embedded systems Design flow. Processor Technology, IC Technology, Trade-offs.	8	CO1
II	**ARM Processor Fundamentals**, ARM core dataflow model, registers, ARM & THUMB Register Set, CPSR & SPSR, Pipeline, Exceptions, Interrupts and Vector Table.	8	CO2
III	**Instruction Set** - Data processing instructions, Load – Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.	8	CO3
IV	**Component Interfacing & Networks** - Memory Interfacing, I/O Device Interfacing, Interrupt Controllers, Networks for Embedded systems- USB, PCI, UART, SPI, I2C, CAN, Wireless Applications - Bluetooth, Zigbee, Wi-Fi.	8	CO4
V	**RTOS** - Introduction to Operating Systems, Basic Features & Functions of an Operating System, Kernel & its Features [polled loop system, interrupt driven system, multi rate system], Processes/Task and its states, Process/Task Control Block, Threads, Scheduler, Dispatcher, Context Switching , Scheduling and various Scheduling algorithms, Inter-process Communication (Shared Memory, Mail Box, Message Queue), Inter Task Synchronization (Semaphore, Mutex), Dead Lock, Priority Inversion (bounded and unbounded), Priority Ceiling Protocol & Priority Inheritance Protocol	8	CO5

Online Resources:

1. NPTEL Course: NPTEL – Embedded System Design– Prof. Indranil Sengupta Prof. Kamalika Datta, **IIT Kharagpur**
2. ARM Developer Documentation.
3. Keil ARM Assembly Programming Guide
4. https://www.electronicwings.com – Texas Instruments – Interface & Connectivity Tutorials
5. https://www.coursera.org/learn/arduino – Free RTOS Official Documentation

Text Books

1 Introduction to Embedded Systems, Shibu K V, Tata McGraw Hill Education
2 Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008.
3 Introduction to Embedded Systems: Shibu K. V. (TMH)
4 Embedded Systems: L. B. Das (Pearson)

Reference Books:

1 Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
2 Embedded Systems: Rajkamal (TMH)
3 Embedded System design: S. Heath (Elsevier)
4 Embedded microcontroller and processor design: G. Osborn (Pearson)
5 Embedded Microcomputer Systems – Real Time Interfacing – Jonathan W. Valvano; Cengage Learning; Third or later edition.

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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	**Subject Code: 5BET01P**	**Name of Subject: PCC-VI: Embedded System Design Lab**	
Total Hours Distribution per week			
Total Credit: 1	**Lecture (L): -**	**Tutorial (T) : -**	**Practical (P): 2 Hrs**
Examination Scheme			
Continuous Assessment		**End Sem Examination**	**Total Marks**
25 Marks		**25 Marks**	**50 Marks**

Course Objectives	
1	Understand the fundamentals of assembly language programming and Develop assembly language programs for mathematical computations, data manipulation, and memory operations.
2	To study the Interfacing of peripheral devices such as DACs, stepper motors, switches, LEDs, relays, buzzers, and seven-segment displays with LPC2148.
3	To study the embedded applications development integrating hardware interfacing and assembly language programming concepts.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Write and execute assembly language programs for mathematical computations, data manipulation, and memory operations.
2	To develop and demonstrate the Interfacing of peripheral devices such as DACs, stepper motors, switches, LEDs, relays, buzzers, and seven-segment displays with LPC2148.
3	To Develop and debug embedded applications integrating hardware interfacing and assembly language programming concepts.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	1	-	1	1	1	2	1	2
CO2	3	3	3	2	3	1	-	2	1	2	3	2	3
CO3	3	3	3	3	3	1	-	2	2	2	3	2	3

List of Experiments:

Any 8 practicals to be performed

Exp. No.	**List of Experiments**	**COs**
1	Write a program to find the sum of the first 10 integer numbers.	CO1
2	Write an Assembly Language Program (ALP) to I) Multiply two 16-bit numbers. ii) Add two 32-bit numbers.	CO2
3	Write a program to find the factorial of a number.	CO2
4	Write a program to add an array of 16-bit numbers and store the 32 bit result in internal RAM.	CO2
5	Write a program to find the square of a number (1 to 10) using a look-up table.	CO2
6	Write a program to find the largest or smallest number in an array of 32 numbers.	CO2

Exp. No.	List of Experiments	COs
7	Write a program to arrange a series of 32-bit numbers in ascending/descending order.	CO3
8	Write a program to count the number of ones and zeros in two consecutive memory locations.	CO3
9	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	CO3
10	Interface a DAC and generate Triangular and Square waveforms. 11 Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between. 12 Interface a simple Switch and display its status through Relay, Buzzer and LED	CO4
11	Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.	CO5
12	Interface a simple Switch and display its status through Relay, Buzzer and LED	

Online Resources:

1. Keil µVision IDE Tutorials and Documentation:
   Useful for ARM assembly programming, debugging, simulation, and project development.
2. Proteus Design Suite Tutorials:
   Useful for simulation of DACs, stepper motors, seven-segment displays, LEDs, and interfacing circuits.
3. ARM Developer – Assembly and Cortex-M Programming Resources:
   Provides ARM instruction set details, programming examples, and processor architecture references.
4. Circuit Digest – Embedded System Projects and Interfacing Tutorials:
   Useful for practical interfacing examples involving motors, displays, switches, and communication protocols.
5. Free RTOS Documentation and Hands-on Guides:
   Useful for learning RTOS concepts, task scheduling, semaphores, mutexes, and embedded real-time applications.

