

Zeal Education Society's

ZEAL COLLEGE OF ENGINEERING & RESEARCH, PUNE – 41

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

NBA Accredited, NAAC Accredited with A+ Grade, ISO 21001:2018



DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Curriculum Structure and Syllabus of T.Y. B. Tech. – Electronics and Telecommunication Engineering

**(With effect from - Academic Year 2026 - 27)
(2024Pattern)**

VISION OF THE INSTITUTE

To be a premier institute in technical education by imparting academic excellence, research, social and entrepreneurial attitude.

MISSION OF THE INSTITUTE

- To achieve academic excellence through innovative teaching and learning process.
 - To imbibe the research culture for addressing industry and societal needs.
 - To inculcate social attitude through community engagement initiatives.
 - To provide conducive environment for building the entrepreneurial skills.



Curriculum Structure of Third Year Bachelor of Technology (B.Tech) Electronics and Telecommunication Engineering

*With effect from
Academic Year 2026-27(2024pattern)*

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VISION:

To become one of the leading center in the field of Electronics and Telecommunication Engineering, developing competent engineers through innovative teaching, research promotion, social responsibility, and entrepreneurial skills.

MISSION:

- M1:** To improve continually the teaching learning process through well mechanized monitoring and feedback system.
- M2:** To create and establish research facilities for fulfilling research and learning needs of the students.
- M3:** To provide conducive environment for becoming socially responsible engineers.
- M4:** To strengthen industry-institute interaction to produce ready to work Engineers and entrepreneurs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

- PEO1:** Graduates will excel in the area of analog and digital signal processing, embedded systems, VLSI, electronic product design etc., demonstrating leadership and managerial expertise in the electronics & telecommunication industry.
- PEO2:** Graduates will exhibit the professional skills, ethical and moral values, capabilities of working as an individual and in a team to fulfill the need of industries and society.
- PEO3:** Graduates will develop entrepreneurial skills to create innovative solutions, while continuously learning and staying updated for career growth in electronics and telecommunication engineering.

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

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

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: To apply knowledge to identify, develop and test the electronics and telecommunication systems using hardware and software tools

PSO2: To develop feasible solutions for real-time problems related to electronic circuit design, wireless sensor network, VLSI, embedded, microwave, Tele-communication, signal and image processing.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

LIST OF ABBREVIATIONS	
Abbreviation	Description
BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Programme Core Course
PEC	Programme Elective Course
MDM	Multidisciplinary Minor
OE	Open Elective - Other than a particular program
VSEC	Vocational and Skill Enhancement Course
AEC	Ability Enhancement Course
ENTR	Entrepreneurship
EC	Economics
MC	Management Courses
IKS	Indian Knowledge System
VEC	Value Education Courses
RM	Research Methodology
CEP	Community Engagement Project
FP	Field Project
PROJ	Project
INT	Internship
OJT	On Job Training
CC	Co-curricular Courses
HSSM	Humanities Social Science and Management
ELC	Experiential Learning Course
B. Tech	Bachelor of Technology
L	Lecture
P	Practical
T	Tutorial
H	Hours
CR	Credits
CIE	Continuous Internal Evaluation
MTE	Mid Term Evaluation
ETE	End Term Evaluation
TW	Term Work
OR	Oral
PR	Project

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Third Year B. Tech. – Electronics and Telecommunication Engineering: Semester - V

Course Code	Course Type	Course Name	Teaching Scheme (hrs/Week)							Evaluation Scheme					
			L	P	T	H	CR			CIE	ETE	T W	P R	O R	Total
							TH	PR/Tut	Total						
ETPC508	PCC	Digital Communication Systems	3		-	3	3	-	3	40	60	-	-	-	100
ETPC508P	PCC	Digital Communication Lab		2		2		1	1				50		50
ETPC509	PCC	Electromagnetic Field Theory	3		1	4	3	1	4	40	60	25	-	-	125
ETPC510	PCC	Microcontrollers And Applications	3		-	3	3		3	40	60	-	-	-	100
ETPC510P	PCC	Microcontrollers And Applications Lab		2				1	1				50		50
ETPE501	PEC	Program Elective Course - I *	3		-	3	3		3	40	60	-	-	-	100
ETPE501P	PEC	Program Elective Course – I Lab *		2		2		1	1					25	25
ALOE503	OE	Open Elective - III #	2	-	-	2	-	2	2			50	-	50	100
ETMD503	MDM	Project Management System - II	-	4	-	4	-	2	2	-	-	25	-	-	25
ETIN504	ELC - INT	Internship - IV	4 week					2	2			25	-	-	25
Total			14	10	1	25	12	10	22	160	240	125	100	75	700

* Program Elective Course – I: Choose any one from the following:

Sr. No.	Course Code	Course Name
1.	ETPE501A	Digital Signal Processing
2.	ETPE501B	Fundamental of Java Programing
3.	ETPE501C	Computer Network


BoS Chairman




Director
ZES's Zeal College of
Engineering & Research
Narhe, Pune - 411041.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

# - Select any one course from the given Open Elective Courses		
Course Code	Course Type	Open Elective - III
ALOE503A	OEC	Data Analytics
ALOE503B		Green Building
ALOE503C		Electric Mobility
ALOE503D		Introduction to Stock Market
ALOE503E		Patent Law for Engineers and Scientist



BoS Chairman




Director

ZES's Zeal College of
Engineering & Research
Narhe, Pune - 411041.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Third Year B. Tech. – Electronics and Telecommunication Engineering: Semester - VI