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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	Subject Code: 5BET02T	Name of Subject: PCC-VII: Analog System Design(Theory)		
Total Hours Distribution per week				
Total Credit: 2	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	**Continuous Assessment**	**End Sem Examination**	**Total Marks**	**Examination Duration:**
15 Marks	**10 Marks**	**25 Marks**	**50 Marks**	**2 Hours**

Course Objectives	
1	To understand characteristics of various Analog Circuits.
2	To design and analyse linear and nonlinear applications of Op-Amp.
3	To design RC & LC oscillators.
4	To design RC Filters and drivers.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Describe and explain the basic concepts of OPAMP.
2	Demonstrate and analyse various linear applications of OPAMP
3	Demonstrate and analyse various non-linear applications of OPAMP
4	Evaluate and design various types of oscillators and filters

Course Competencies:

1. Students will be able to understand the construction, characteristics, parameters, and operation of operational amplifiers and differential amplifier circuits.
2. Students will be able to analyze and design linear OP-AMP based circuits for amplification, signal conditioning, mathematical operations, and data conversion applications.
3. Students will be able to develop and evaluate non-linear and timing circuits using OP-AMPs, 555 timers, multivibrators, and phase-locked loops.
4. Students will be able to design sinusoidal oscillators, waveform generators, and active filters for analog signal processing applications.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	-
CO2	3	3	3	2	3	-	-	-	2	1	2	3	2
CO3	3	3	3	2	3	-	-	-	2	1	2	3	2
CO4	3	3	3	3	2	1	1	-	2	1	2	3	2

Syllabus

Unit	Details of Topic	Hours	COs
I	**Introduction To Operational Amplifier:** Op-Amp Fundamentals: Block diagram of operational amplifier, Differential amplifiers using transistors. Op-Amp parameters, virtual ground concept, Ideal OP-Amp, Equivalent circuit, Voltage Transfer curve, Inverting & non inverting configurations.	7	CO1
II	**Op-Amp Linear Applications:** Voltage follower, Summing amplifier, scaling and averaging amplifier, Instrumentation amplifier and applications, Integrator and differentiators, current to voltage converters, voltage to current converters, Peak detector, Log and antilog amplifiers and analog multipliers.	8	CO2
III	**Op-Amp Non Linear Applications:** Comparators, Schmitt trigger, Precision Rectifier. Multivibrator: Bistable, Monostable, Astable using Op-Amp, Sample/Hold circuits, 555 Timer and its applications, Phase lock loops.	7	CO3
IV	**Design Of Sinusoidal Oscillators, Function Generator And Filters:** OPAMP based Wein Bridge and Phase Shift oscillators, Transistorized Hartley & Colpitts oscillator, Crystal oscillators, Evaluation of figure of merit for all above oscillator circuits. Design of Butterworth Active Filters LPF, HPF, BPF, BRF etc.	8	CO5

Online Resources:

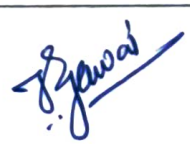
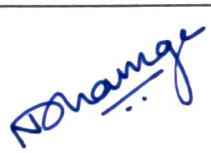
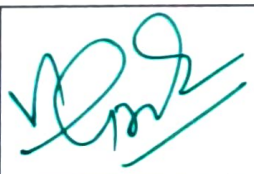
1. NPTEL Course: Analog Circuits – Prof. Jayant Mukharjee, IIT Bombay.
2. NPTEL Course: Integrated Circuits and Applications– Prof. Shaik Ahamed, IIT Guwahati.

Text Books

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.
4. N. C. Goyal and Khetan 'A Monograph on Electronics Design Principals', Khanna Publications
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill.

Reference Books:

1. Linear Integrated Circuits Manual I, II, and III: National Semiconductor.
2. Linear Applications Handbook National Semiconductors.
3. Regulated Power supply Handbook. Texas Instruments.
4. Electronics: BJT's, FETS and Microcircuits – Anielo.
5. Operational Amplifier Design and Applications Tobey, Graham, Huelsman McGraw Hill.

			June 2026	1.00	Applicable forAY 2025-26 Onwards
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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	**Subject Code: 5BET02P**	**Name of Subject: PCC-VII: Analog System Design Lab**	
Total Hours Distribution per week			
Total Credit: 1	**Lecture (L): -**	**Tutorial (T) : -**	**Practical (P): 2 Hrs**
Examination Scheme			
Continuous Assessment		**End Sem Examination**	**Total Marks**
25 Marks		**25 Marks**	**50 Marks**

Course Objectives	
1	To analyze and design linear OP-AMP applications such as amplifiers, mathematical operation circuits, signal conditioning circuits, and instrumentation amplifiers.
2	To study and implement non-linear and timing circuits including comparators, Schmitt triggers, multivibrators, precision rectifiers, 555 timer circuits, and PLL systems.
3	To design and evaluate regulated and unregulated DC power supplies using rectifiers, filters, IC voltage regulators, and switching regulator techniques and sinusoidal oscillator.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Test and design analog electronic circuits using OP-AMP
2	Examine and Design linear and nonlinear applications of operational amplifier.
3	Analyze and Design the oscillators and active filters.

CO-PO Mapping:

CO	**Program Outcomes & Program Specific Outcomes**												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	3	-	-	-	1	-	1	3	2
CO2	3	3	3	2	3	-	-	-	1	-	1	3	1
CO3	3	3	3	2	2	-	-	-	1	-	1	2	1

List of Experiments:

Perform any 10 Practicals. (All COs to be addressed)

Exp. No.	**Experiments Description**	**COs**
1	Design and implementation of inverting and Non-Inverting operational amplifier	CO1
2	Implementation of scaling and averaging amplifier using OP-AMP	CO2
3	To plot the frequency response of Non-Inverting operational amplifier	CO1
4	To study Integrator and Differentiator circuits using operational amplifier	CO2
5	Design of current-to-voltage and voltage-to-current converter circuits	CO2
6	To study the Schmitt Trigger circuit using operational amplifier	CO2
7	To study the precision Half wave and Full wave Rectifier	CO2
8	To design Wein Bridge Oscillator circuit using operational amplifier	CO3