Course Code	Course Type	Course Name	Teaching Scheme							Evaluation Scheme					
			L	P	T	H	CR			CIE	ETE	TW	PR	OR	Total
							TH	PR/Tut	Total						
ETPC611	PCC	Control System	3	-	-	3	3		3	40	60	-	-	-	100
ETPC612	PCC	Power Electronics	3	-	-	3	3		3	40	60	-		-	100
ETPC612P	PCC	Power Electronics Lab		2				1	1				50		50
ETPE602	PEC	Program Elective Course - II*	2		-	2	2		2	40	60	-	-		100
ETPE602P	PEC	Program Elective Course – II Lab*		2				1	1					25	25
ETPE603	PEC	Program Elective Course - III*	3	-	-	3	3		3	40	60	-	-		100
ETPE603P	PEC	Program Elective Course – III Lab*		2		2		1	1					25	25
ETMD604	MDM	Course IV Embedded Systems	3		-	3	3	-	3	40	60	-	-	-	100
ETMD604P	MDM	Course IV Embedded Systems Lab		2				1	1				50		50
ETVS605	VSEC	Quality Management System - III	-	4	-	4	-	2	2	-	-	25	-	-	25
ETIN605	ELC - INT	Internship - V	4 Weeks					2	2	-	-	25	-	-	25
Total			14	12	0	26	14	8	22	200	300	50	100	50	700



BoS Chairman




Director

ZES's Zeal College of
Engineering & Research
Narhe, Pune - 411041.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

* Program Elective Course – II and III : **Choose any one from the following:**

Course Code	Course Type	Program Elective-II	Course Code	Course Type	Program Elective-III
ETPE602A	PEC	Digital Image Processing	ETPE603A	PEC	Modernized IoT
ETPE602B		Advanced JAVA	ETPE603B		Cloud Computing
ETPE602C		Wireless Communication	ETPE603C		Fiber Optic Communication



BoS Chairman




Director
 ZES's Zeal College of
 Engineering & Research
 Narhe, Pune - 411041.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

INDEX

Sr. No.	Course Code	Course Name	Page No.
Third Year B. Tech. : Semester - V			
1	ETPC508	Digital Communication	
2	ETPC508P	Digital Communication Lab	
3	ETPC509	Electromagnetic Field Theory	
4	ETPC510	Microcontrollers And Applications	
5	ETPC510P	Microcontrollers And Applications	
6	ETPE501	Program Elective Course - I *	
7	ETPE501P	Program Elective Course – I Lab *	
8	ALOE503	Open Elective - III #	
9	ETMD503	Project Management System - II	
10	ETIN504	Internship - IV	
Third Year B. Tech. : Semester - VI			
1	ETPC611	Control System	
2	ETPC612	Power Electronics	
3	ETPC612P	Power Electronics Lab	
4	ETPE602	Program Elective Course - II*	
5	ETPE602P	Program Elective Course – II Lab*	
6	ETPE603	Program Elective Course - III*	
7	ETPE603P	Program Elective Course – III Lab *	
8	ETMD604	Course IV Embedded Systems	
9	ETMD604P	Course IV Embedded Systems Lab	
10	ETVS605	Quality Management System - III	
11	ETIN605	Internship - V	

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

SYLLABUS

SEMESTER - V

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)									Semester: V
Course: Digital Communication Systems									Code: ETPC508
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Basic knowledge of Signals, Analog Communication System									
Course Objectives:									
1. To Compare and contrast various types of digital modulation techniques									
2. To study the variety of source coding techniques.									
3. To study the channel coding theorem & various codes.									
Course Outcomes: After completion of this course, students will able to -									
CO1	A Comparative Study of Digital Modulation Techniques and Their Performance Parameters								
CO2	Apply the statistical theory for describing various signals in a communication system..								
CO3	Choose the best suitable Source coding technique by evaluating various parameters of the system.								
CO4	Analyze a communication system using information theoretic approach								
CO5	Analyze various error detection and correction techniques.								
CO6	Analyze the encoding, decoding, error detection, and error correction processes of BCH codes.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Digital Modulation Techniques: Introduction, Basic Block Diagram OF Digital Modulation, ASK modulator, Coherent and Non-Coherent ASK detector, FSK modulator, Spectrum of FSK, coherent reception, non-coherent detection of FSK. BPSK transmitter, Coherent reception of BPSK, DPSK, QPSK, QAM. Probability of error of error of ASK, FSK, BPSK, and QPSK, QAM Illustrative Problem.								7
2.	Random Processes: Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation and Covariance function, Ergodic processes, Power spectral density. Mathematical Representation of Noise: Some Sources of Noise, Frequency-domain Representation of Noise, Superposition of Noises, Linear Filtering of Noise, Quadrature Components of Noise, Representation of Noise using Orthonormal Coordinates								5
3.	Information theory and Source coding: Information, entropy and its properties, mutual information & its properties,								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	channel capacity. Entropy of binary memory less source and its extension to discrete memoryless source, coding theorem, Shannon Fano coding, HUFFMAN coding	
4.	Spread Spectrum Modulation Use of Spread Spectrum, Direct Sequence (DS) Spread Spectrum, Spread Spectrum and Code Division Multiple Access (CDMA), Ranging Using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Pseudorandom (PN) Sequences: Generation and Characteristics, Synchronization in Spread Spectrum Systems	5
5.	Fundamentals of Linear Block Coding: Systematic codes, and its encoding circuits, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, Decoding circuits, Probability of undetected error for linear block code in BSC, Hamming code and their applications.	7
6.	Channel coding –I: Cyclic and Convolutional Codes: Cyclic codes and its basic properties, Generator & parity check matrix of cyclic codes, encoding & decoding circuits, syndrome computation & error detection, Introduction to BCH codes, encoding & decoding with error detection & correction. Introduction to convolution codes.	7
TOTAL		39
Text Books:		
1. Singh and Sapre, “Communication Systems Analog and Digital” TMH, 2004. 2. J. G. Proakis and M. Salehi, Fundamentals of Communication Systems, Prentice Hall, December 2004. 3. S. Haykin and M. Moher, An Introduction to Analog and Digital Communications, Wiley, January 2006, 2/e.		
Reference Books:		
1. Bernard Sklar, —” Digital Communications - Fundamentals and Applications”, 2nd Edition Pearson Education (Asia) Pvt. Ltd, 2001. 2. Simon Haykin, — Digital Communications, John Wiley and Sons. 3. Andrew J. Viterbi, —CDMA: Principles of Spread Spectrum Communications, Prentice Hall, USA, 1995.		
E-Resources:		
1. NPTEL - Principles of Digital Communications: https://nptel.ac.in/courses/108101113 2. NPTEL - Principles of Communication System Part II : https://nptel.ac.in/courses/108104098 3. NPTEL - Digital Communication using GNU Radio: https://onlinecourses.nptel.ac.in/noc25_ee19/preview 4. Virtual Lab https://www.etti.unibw.de/labalive/index/digitalmodulation/ 2. Link:		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Digital Communication Lab								Code: ETPC508P	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	02	-	-	-	-	50	50
Prerequisites:									
Basic knowledge of Signals, Analog Communication System									
Course Objectives:									
1. To understand digital communication systems and modulation techniques through experiments. 2. To analyze the performance of digital communication systems under various channel conditions. 3. To gain practical experience in coding, multiplexing, spread spectrum, and signal analysis using simulation tools.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Demonstrate the operation of basic digital communication systems.								
CO2	Implement digital modulation and demodulation techniques using hardware and simulation tools.								
CO3	Analyze the effect of noise and channel impairments on communication system performance.								
CO4	Perform error detection and error correction coding experiments.								
CO5	Evaluate spread spectrum and multiplexing techniques for communication applications.								
CO6	Use MATLAB/Simulink and laboratory instruments for communication signal analysis and system verification.								
Laboratory Experiments									
1. To Study of BPSK transmitter & receiver using suitable hardware setup/kit. 2. Performance Analysis of QPSK Signals Using an Experimental Kit. 3. To Study of Error Control Coding suitable hardware setup/kit. 4. Performance Analysis DSSS transmitter and receiver using suitable hardware setup/kit. 5. Performance of any digital modulation scheme using MATLAB Simulink 6. Perform the data formats experiment to analyze waveforms of various data formats Representations. 7. Simulation study of Performance of M-ary QAM. 8. Simulation study of OFDM transmitter & receiver. 9. Simulation Study of CDMA technique. 10. Simulation Study of performance of BPSK receiver in presence of noise 11. Generation of PN sequence using discrete components 12. Performance check of Cyclic Code using MATLAB Editor-based program Any 8 experiments from above list									
Text Books:									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

1. Singh and Sapre, “Communication Systems Analog and Digital” TMH, 2004.
2. J. G. Proakis and M. Salehi, Fundamentals of Communication Systems, Prentice Hall, December 2004.
3. S. Haykin and M. Moher, An Introduction to Analog and Digital Communications, Wiley, January 2006, 2/e.

Reference Books:

1. Bernard Sklar, —” Digital Communications - Fundamentals and Applications”, 2nd Edition Pearson Education (Asia) Pvt. Ltd, 2001.
2. Simon Haykin, — Digital Communications, John Wiley and Sons.
3. Andrew J. Viterbi, —CDMA: Principles of Spread Spectrum Communications, Prentice Hall, USA, 1995.

E-Resources:

1. NPTEL - Principles of Digital Communications: <https://nptel.ac.in/courses/108101113>
2. NPTEL - Principles of Communication SystnPartII :<https://nptel.ac.in/courses/108104098>
3. NPTEL - Digital Communication using GNU Radio: https://onlinecourses.nptel.ac.in/noc25_ee19/preview
4. [Virtual Lab](#)
<https://www.etti.unibw.de/labalive/index/digitalmodulation/> 2. Link:

[**Back to Structure**](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Electromagnetic Field Theory								Code: ETPC509	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	01	04	40	60	-	-	-	100
Prerequisites:									
Engineering Mathematics, Engineering Physics, Basic Electrical Engineering									
Course Objectives:									
1. Apply vector calculus and electromagnetic laws to analyze electrostatic and magneto static fields.									
2. Understand Maxwell's equations and electromagnetic wave propagation.									
3. Apply transmission line theory to analyze wave propagation, impedance matching, and standing waves.									
Course Outcomes: After completion of this course, students will able to -									
Sr. No.	Outcome								
CO1	Explain vector algebra and vector calculus concepts used in electromagnetic field analysis.								
CO2	Apply Coulomb's law and Gauss's law to determine electrostatic field quantities and potentials.								
CO3	Apply Biot–Savart law and Ampere's circuital law to determine magnetostatic field quantities and potentials.								
CO4	Analyze electric and magnetic field boundary value problems using Poisson's and Laplace's equations.								
CO5	Analyze Maxwell's equations and electromagnetic wave propagation in different media.								
CO6	Evaluate transmission line characteristics, impedance matching, and standing wave behavior.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Vector Analysis &Electric Field Basics of Vectors, Coordinate systems: Cartesian, Cylindrical and Spherical, Line, Surface and Volume Integrals, Divergence, Divergence Theorem, Gradient, Curl, Stokes Theorem. Coulomb’s Law & Electric Field Intensity, Gauss Law & its applications, Electric Potential & Potential Gradient, Conservative property of Electric Field, Equipotential surfaces.								8
2.	Magnetic Field Biot-Savart’s Law, Magnetic Field Intensity & Magnetic Flux Density, Amperes Circuital Law, Magnetic Scalar & Vector Potential								6
3.	Boundary Conditions Poisson’s & Laplace’s Equations, Uniqueness Theorem, Capacitance of parallel plate, coaxial, spherical capacitors, Boundary conditions: Dielectric-dielectric,								6