Exp. No.	List of Experiments	COs
9	To design Phase Shift Oscillator circuit using operational amplifier	CO3
10	Design of regulated power supply using IC 78xx and 79xx regulators	CO3
11	To design 1st order Low pass Filter circuit using operational amplifier	CO3
13	To design 1st order High pass Filter circuit using operational amplifier	CO3
14	To Study IC 723 as voltage regulator	CO3

Simulators & IDEs:

- LTspice – Simulation of OP-AMP circuits, filters, oscillators, and SMPS
- NI Multisim– Analog and mixed-signal circuit simulation
- Tanner EDA-CMOS circuit simulator

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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	Subject Code: 5BET03T	Name of Subject: PCC-VIII: Electromagnetic Waves		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To develop a strong foundation in vector algebra and vector calculus in different coordinate systems (Cartesian, cylindrical, and spherical).
2	To develop understanding of fundamental concepts of electromagnetic fields and waves, including Maxwell's equations and their physical significance.
3	To analyze the behavior of electromagnetic wave propagation in different media such as free space, dielectrics, and conductors.
4	To understand polarization, waveguides, and transmission lines, and their applications in communication systems.
5	To develop analytical and problem-solving skills for evaluating radiation mechanisms and antenna performance.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Apply vector algebra and vector calculus concepts to analyze electric fields using Coulomb's Law and Gauss's Law.
2	Analyze magnetic fields using Biot–Savart Law and Ampere's law, and interpret Maxwell's Equations for static and time-varying fields.
3	Evaluate electromagnetic wave propagation in different media and apply concepts such as Poynting theorem, reflection, refraction, and total internal reflection.
4	Analyze wave propagation in rectangular waveguides by evaluating TE and TM modes, cut-off frequency, and waveguide parameters.
5	Evaluate antenna parameters including radiation resistance and array fundamentals.

Course Competencies:

1. Students will be able to apply vector algebra and vector calculus.
2. Students will be able to analyze electrostatic and magneto-static fields.
3. Students will be able to interpret and apply Maxwell's Equations to explain time-varying electromagnetic fields and wave behavior.
4. Students will be able to evaluate electromagnetic wave propagation characteristics.
5. Students will be able to evaluate radiation mechanisms and antenna performance.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	2	1	–	–	–	–	–	1	3	1
CO3	3	3	2	2	2	–	–	–	–	–	1	3	2
CO4	3	3	3	2	2	–	–	–	1	–	1	3	2
CO5	3	3	3	2	2	1	–	–	1	1	1	3	3

Syllabus

Unit	Details of Topic	Hours	COs
I	**Electric Field:** Basics of Vectors, Vector algebra and vector calculus, Coordinate system and concepts of differential surface and differential volume, Basics of Coulombs Law, Gauss Law, Divergence Theorem, Gradient, Curl.	7	CO1
II	**Magnetic Field & Maxwell's equations:** Basics of Magnetic Field, Biot-Savart's Law, Amperes Circuital Law, Stokes Theorem, Maxwell's equations for Time constant fields and Time Varying fields.	7	CO2
III	**Electromagnetic Waves:** Electromagnetic wave equation, Wave propagation in free space, perfect dielectric and perfect conductor, Skin effect, Poynting vector and Poynting theorem, Snell's Law, Brewster Angle, Total Internal Reflection.	8	CO3
IV	**Rectangular Waveguide:** Basics of Waveguide and its types, Comparison of Rectangular waveguide with Transmission Lines, TE, TM and TEM Waves, Field equations for TE and TM waves through rectangular waveguide, Modes in rectangular waveguide, Various losses, Cut-off frequency and wavelength, Phase and Group velocities, Guide Wavelength, Wave impedances in waveguide.	8	CO4
V	**Reflection, Refraction, and Transmission Lines:** Reflection and refraction of plane waves , Normal and oblique incidence, Brewster angle and Total Internal Reflection, Transmission line parameters and equations, Smith Chart fundamentals, Impedance matching techniques, Basics of antenna and antenna terminologies, Types of Antennas, wired Antenna, Dipole antenna.	8	CO5

Online Resources:

1. NPTEL Course: Introduction of Electromagnetic Theory – Prof. D. K. Ghosh.
2. https://github.com/RobinKa/maxwell-simulation
3. https://dn721506.ca.archive.org/0/items/in.ernet.dli.2015.141092/2015.141092.Electromagnetic-Waves_text.pdf – ebook in pdf
4. https://codesandbox.io/p/sandbox/intelligent-maxwell-4fsw33 – **Browser-based advanced EM simulator**

Text Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall.
5. William H. Hayt Jr. &John A. Buck, Engineering Electromagnetics, McGraw-Hill.

Reference Books:

1. William H. Hayt Jr. &John A. Buck, Engineering Electromagnetics, McGraw-Hill.
2. David Cheng, Electromagnetics, Prentice Hall.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	Subject Code: 5BET04T- A	Name of Subject: PEC-I: CMOS VLSI Design (Theory)		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	To learn basic CMOS Circuits.
2	To learn CMOS device parameters and characteristics.
3	To Study CMOS processing technology
4	To learn physical design of logic gates.
5	To learn the concepts of designing VLSI Subsystems.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Describe and interrupt the basic concept of MOS transistors
2	Apply MOSFET concepts to design basic and compound CMOS logic circuits
3	Analyze CMOS inverter characteristics including DC, transient behavior, and noise margins.
4	Evaluate circuit performance using capacitance, switching characteristics, and power dissipation.
5	Apply VLSI design principles including layout rules, transistor sizing, and CMOS logic structures.