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Dielectric-Conductor, Boundary conditions between magnetic materials.	
4.	Electrodynamic Fields & Maxwell's Equations Faradays law, Displacement current and Displacement current density, Continuity Equation. Maxwell's equations for Time constant fields and Time Varying fields	6
5.	Uniform Plane Wave Wave propagation in free space and in dielectrics. Poynting Vector and power considerations. Propagation in good conductors, skin effect.	6
6.	Transmission Line Waves in transmission line, Line parameters, Transmission line equation & solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Standing Wave Ratio(SWR), Smith Chart, impedance matching	8
TOTAL		39

List of Tutorials

1. Vector Analysis and Coordinate Systems
2. Coulomb's Law and Electric Field Intensity
3. Electric Flux Density, Gauss's Law, and Electric Potential
4. Magnetic Field Intensity and Ampere's Circuital Law
5. Poisson's and Laplace's Equations; Capacitance of Parallel Plate, Coaxial, and Spherical Capacitors
6. Boundary Conditions at Dielectric–Dielectric and Dielectric–Conductor Interfaces
7. Boundary Conditions at Magnetic Material Interfaces
8. Displacement Current, Displacement Current Density, and the Continuity Equation
9. Maxwell's Equations for Time-Varying Electromagnetic Fields
10. Uniform Plane Wave Propagation
11. Transmission Line Parameters and Characteristics
12. Smith Chart Applications and Problem Solving

Text Books:

1. Sadiku M.N.O. and Kulkarni S.V., “Principles of Electromagnetics”, Oxford University Press, 3rd Edition, 2015.
2. Hayt William H. and Buck John A., “Engineering Electromagnetics”, Tata McGraw-Hill Education, 8th Revised Edition.

Reference Books:

1. Kraus J.D. and Fleisch D.A., “Electromagnetics with Applications”, McGraw-Hill International Editions, 5th Edition.
2. Jordan E.C. and Balmain K.G., “Electromagnetic Waves and Radiating Systems”, Prentice Hall of India (PHI), 1964.

E-Resources:

1. NPTEL Course “Transmission Lines and EM Waves -Video course” Prof. R.K. Shevgaonkar Link of the Course: <https://nptel.ac.in/courses/117/101/117101056/2>.
2. NPTEL Course on “Electromagnetic theory - Video course” Dr. Pradeep Kumar K Link of the Course: <https://nptel.ac.in/courses/108/104/108104087/>

Back to Structure

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Microcontroller & Applications								Code: ETPC510	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	02	-	04	40	60	-	-	-	100
Prerequisites:									
Basic knowledge of Digital Logic Design, Electronic Components and Basics of C Language is required									
Course Objectives:									
1. To identify the use, selection criteria, and various types of architectures in microcontrollers for developing embedded system applications. 2. To interpret the internal structure as well as programming using various addressing modes of microcontroller and study of various programming modules of microcontroller. 3. To explain the necessity of microcontroller based programming and development in a real time case.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Relate, classify, compare and describe the role of Microcontrollers in an Embedded System based design applications.								
CO2	Illustrate the internal structure, addressing modes and use of IDE tools for programming 8051 microcontroller.								
CO3	Articulate the necessity of performing various Arithmetic/Logical, and Timer/Counter operations associated with 8051 microcontroller.								
CO4	Illustrate the use of Serial Communication and Interrupts in 8051 microcontrollers.								
CO5	Interface various peripherals to 8051 microcontroller used in real life applications.								
CO6	Determining the basic need of using PIC 18 Microcontroller and identify the use of PIC 18 Microcontroller in embedded system based design applications.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to 8051 Microcontrollers: 8051 Microcontroller: Microprocessor Vs Microcontroller,MCS 51 family, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization.								7
2.	8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.								7
3.	IO Ports and Timers: I/O port structure, Handling I/O ports using								6

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	simple programs , 8051 Timers and Counters – Programming 8051 timers, Counter programming, Programming timers 0 and 1 using C	
4.	8051 Interrupts and serial communication: 8051 Serial Communication- Basics of Serial Data Communication, RS232 standard, Simple Serial Port programming in C to transmit a message and to receive data serially Programming 8051 Microcontroller interrupts: Interrupts Vs polling, Interrupt service routine (ISR) and execution of 8051 interrupts, Interrupt registers and programming various type of interrupts, concept of interrupt priority in 8051.	7
5.	Real world interfacing: Interfacing LEDS, 7-segment multiplexed display, ADC and DAC, temperature sensor interfacing, LCD, DC motor and Stepper motor	6
6.	PIC Microcontrollers: Introduction to PIC Microcontrollers, Architecture and pipelining. Program memory considerations. Addressing modes. CPU Registers. instruction set, simple operation	6
TOTAL		39
Text Books:		
1. Muhammad Ali Mazidi, the 8051 Microcontroller & Embedded System using assembly & C, Pearson Education, 2008. 2. Mazidi, Muhammad Ali, Rolin D. McKinlay, and Janice G. Mazidi. The 8051 Microcontroller: a systems approach. Pearson Higher Ed, 2012. 3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education India, 2009.		
Reference Books:		
1. Ajay V. Deshmukh, Microcontrollers - Theory and Applications, Tata McGraw Hill. 2. Kenneth J. Ayala, the 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, 1996.		
E-Resources:		
1. NPTEL Course on “Introduction to Microcontrollers & Microprocessors” https://nptel.ac.in/courses/117104072 2. NPTEL Course on “Microcontrollers & Microprocessors” https://nptel.ac.in/courses/108105102 3. Data Sheet of 80xx family.		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Microcontroller & Applications Lab								Code: ETPC510P	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	-	50	50
Prerequisites:									
Basic knowledge of Digital Logic Design, Electronic Components and Basics of C Language is required									
Course Objectives:									
1. To understand the architecture and programming of the 8051 microcontroller. 2. To develop interfacing skills for peripheral devices, sensors, and actuators using the 8051 microcontroller. 3. To implement real-time embedded applications using timers, interrupts, serial communication, and control techniques.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Write and execute assembly/C programs for 8051 microcontroller applications.								
CO2	Interface input/output devices such as LEDs, LCDs, and seven-segment displays with the 8051 microcontroller.								
CO3	Implement serial communication, timers, and interrupt-based applications using the 8051 microcontroller.								
CO4	Design and develop sensor-based embedded systems using the 8051 microcontroller.								
CO5	Interface DAC, ADC, stepper motors, and PWM-based control systems for real-time applications.								
CO6	Develop and test embedded system applications using hardware and virtual laboratory environments.								
Laboratory Experiments									
❖ Group A Experiments: (Perform any TWO)									
1. Write a program to perform arithmetic operations (8 bit & 16 bit) using 8051 microcontroller 2. Write a program to perform data transfer and data exchange between two memory blocks using 8051 microcontrollers. 3. Write program to find smallest and largest number 4. Write program to arrange numbers in ascending and descending order									
❖ Group B Experiments: (Perform any THREE) by using embedded C									
1. Interfacing of multiplexed 7-segment display using 8051 microcontrollers 2. Interfacing of 16x2 LCD with 8051 Microcontroller. 3. Interfacing buzzer and relay. 4. Interface any sensor with 8051 Microcontroller and write a program to display sensed values on serial monitor. 5. Generate square wave using timer (with and without using interrupt)									
❖ Group C Experiments: (Perform any THREE)									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|--|
| <ol style="list-style-type: none">1. DAC Interfacing for waveform generation using 8051 microcontrollers.2. Interface analog voltage 0-5V to internal ADC and display value on LCD.3. Write a program to interface a stepper motor for direction control using 8051 microcontrollers.4. Write program for serial communication5. Write program for interrupt handling6. Perform any TWO Virtual Lab experiments. (Compulsory) |
|--|

Text Books:

- | |
|---|
| <ol style="list-style-type: none">1. Muhammad Ali Mazidi, the 8051 Microcontroller & Embedded System using assembly & C, Pearson Education, 2008.2. Mazidi, Muhammad Ali, Rolin D. McKinlay, and Janice G. Mazidi. The 8051 Microcontroller: a systems approach. Pearson Higher Ed, 2012.3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education India, 2009. |
|---|

Reference Books:

- | |
|--|
| <ol style="list-style-type: none">1. Ajay V. Deshmukh, Microcontrollers - Theory and Applications, Tata McGraw Hill.2. Kenneth J. Ayala, the 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, 1996. |
|--|

E-Resources:

- | |
|---|
| <ol style="list-style-type: none">1. NPTEL Course on “Introduction to Microcontrollers & Microprocessors”
https://nptel.ac.in/courses/1171040722. NPTEL Course on “Microcontrollers & Microprocessors”
https://nptel.ac.in/courses/108105102 |
|---|

[**Back to Structure**](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Digital Signal Processing								Code: ETPE501A	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Signals and Systems									
Course Objectives:									
1. Introduction of systems using transforms. 2. Design and implementation of IIR and FIR filters. 3. Design and implementation of signal processing applications.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the role of the Z-transform in digital system analysis.								
CO2	Analyze and resolve the signals using Discrete-Fourier Transform.								
CO3	Analyze and resolve the signals using Fast Fourier Transform.								
CO4	Analyze the characteristics and frequency response of IIR filters.								
CO5	Analyze the characteristics and frequency response of FIR filters.								
CO6	Illustrate the architecture and use of digital signal processors.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Z-Transform: Introduction, Need for Z-Transform, Definition of Z-Transform, Stability and ROC, Properties of ROC, Properties of Z-Transform, The System function, Poles and zeros of System function, stability criterion, Solution of difference equations using Z transform.								07
2.	Discrete-Fourier Transform: Introduction, The Discrete-Fourier Transform, Properties of DFT, Relation of DFT to Fourier Transform, Relation of DFT to the Z-Transform, Linear convolution, Circular convolution, Methods to evaluate Circular Convolution, Computation of linear convolution using circular convolution.								07
3.	Fast Fourier Transform: Introduction, Direct Evaluation of the DFT, The Fast Fourier Transform, decimation in time (DIT) and decimation in frequency(DIF) using Radix-2 FFT algorithm for 4 point and 8 point sequences, Difference and Similarities between DIT & DIF Algorithms, IDFT using FFT Algorithm. Linear filtering using overlap add and overlap save method.								06
4.	Infinite Impulse Response (IIR) Filters: Introduction, analog filter design ,Design of Digital filters from Analog filters, IIR filter design by approximation of backward derivatives, IIR filter design by impulse invariance method, Bilinear transformation method, warping effect. Butterworth filter design. Characteristics of Butterworth filters and								07