Course Competencies:

1. Students will be able to understand MOS Transistor Theory
2. Students will be able to apply knowledge to design complex combinational circuits using static CMOS, pass transistor logic.
3. Students will be able to analyze the impact of wire parasitics (capacitance, resistance) on performance
4. Students will be able to understanding schematic design, layout considerations, and design rules for integrated circuits.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1	2	-	-	-	-	-	2	2	2
CO2	3	2	2	2	2	-	-	-	-	-	2	3	2
CO3	2	1	2	2	2	-	-	-	-	-	2	2	2
CO4	3	2	2	2	2	-	-	-	-	-	2	3	3
CO5	2	1	2	1	2	-	-	-	-	-	2	2	2

Syllabus

Unit	Details of Topic	Hours	COs
I	**Introduction Of MOSFET:** nMOS enhancement and pMOS enhancement transistor, threshold voltage, body effect, MOS effect, MOS device equations, small signal model for MOS transistor.	8	CO1
II	**Logic Design with MOSFET:** Logic design with MOSFET: Ideal switches and Boolean operations, MOSFET as Switches, Basic Logic Gates in CMOS, C0mpound Gates in CMOS, Transmission Gate Circuits (TG), Pass Transistor	7	CO2
III	**CMOS Inverter Characteristics:** CMOS inverter, Principle of operation, dc characteristics, transient characteristics, βn / βp ration, Noise Margin, introduction to Bi-CMOS inverter.	8	CO3
IV	**Circuit Characterization and Performance Estimation:** MOS device Capacitance, Resistance and capacitance estimation, switching characteristics, power dissipation, charge sharing.	7	CO4
V	**VLSI Design:** VLSI processing integration, layout design rules, and stick diagram representation latch up, CMOS circuits and logic design: transistor sizing, fan-in, fan-out and physical design of simple logic gates, CMOS logic structures and clocking strategies.	8	CO5

Online Resources:

1. NPTEL Course: Digital IC Design – Prof. Janakiraman, IIT Madras.
2. NPTEL Course: Design and Analysis of VLSI Subsystem– Prof. Madhav Rao, IIT Bangalore.
3. https://www.udemy.com – CMOS VLSI-fundamentals Design & Technology.

Text Books

1. "Principal of CMOS VLSI design", Neil H. E. Weste, K. Eshraghian, Addison Wesley VLSI Series.
2. "Digital Interrogated circuits, A Design Perspective" , J. M. Rabaey, A. Chandrakasan, and B. Nikolic., PHI Publications .
3. "CMOS VLSI Design" , Pucknell & K. Eshraghain, PHI Publications
4. Sung-MO Kang, Yusuf leblebici, CMOS VLSI Design, Third edition, 2008, Tata McGraw Hill

Reference Books:

1. "VLSI Technology", S.M. Sze, McGraw Hill Publications
2. "VLSI Design Technologies for Analog & Digital Circuits", Randall L Gei , McGraw Hill Publications
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	Subject Code: 5BET04P-A	Name of Subject: PEC-I: CMOS VLSI Design Lab	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L): -	Tutorial (T) : -	Practical (P): 2 Hrs
Examination Scheme			
Continuous Assessment		End Sem Examination	Total Marks
25 Marks		25 Marks	50 Marks

Course Objectives	
1	To learn CMOS device parameters and characteristics.
2	To implement different combinational circuits using CMOS.
3	To learn physical design of logic gates.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Analyze the electrical characteristics of NMOS and PMOS transistors, including their operating regions and I–V behavior.
2	Design CMOS transistor.
3	Design layout for various circuits.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	1	-	2	3	2
CO2	3	3	2	2	1	-	-	-	1	-	2	3	2
CO3	3	3	3	2	1	-	-	-	1	-	2	3	2

List of Experiments:

Any Eight practicals are to be conducted. (All the COs to be addressed)

Exp. No.	Experiment Description	COs
1	To study characteristic of NMOS/PMOS.	CO1
2	To study DC characteristic of CMOS.	CO1
3	To study CMOS as a inverter.	CO1
4	Implement 2:1 Multiplexer using transmission gate.	CO2
5	Implementation of NAND gate.	CO2
6	Implementation of NOR gate.	CO2
7	Implement Half adder using transmission gate.	CO2
8	Implement XOR operation using Pass transistor.	CO2
9	To study characteristic of BiCMOS inverter.	CO3
10	Design a layout $Y = \overline{A.(D + E) + B.C}$	CO3
11	Implement D-Flip flop.	CO3

Online Resources:

- **NPTEL Courses**:
- NPTEL courses on VLSI Design and Microelectronics
- MIT Open Course Ware – VLSI and semiconductor lectures

Simulators & IDEs:

- Cadence Virtuoso – Industry-standard VLSI design tool
- Microwind – Educational layout and simulation tool
- LTspice – Circuit simulation and waveform analysis
- Multisim – Digital and analog simulation
- Tanner EDA-CMOS circuit simulator

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	**Subject Code: 5BET04T-B**	**Name of Subject: PEC-I : Wireless Sensor Network (Theory)**		
Total Hours Distribution per week				
Total Credit: 3	**Lecture (L): 3 Hrs**		**Tutorial (T) : -**	**Practical (P): -**
Examination Scheme				
Mid Sem Examination	**Continuous Assessment**	**End Sem Examination**	**Total Marks**	**Examination Duration:**
30 Marks	**20 Marks**	**50 Marks**	**100 Marks**	**3 Hours**

Course Objectives	
1	Understand the basic architecture and applications of wireless sensor networks.
2	Learn communication protocols and routing techniques for efficient WSN operation.
3	Comprehend network and transport layer characteristics and protocols
4	Discuss the major challenges and enabling technologies associated with wireless sensor networks.
5	Examine sensor network platforms, operating systems, and software tools used for programming sensor networks.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Describe the architecture, components, and applications of wireless sensor networks.
2	Explain the functioning of sensor node hardware and operating systems.
3	Analyze various MAC and routing protocols used in WSNs.
4	Evaluate performance metrics and energy efficiency in sensor network communication.
5	Apply WSN concepts in designing basic real-world applications and integrating with IoT.

Course Competencies:

1. Students will be able to understand the architecture, characteristics, and communication protocols of Wireless Sensor Networks (WSNs).
2. Students will be able to analyze challenges, enabling technologies, and design considerations in sensor networks.
3. Students will be able to apply knowledge of sensor node platforms, operating systems, and programming tools for WSN development.
4. Students will be able to understand single-node architecture including hardware components, energy consumption, and execution environments.
5. Students will be able to analyze and design energy-efficient and reliable wireless sensor network-based embedded systems.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	-	1	2	3	2
CO2	3	3	2	2	2	-	-	-	-	1	2	3	3
CO3	3	3	3	2	3	1	-	-	-	1	2	3	2
CO4	3	3	2	3	3	1	1	-	1	1	2	3	3
CO5	3	3	3	3	3	1	1	1	1	2	3	3	3

Syllabus

Unit	Details of Topic	Hours	COs
I	**Introduction to Wireless Sensor Networks:** Overview of wireless communication, Evolution from traditional networks to sensor networks, Architecture and components of WSNs, Types of wireless sensor networks: static vs mobile, proactive vs reactive, Applications of WSNs: industrial, environmental, military, healthcare, smart cities.	8	CO1
II	**Sensor Node Architecture and Hardware:** Hardware architecture of sensor nodes, Microcontroller, transceiver, power unit, and sensing unit, Operating systems for sensor nodes (TinyOS, Contiki), Challenges in sensor node design: energy, memory, and computation constraints, Sensor deployment strategies and coverage models	8	CO2
III	**Communication and MAC Protocols:** Wireless channel characteristics and communication fundamentals, Medium Access Control (MAC) issues in WSNs, Contention-based MAC protocols: CSMA, S-MAC, T-MAC, Schedule-based MAC: TDMA, IEEE 802.15.4, Energy-efficient communication techniques	8	CO3
IV	**Routing and Data Dissemination Protocols:** Routing challenges in WSNs, Classification of routing protocols: data-centric, hierarchical, location-based, LEACH (Low-Energy Adaptive Clustering Hierarchy), Directed Diffusion, Rumor Routing, SPIN, GAF, Data aggregation and fusion techniques.	7	CO4
V	**Advanced Topics and Applications:** Localization techniques and synchronization in WSNs, Mobility management in WSNs, Security issues and countermeasures in WSNs, Introduction to IoT and integration with WSNs, Case studies and applications in smart environments, healthcare, and industrial monitoring.	8	CO5

Online Resources:

1. Fundamental Concepts & Theory: https://www.intechopen.com/chapters/86241
2. Key Video Resources: YouTube: Introduction to WSN: Covers applications in smart cities, industrial automation, and security.
3. YouTube: Introduction to WSN | Network and ...: Focuses on network resilience and self-healing mechanisms.
4. NPTEL Course: Wireless Ad Hoc and Sensor Networks- By Prof. Sudip Misra, IIT Kharagpur.

Text Books:

1. Wireless sensor networks Feng Zhao and Leonides Guibas , Elsevier publication edition 2004.
2. AdHoc Wireless networks C. Siva Ram Murthy, and B. S. Manoj , Pearson Education edition 2008.
3. Mobile Communications Jochen Schiller 2nd edition, Pearson Education.
4. "Wireless Sensor Networks: Technology, Protocols, and Applications", Kazem Sohraby, Daniel Minoli, Taieb Znati, Wiley Interscience Publication, 2007.
5. "Protocols and Architecture for Wireless Sensor Networks", H.Karl and A.Wiling, John Wiley & Sons, India,2012.

Reference Books:

1. Wireless Communications and Networks William Stallings Pearson Education, 2004.
2. "Computer Networks", Andrew Tanenbaum, 4th Edition, Pearson Education, 2007.

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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester :V	**Subject Code: 5BET04P-B**	**Name of Subject: PEC-I: Wireless Sensor Network Lab**	
Total Hours Distribution per week			
Total Credit: 1	**Lecture (L): -**	**Tutorial (T) : -**	**Practical (P): 2 Hrs**
Examination Scheme			
Continuous Assessment		**End Sem Examination**	**Total Marks**
25 Marks		**25 Marks**	**50 Marks**

Course Objectives	
1	To provide hands-on experience in designing and implementing Wireless Sensor Network (WSN) based systems using sensor nodes.
2	Understand design issues, challenges and emerging technologies for wireless sensor networks
3	Learn about various routing protocols and MAC Protocols and required software required for implementation of wireless sensor networks.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Implement the fundamental operations of Wireless Sensor Networks by configuring sensor nodes, and network topologies using appropriate hardware and simulation tools.
2	Analyze the performance of Wireless Sensor Network protocols using various routing protocols through simulating software.
3	Implement wireless sensor networks using various design principles, node architectures, hard-ware and software.

CO-PO Articulating Matrix

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	3	-	-	-	1	1	-	3	2
CO2	2	3	1	3	3	-	-	-	1	1	-	3	2
CO3	3	2	3	2	3	-	-	-	2	1	1	3	3

List of Experiments:

Any Eight practical's are to be conducted. (All the COs to be addressed)

Exp. No.	Topics / Experiment Description	Mapped CO
1	Introduction of Wireless sensor network applications and its simulation.	CO1
2	Study other wireless sensor network simulators.	CO1
3	Network Simulator installation of wireless sensor network.	CO2
4	Write TCL script for transmission between mobile nodes.	CO2
5	Implement a Proactive and Reactive based MAC protocol using Simulation Tool.	CO3
6	Implement a Scheduling based protocol for WSNs using Simulation Tool.	CO3
7	Implement a Low Energy Adaptive Hierarchy protocol using Simulation Tool.	CO4
8	Implement a Sensor Protocol for Information via Negotiation (SPIN) using Simulation Tool.	CO4
9	To integrates of WSN with IoT platforms (e.g., sending sensor data to cloud).	CO5
10	Study and implementation of basic WSN security mechanisms (encryption/authentication).	CO5

Online Resources:

1. Wireless Sensor Network – IIT Kharagpur
2. ALL ABOUT ELECTRONICS
3. Mangaluru (WSN tutorials)

Simulators:

1. Proteus / Tinkercad / NS2 / NS3 / Contiki /MATLAB (for simulation).
2. Proteus Design Suite – Circuit simulation and hardware emulation

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	Subject Code: 5BET04T - C	Name of Subject: PEC-I: Digital Image Processing (Theory)		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) :	Practical (P): -
Examination Scheme				
Mid Sem Examination	**Continuous Assessment**	**End Sem Examination**	**Total Marks**	**Examination Duration:**
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives	
1	Learn pixel representation, image acquisition, sampling, and quantization.
2	Apply techniques to improve visual quality (contrast, brightness, filtering).
3	Use Fourier, Wavelet, and other transforms for analysis and processing.
4	Study coding techniques for efficient storage and transmission.
5	Divide images into meaningful regions, Extract features and represent images for analysis, recognition and classification.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Explain the concepts of image acquisition, sampling, quantization.
2	Improve image quality using spatial and frequency domain methods.
3	Competence in Fourier, Wavelet, and other transforms for image analysis.
4	Reduce image size using lossless and lossy techniques of Compression.
5	Partition images into meaningful regions for recognition and analysis, Describe, classify images by its shape and texture.

Course Competencies:

1. Students will be able to understand the basic fundamentals of Digital Image Processing.
2. Students will be able to ability to select appropriate enhancement techniques for specific applications.
3. Students will be able to proficiency in applying mathematical transforms (Fourier, Wavelet, DCT).
4. Students will be able to capability to apply DIP techniques in diverse fields like medical imaging, satellite remote sensing, robotics, surveillance etc.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	2	1	-	-	1	1	2	3	3
CO3	3	3	2	2	2	-	-	-	1	1	2	3	2
CO4	3	3	2	2	2	1	-	-	1	1	2	3	3
CO5	3	3	2	2	2	1	-	-	1	1	3	3	3

Syllabus

Unit	Details of Topic	Hours	COs
I	**Digital Image Fundamentals** Components of Image Processing System. Image Sensing and Acquisition, Image Sampling & Quantization, Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR etc.	8	CO1
II	**Image Enhancement** Enhancement in Spatial Domain: basic gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters, Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters, Fundamental of color image processing: color models, RGB, CMY, YIQ, HIS, Pseudo Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image processing.	8	CO2
III	**Image Transforms** 2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform, slant Transform , Basics of wavelet transform.	7	CO3
IV	**Image Coding and Compression** Image Coding Fundamentals, Image Compression Model, fundamentals-redundancy: coding, interpixel, psychovisual, fidelity criteria, Basic compression methods Error Free Compression - variable length, bit plane, LZW arithmetic Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.	7	CO4
V	**Image Analysis** Segmentation: Point, line, Hough Transform, Edge detection, Boundary detection and Thresholding, Region Based segmentation. Representation & Description :Boundary representation by chain codes, signature & skeleton Boundary descriptors, shape number, Fourier descriptors ,Basics of Regional descriptor, boundary representation by chain codes and B splines, Hough Transform, Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images.	9	CO5

Online Resources:

1. NPTEL Course: Digital Image Processing – Prof. P. K. Biswas, IIT Khadagpur.
2. https://www.tutorialspoint.com/DIP
3. https://www.tutorialspoint.com › dip › image_ processing...

Text Books:

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education,
2. Arthur Weeks Jr., "Fundamentals of Digital Intake Processing", PHI.
3. S Jayaraman, "Digital Image Processing", Tata McGraw Hill Publications.
4. A. K. Jain, "Fundamentals of Digital Image Processing"; Pearson Education

Reference Book:

1. Pratt William, "Digital Image Processing", John Wiley & Sons
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Second Edition, Thomson Learning, 2001
3. Milan Sonka, Vaclav halvac , "Image Processing analysis & Machine Vision", Cenage Learning

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Semester: V	Subject Code: 5BET04P - C	Name of Subject: PEC-I: Digital Image Processing Lab	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L): -	Tutorial (T) : -	Practical (P): 2 Hrs
Examination Scheme			
Continuous Assessment		**End Sem Examination**	**Total Marks**
25 Marks		25 Marks	50 Marks

Course Objectives	
1	Gain hands-on experience in improving image quality using spatial and frequency domain, Fourier, DCT, and wavelet transforms for compression and analysis.
2	Learn edge detection, segmentation, and morphological operations to identify meaningful structures.
3	Build skills using MATLAB, Python (OpenCV), or similar platforms for algorithm implementation.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Apply both theoretical knowledge and practical skills in digital image processing.
2	Design and implement efficient algorithms for image enhancement, compression, and analysis.
3	Use industry-standard tools to solve real-world problems in computer vision, medical imaging, and multimedia applications.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	3	-	-	1	1	-	2	3	2
CO2	3	3	2	2	3	-	-	1	1	-	2	3	2
CO3	3	3	3	3	3	2	1	1	1	3	3	3	3

List of Experiments

Any EIGHT Practicals to be performed. (All COs to be addressed)

Exp. No.	Experiment Description	COs
1	Introduction to MATLAB	CO1
2	Image sampling and quantization	CO1
3	Analysis of spatial and intensity resolution of images.	CO1
4	Intensity transformation of images.	CO1
5	Haar Transform	CO2

Exp. No.	Experiment Description	COs
6	Histogram Processing	CO2
7	Image Enhancement-Spatial filtering	CO2
8	Image Enhancement- Filtering in frequency domain	CO2
9	DFT analysis of images	CO3
10	Walsh Transform	CO3
11	Hadamard Transform	CO3
12	DCT Transform	CO3
13	Edge detection	CO4
14	line detection	CO4
15	point detection	CO4
16	Basic Morphological operations	CO4
17	Basic Thresholding functions	CO4
18	Analysis of images with different color models	CO5

NPTEL Courses:

NPTEL Course: Digital Image Processing – Prof. P. K. Biswas, IIT Khadagpur.