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Chebyshev filters, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design.	
5.	Finite Impulse Response(FIR) Filters: Introduction, Characteristics of practical frequency-selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR (low pass and High pass) filters using windows - Rectangular, Bartlett, Hanning, Hamming and Blackman windows, Frequency response of Linear phase FIR filters, Structure for FIR Systems: Direct form and Cascade form, Gibbs phenomenon.	06
6.	Introduction of Processors & applications: Introduction to DSP processor (TMS3200C6713). Speech Processing, Speech Analysis, Speech coding, subband coding, channel vocoder, homomorphic vocoder, digital Processing of audio signals, Radar signal Processing, DSP Based measurement system.	06
TOTAL		39
Laboratory Experiments		
1. Perform any 08 experiment out of 10: 2. Find the z-transform of a given difference equation, compute its pole zero plot and comment on its stability. 3. Compute DFT and IDFT { e.g. $x(n) = \{1,2,3,4\}$ using $N=4$ and $N=8$} 4. Find N-point circular convolution using formula and verify its results. Implement linear filtering using circular convolution. 5. Write a program for Direct form – I, II form realization of the given IIR system function. 6. Implement FIR structures using Direct Form/Cascade/Linear phase structures. 7. Design a Second order band pass Digital Butterworth filter with passband of 200 Hz to 300 Hz and sampling frequency of 2000Hz using Bilinear Transformation. 8. Write a program to demonstrate the time shifting and frequency shifting property of DTFT. 9. Design low pass butter worth digital filter with given specification using impulse invariance method. 10. Implement FIR Filter using fixed-point DSP processor simulation. 11. 10. Write and simulate an assembly program to perform vector multiplication.		
Text Books:		
1. Babu P. Ramesh, “Digital Signal Processing”, Scitech Publisher 4th Edition 2. Kani A Nagoor, “Digital Signal Processing” Tata McGraw Hill 2nd Edition 3. Dr. Shaila Apte, “Advanced Digital Signal Processing”, Wiley India Publication, 4. Proakis John G. / Manolakis D.G. “Digital Signal Processing”; Pearson Education 4th Edition. 5. Mitra Sanjit K, “Digital Signal Processing”, Tata McGraw Hill 3rd Edition.		
Reference Books:		
1. Ifeachor E.C, Jervis B. W, “Digital Signal Processing : Practical approach”, Pearson Publication, 2nd Edition. 2. Chen C. T. “Digital Signal Processing” Oxford University, 2nd Edition 3. Salivahanan S / Gnanapriya “Digital Signal Processing” Tata McGraw Hill 2nd Edition. 4. Oppenheim, Schafer, “Discrete-time Signal Processing”, Pearson Education, 1st Edition. 5. Bose T, “Digital Signal Processing” John Wiley.		
E-Resources:		
NPTEL Course “Digital Signal Processing” https://nptel.ac.in/courses/108106151		

[**Back to Structure**](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Digital Signal Processing Lab								Code: ETPE501AP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	25	-	25
Prerequisites:									
Signals and Systems									
Course Objectives:									
1. To understand the fundamental concepts of digital signal processing and transform techniques.									
2. To analyze and design FIR and IIR digital filters using software tools.									
3. To implement DSP algorithms and processor-based applications for signal processing.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Analyze discrete-time signals and systems using Z-transform, DFT, and DTFT techniques.								
CO2	Compute circular convolution and implement digital filtering operations.								
CO3	Realize FIR and IIR systems using various filter structures.								
CO4	Design digital Butterworth filters using bilinear transformation and impulse invariance methods.								
CO5	Implement DSP algorithms using fixed-point DSP processor simulations and assembly language programming.								
CO6	Evaluate the performance and stability of digital signal processing systems through simulation and experimentation.								
Laboratory Experiments									
1. Perform any 08 experiment out of 10:									
2. Find the z-transform of a given difference equation, compute its pole zero plot and comment on its stability.									
3. Compute DFT and IDFT { e.g. $x(n) = \{1,2,3,4\}$ using $N=4$ and $N=8$ }									
4. Find N-point circular convolution using formula and verify its results. Implement linear filtering using circular convolution.									
5. Write a program for Direct form – I, II form realization of the given IIR system function.									
6. Implement FIR structures using Direct Form/Cascade/Linear phase structures.									
7. Design a Second order band pass Digital Butterworth filter with passband of 200 Hz to 300 Hz and sampling frequency of 2000Hz using Bilinear Transformation.									
8. Write a program to demonstrate the time shifting and frequency shifting property of DTFT.									
9. Design low pass butter worth digital filter with given specification using impulse invariance method.									
10. Implement FIR Filter using fixed-point DSP processor simulation.									
11. 10. Write and simulate an assembly program to perform vector multiplication.									
Text Books:									
1. Babu P. Ramesh, “Digital Signal Processing”, Scitech Publisher 4 th Edition									
2. Kani A Nagoor, “Digital Signal Processing” Tata McGraw Hill 2 nd Edition									
3. Dr. Shaila Apte , “ Advanced Digital Signal Processing”, Wiley India Publication.									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|--|
| <ol style="list-style-type: none">4. Proakis John G. / Manolakis D.G. “Digital Signal Processing”; Pearson Education 4th Edition.5. Mitra Sanjit K, “Digital Signal Processing”, Tata McGraw Hill 3rd Edition. |
|--|

Reference Books:

- | |
|--|
| <ol style="list-style-type: none">1. Ifeachor E.C, Jervis B. W, “Digital Signal Processing : Practical approach”, Pearson Publication, 2nd Edition.2. Chen C. T. “Digital Signal Processing” Oxford University, 2nd Edition3. Salivahanan S / Gnanapriya “Digital Signal Processing” Tata McGraw Hill 2nd Edition.4. Oppenheim, Schafer , “Discrete-time Signal Processing”, Pearson Education, 1st Edition.5. Bose T, “Digital Signal Processing” John Wiley. |
|--|

E-Resources:

NPTEL Course “Digital Signal Processing” https://nptel.ac.in/courses/108106151
--

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Fundamentals of Java Programming								Code: ETPE501B	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Data Structures, Object Oriented Programming concept, Programming Fundamentals.									
Course Objectives:									
1. Apply Java programming concepts to develop object-oriented applications. 2. Implement interfaces, packages, exception handling, and file handling in Java programs. 3. Develop Java applications using multithreading and I/O operations for real-world problems.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the basic principles and object-oriented features of Java programming.								
CO2	Apply classes and objects to design and develop Java applications.								
CO3	Analyze inheritance and polymorphism in Java application development.								
CO4	Analyze the role of interfaces and packages in designing modular Java applications.								
CO5	Apply exception handling techniques to create robust Java applications.								
CO6	Develop multithreaded Java applications for concurrent execution.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Java Programming Java Introduction, Features of Java, Basics of Java Environment, Java Development Kit (JDK), Java Virtual Machine (JVM), Comparison of Java with C++ language, Object Oriented Programming Concepts (Class, Object, Encapsulation, Inheritance, Polymorphism), Java Tokens, Keywords, Data Types, Variables, Input and Output Statements, Command Line Arguments, Building Java Programs, Compiling and Running Java Programs, Operators, Control Statements, Type Conversion and Casting, Example Programs.								7
2.	Classes, Objects, Arrays & Strings Class Fundamentals: Class, Creating Objects, Methods, Method Overloading, Constructors, Constructor Overloading, Static Class Members, Access Modifiers, this Keyword, Argument Passing, Recursion, Wrapper Classes. Arrays: One-Dimensional and Two-Dimensional Arrays, Array Operations. Strings: String Class, StringBuffer Class, Common String Methods, Garbage Collection, Programming Examples.								7
3.	Inheritance and Polymorphism								6

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Inheritance in Java, Types of Inheritance, Defining a Subclass, Member Access Rules, super Keyword, Method Overriding, Runtime Polymorphism, Dynamic Method Dispatch, Abstract Classes, final Keyword, Programming Examples.	
4.	Packages and Interfaces Packages: Creating Packages, defining a Package, Sub-Packages, Access Protection, ClassPath, Importing Packages, User Defined Packages. Interfaces: Defining Interfaces, Implementing Interfaces, Extending Interfaces, Multiple Inheritance using Interfaces, Programming Examples.	7
5.	Exception Handling Introduction to Exceptions, Exception Handling Fundamentals, try Block, catch Block, finally Block, Methods of Exception Class, Multiple catch Statements, Nested try Statements, throw Statement, throws Statement, User Defined Exceptions, Checked and Unchecked Exceptions, Programming Examples.	6
6.	Multithreading and File Handling Introduction to Multithreading, Difference between Process and Thread, Thread Life Cycle, Thread Class, Runnable Interface, Creating Threads, Main Thread, Thread Priorities, Thread Sleep and Join Methods. File Handling and I/O Basics: Introduction to Streams, File Class, Reading Console Input, Writing Console Output, FileInputStream, FileOutputStream, Reading Data from Files, Writing Data to Files, Programming Examples..	6
TOTAL		39
Text Books:		
1. Balagurusamy, E., Programming with Java, Tata McGraw-Hill Publishing House, 6th Edition. 2. Schildt, Herbert, Java: The Complete Reference, Tata McGraw-Hill Publishing House, 7th Edition. 3. Bhaskar, V. Vijaya, Object-Oriented Programming Through Java, SciTech Publishing House.		
Reference Books:		
1. T. Budd, “Understanding OOP with Java”, Pearson Education, 2nd Updated Edition. 2. Y. Daniel Liang (2010), “Introduction to Java programming”, Pearson Education, India. 3. Cay Horstmann, “Core Java Volume 1”, Kindle, 11th Edition.		
E-Resources:		
1) NPTEL Course “Programming in Java” https://nptel.ac.in/courses/106105191 2) SWAYAM Course Portal: https://onlinecourses.nptel.ac.in/noc26_cs36/preview		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Fundamentals of Java Programming Lab								Code: ETPE501BP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	25	-	25
Prerequisites:									
Data Structures, Object Oriented Programming concept, Programming Fundamentals.									
Course Objectives:									
1. To understand the fundamentals of Java programming and object-oriented concepts.									
2. To develop Java applications using classes, inheritance, interfaces, exception handling, and multithreading.									
3. To build file handling and mini-project applications using Java programming techniques.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Develop Java programs using operators, control structures, arrays, and strings.								
CO2	Implement object-oriented concepts such as classes, objects, constructors, method overloading, and inheritance.								
CO3	Design Java applications using packages, interfaces, and polymorphism.								
CO4	Apply exception handling mechanisms to develop robust Java programs.								
CO5	Develop multithreaded and file-handling applications using Java.								
CO6	Design and implement real-world Java-based mini projects to solve practical problems.								
	List of Experiments								
	List of Laboratory Experiments (Any 8) 1. Write Java programs : i) To find factorial of number. ii) To display first N prime numbers. iii) To Calculate sum and average of N numbers. 2. Develop a menu-driven calculator using switch-case to perform: Addition, Subtraction, Multiplication, Division, Factorial. 3. Create a class Rectangle with data members: Length & Width. Implement methods to calculate area and compare the areas of two rectangle objects. 4. Write a Java program to demonstrate the Method Overloading and Constructor Overloading. 5. Write a Java program to: i) Sort an array of integers. ii) Perform basic string operations (length, concatenation, comparison). 6. Write a Java program to perform addition of two matrices. 7. Create a base class Player and derive Cricket Player, Football Player, Hockey Player and demonstrate inheritance and method overriding.								