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K.D.K. COLLEGE OF ENGINEERING, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	**Subject Code: 5BET04T - D**	**Name of Subject: PEC-I: Computer Communication Networks (Theory)**		
Total Hours Distribution per week				
Total Credit: 3	**Lecture (L): 3 Hrs**		**Tutorial (T) : -**	**Practical (P): -**
Examination Scheme				
Mid Sem Examination	**Continuous Assessment**	**End Sem Examination**	**Total Marks**	**Examination Duration:**
30 Marks	**20 Marks**	**50 Marks**	**100 Marks**	**3 Hours**

Course Objectives	
1	Build an understanding of the fundamental concepts of computer networking and its topologies.
2	Learn about the transmission media used for wired and wireless network and learn the concept of switching techniques.
3	Learn the concept of network services and various protocols of Data Link Layer and MAC sub-layer.
4	Introduce the concept Network Layer and IP Addressing techniques.
5	Introduce the function of Application Layer and Presentation layer paradigm and protocols.

Course Outcomes	
After completion of syllabus , students would be able to	
1	Describe the basics of Computer Network, Data Communication, Network topologies, transmission media and switching techniques.
2	Analyze the services and features of various protocols of Data Link Layer and MAC sub-layer.
3	Apply the concept of IP Addressing techniques and its various protocols of Network Layer.
4	Describe the transport layer, Application Layer services and its protocol Headers and analyze the congestion control protocols.
5	Explain the function of Application Layer and Presentation layer paradigm and protocols.

Course Competencies:

1. Students will be able to understand concept of Network and Network requirements.
2. Students will be able to apply knowledge to design interfacing with peripherals.
3. Students will be able to develop assembly programs and debug systems.
4. Students will be able to analyze microcontroller-based embedded systems.

CO-PO Articulating Matrix:

CO	**Program Outcomes & Program Specific Outcomes**												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	1	-	-	-	-	2	1	2
CO2	3	3	1	2	2	1	-	-	-	-	2	1	2
CO3	3	3	3	2	2	1	-	-	-	-	2	2	3
CO4	3	3	3	2	2	1	-	-	-	-	2	2	2
CO5	3	2	3	1	2	1	-	1	-	1	2	3	3

Syllabus:

Unit	Details of Topic	Hours	CO Mapping
I	**Computer Networks Overview and Introduction to Physical Layer:** Introduction to Networks, Network Topology, Types of communication: simplex, half duplex, full duplex, Network classification:- LAN,MAN,WAN, Network Architecture, Protocols, Services and primitives, OSI Reference Model, TCP/IP Reference Model. Transmission Media:-Guided Media, Unguided, Structure of Switch, types of switches, Switching Techniques:-Circuit-switching, Message switching, packet switching,	8	CO1
II	**Data Link Layer:** Design Issues, Framing methods, Flow Control and Error Control, Stop-and-wait flow control, Sliding-window flow control, Stop-and-wait ARQ, Go-back-N ARQ, Selective Repeat, ARQ, HDLC, MAC sub layer: ALOHA, CSMA-CD.	7	CO2
III	**Network Layer:** Network layer duties, Routers, IP addressing and its classification, IPv4 address, IPv6 address, Mask and Subnet, Routing algorithms like Shortest path routing, Djkstra's algorithm, Bellman Ford Algorithm, Distance Vector Routing, Dynamic Routing.	8	CO3
IV	**Transport Layer:** Transport layer services, Connection oriented & Connectionless, Three-way handshaking, UDP model, TCP:- TCP header format, comparison between UDP and TCP, Need of Congestion control, Principal of congestion, Quality of Service (QoS), Token bucket and leaky bucket algorithm.	7	CO4
V	**Application Layer:** Application Layer: DNS, Electronic Mail, File Transfer (FTP), WWW, HTTP, SNMP, SMTP. Introduction to Cryptography, Secret key algorithm, public key algorithm, Digital Signature, Basics of Attacks and security.	8	CO5

Online Resources:

1. NPTEL Course: Microprocessors and Microcontrollers – Prof. S. Srinivasan, IIT Madras.
2. https://www.tutorialspoint.com/microprocessor
3. https://www.electronicwings.com – Arduino and 8051 tutorials.
4. https://www.coursera.org/learn/arduino – Introduction to Arduino IoT.

Text Books:

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH.
2. Computer Networks, A. S. Tanenbaum, 4th Edition, Pearson education.

Reference Books:

1. Data and Computer Communications, tenth Edition by William Stallings, Pearson Educations.

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FACULTY OF SCIENCE & TECHNOLOGY

B.TECH. (Electronics and Telecommunication Engineering)

Semester: V	**Subject Code: 5BET04P - D**	**Name of Subject: PEC-I: Computer Communication Networks Lab**	
Total Hours Distribution per week			
Total Credit: 1	**Lecture (L):**	**Tutorial (T): -**	**Practical (P): 2 Hrs.**
Examination Scheme			
	Continuous Assessment	**End Sem Examination**	**Total Marks**
	25 Marks	**25 Marks**	**50 Marks**

Course Objectives	
1	To introduce the core architecture of computer networks, physical layer topologies, and various switching techniques.
2	To develop expertise in framing, error/flow control protocols at the Data Link Layer, and addressing/routing algorithms at the Network Layer.
3	To impart knowledge on transport layer congestion management mechanisms and foundational web application layer protocols along with basic network security.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Design, configure, and analyze network topologies and media behaviors using hardware simulation tools.
2	Simulate and evaluate the performance of Data Link Layer flow control and MAC access protocols.
3	Implement IPv4/IPv6 subnetting schemes and evaluate routing protocols in simulated enterprise environments.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	3	-	-	1	2	2	-	2	1
CO2	3	2	1	3	2	-	-		1	2	-	2	1
CO3	3	3	3	2	3	2	2	1	3	2	2	3	2

List of Experiments

Any EIGHT Experiment are to be performed. (ALL COs to be addresses)

Exp. No.	**Topics / Experiment Description**	**Mapped CO**
1	Study of basic network interconnectivity devices (Hubs, Switches, Routers) and crimping of Straight-through/Cross-over Ethernet cables.	CO1
2	**Simulation:** Configure a basic Local Area Network (LAN) using Star Topology in Cisco Packet Tracer and observe packet flow via Simulation Mode.	CO2
3	**Programming:** Implement the bit-stuffing and character-stuffing framing methods using C/C++ or Python.	CO2
4	**Programming:** Implement the Error Detection mechanism using Cyclic Redundancy Check (CRC) algorithm.	CO2
5	**Simulation:** Analyze performance and throughput drop in Stop-and-Wait ARQ vs Go-Back-N ARQ under varied packet loss conditions.	CO2
6	**Simulation:** Demonstrate collision domains by analyzing pure ALOHA and Slotted ALOHA access mechanisms.	CO2

Exp. No.	Topics / Experiment Description	Mapped CO
7	Demonstrate an IP Subnetting scheme (VLSM) for an organization with 4 distinct departments using IPv4.	CO3
8	**Programming:** Implement Dijkstra's Shortest Path Routing algorithm using any high-level programming language.	CO3
9	**Simulation:** Configure Dynamic Routing using Distance Vector Routing (RIP protocol) across a 4-router network architecture.	CO3
10	**Simulation:** Implement Traffic Shaping using the Leaky Bucket or Token Bucket Congestion Control algorithms	CO4

Online Resources:

- NPTEL/SWAYAM: "Computer Networks" by Prof. Sujoy Ghosh (IIT Kharagpur).
- Interactive Learning: Coursera's "The Bits and Bytes of Networking" (Google Career Certificates).
- Packet Capture Practice: Wireshark Official Guided Labs & Sample Captures.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. (Electronics and Telecommunication Engineering)

Semester : V	Subject Code: 5BETMD03T	Name of Subject: Basics of Deep Learning (Theory)		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	**Continuous Assessment**	**End Sem Examination**	**Total Marks**	**Examination Duration:**
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

	Course Objectives
1	Understand the fundamentals of Machine Learning, Deep Learning, Artificial Neural Networks, and their applications in intelligent systems..
2	Develop knowledge of neural network architectures, activation functions, perceptron learning, and optimization techniques used in deep learning
3	Apply gradient-based learning algorithms and backpropagation techniques for training neural network models.
4	Understand computer vision fundamentals, image processing techniques, and feature extraction methods for visual data analysis.
5	Explore and evaluate advanced deep learning architectures such as CNNs and RNNs for image recognition, object detection, and sequence modeling applications.
	Course Outcomes
After completion of syllabus, the student will be able to	
1	Explain the concepts of Machine Learning, Deep Learning, biological and artificial neurons, neural network architectures, activation functions, and learning mechanisms.
2	Apply perceptron learning, multilayer perceptrons, gradient descent methods, and optimization algorithms to develop neural network models.
3	Analyze and implement feedforward neural networks using backpropagation and advanced optimization techniques for solving classification and prediction problems.
4	Apply computer vision concepts, image processing operations, filtering techniques, feature extraction methods, and edge detection algorithms for image analysis.
5	Evaluate and implement deep learning architectures such as CNNs and RNNs for image classification, object detection, and sequence learning applications.

Course Competencies:

1. Students will be able to understand biological and artificial neuron models..
2. Students will be able to implement perceptron and multilayer perceptron models.
3. Students will be able to design feedforward neural networks.
4. Students will be able to understand image formation and representation
5. Students will be able to implement CNN architectures such as LeNet, AlexNet, VGGNet, GoogLeNet.

CO-PO Articulation Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	1	2	3
CO2	1	2	2		-		-	-	-	1	-	2	3
CO3	1	3	3	-	1	-	-	-	-	1	2	2	3
CO4	-	2	2	3	2	-	-	-	-	1	-	2	3
CO5	1	3	1	2	3	-	1	1	1	2	1	2	3

Syllabus

Unit	Details of Topic	Hours	CO Mapping
I	Issues and challenges in machine learning, difference between machine learning and deep learning, understanding biological neuron and artificial neuron, types of activation functions, architecture of neural network, learning process in ANN	7	CO1
II	**Perceptron learning:** McCulloch Pitts Neuron, thresholding logic. Perceptron's, perceptron learning algorithm, multilayer perceptron's (MLPS). Representation power of MLPs. signoid neurons, gradient descent.	7	CO2
III	**Neural Networks and Different Gradient Descend:** Feedforward Neural Networks. Back propagation Gradient Descent(GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Weighted initialization in neural network, Eigen values and Eigen vectors.	8	CO3
IV	**Computer Vision:** Basic concept of Computer Vision: Image formation, image representation, linear filtering, Image in frequency domain. Image sampling, image processing and feature extraction. correlation, convolution, edge detection: canny edge detector	7	CO4
V	**Different Pertained Models in Deep Learning:** Convolutional Neural Networks: Popular CNN architecture. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet object detection. Introduction to Recurrent Neural Network (RNN), advantages, disadvantages and its application.	7	CO5

Text Books

1. Deep Learning by Amit Kumar Das first edition 2021 Pearson education
2. Deep Learning, an MIT press book. Ian goodfellow and yoshua Bengio and aaron cournville http://www.deeplearningbook.org
3. Daniel Jurafsky, James H. Martin "Speech and language processing: An introduction to natuarral language processing, computatonal linguistics and spech recognition. 2/e. prentice hall,2008

References Books

1. Multiple view geametry in computer vision by Richard HEartley and Andrew
2. Deep learning by Ian Goodfellow and Yoshua bengio and Aaron courville://www.deeplearningbook.org/computer vision, a modern approach by Fosyth and Ponce.

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