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	8. Write a Java program to create a user-defined package and access its classes from another Java program. 9. Write a Java program to implement an interface and demonstrate multiple class implementations. 10. Write a Java program to demonstrate: try-catch-finally, throw/throws using suitable examples. 11. Create multiple threads using Thread class and demonstrate concurrent execution. 12. Write a Java program to read data from one text file and write it into another file. 13. A Mini Project in Java: A group of 4 students can develop a small application in Java such as: Student Record System, Library Management, Electricity Bill Calculator, Bank Account Management, Employee Information System. Virtual Lab Link: https://java-iitd.vlabs.ac.in
	Text Books:
	1. Balagurusamy, E., Programming with Java, Tata McGraw-Hill Publishing House, 6th Edition. 2. Schildt, Herbert, Java: The Complete Reference, Tata McGraw-Hill Publishing House, 7th Edition. 3. Bhaskar, V. Vijaya, Object-Oriented Programming Through Java, SciTech Publishing House.
	Reference Books:
	1. T. Budd, “Understanding OOP with Java”, Pearson Education, 2nd Updated Edition. 2. Y. Daniel Liang (2010), “Introduction to Java programming”, Pearson Education, India. 3. Cay Horstmann, “Core Java Volume 1”, Kindle, 11th Edition.
	E-Resources:
	1. NPTEL Course “Programming in Java” https://nptel.ac.in/courses/106105191 2. SWAYAM Course Portal: https://onlinecourses.nptel.ac.in/noc26_cs36/preview

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Elective Course - I *(Computer Network)								Code: ETPE501C	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-		100
Prerequisites:									
Computer Fundamentals, Operating Systems, Programming Basics Data Communication									
Course Objectives:									
1. To introduce various topologies, types, devices and layered models in computer networking. 2. To expose the students to the design issues, standards and protocols at various layers. 3. To discuss the TCP/IP protocol suite.									
Course Outcomes: After completion of this course, students will able to -									
CO1	To Compare different network topologies, types and OSI & TCP/IP reference models.								
CO2	Explain the various roles, characteristics, and protocols of the physical layer and data link layer.								
CO3	Explain network protocols, interfaces, routing algorithms, key design and performance issues in computer networks.								
CO4	Explain the TCP/IP protocol suite, key application layer protocols (DNS, SMTP, FTP, HTTP, SNMP) and fundamental network security principles.								
CO5	Describe the layered structure of TCP/IP and its role in Internet communication.								
CO6	Analysis the roles and functionalities of DNS, SMTP, FTP, HTTP, and SNMP in supporting Internet services such as email communication, file transfer, web browsing, and network management.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction: Computer Networks, Network Hardware, Network Software, OSI & TCP/IP Reference models, Types of Networks, Frame Relay, Introduction to Internet, ATM, Network devices: Hub, Bridge, Repeaters, Switch (Layer 2 & Layer 3), Router & Gateway, Addressing: Physical addresses, Logical addresses, Port Addresses								7
2.	Physical Layer: Data Communication concepts, Wired and Wireless transmission media, Transmission Impairments and Performance, Parallel and Serial Transmission, Switching, Circuit Switching, Packet Switching, and Virtual Circuit Switching,								7
3.	Data Link Control:								6

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Data Link Layer: Data link layer Design Issues, Framing, Error Detection and Correction, Flow Control, Sliding Window Protocols, HDLC, SLIP, and PPP Medium Access Control Sublayer: Channel Allocation, Description and Analysis of ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE LAN Standards: Ethernet(802.3), Gigabit Ethernet, Wireless LAN (802.11), Broadband Wireless (802.16), Bluetooth.	
4.	Network Layer: Design issues, Routing Algorithms- shortest path, distance vector routing, link state routing, flow-based routing, routing for mobile hosts, congestion control- congestion prevention policies-leaky bucket and token bucket algorithm, congestion control in virtual circuit subnet and choke packets. IPv4, IPv6 header format and basic address mode, DHCP	7
5.	TCP/ IP Protocol Suite: TCP/IP and internet, IP protocol and its header format, addressing, subnetting, other network layer protocol — ARP, RARP, ICMP, IGMP, Transport Layer Protocols: TCP, UDP.	6
6.	Application Layer: Domain Name System, SMTP, FTP, HTTP, WWW, SNMP, Multimedia and Cryptography, Security Goals, Types of Attacks, Services and Techniques	6
TOTAL		39
Text Books:		
1. William Stallings, Computer Networking with Internet Protocols and Technology. 2. Behrouz A. Forouzan, TCP/IP Protocol Suite, Forouzan, MGH, Fourth Edition. 3. James F. Kurose, Person, Computer Networking. Fifth Edition.		
Reference Books:		
1. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall 2. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall		
E-Resources:		
https://www.netacad.com/courses/packet-tracer .		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Elective Course - I *(Computer Network) Lab								Code: ETPE501CP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	25		25
Prerequisites:									
Computer Fundamentals, Operating Systems, Programming Basics Data Communication									
Course Objectives:									
1. Understand basic networking concepts, protocols, and topologies. 2. Implement and simulate networking protocols and algorithms. 3. Analyze network performance and security using simulation tools.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Demonstrate interfaces, commands, and network topologies.								
CO2	Implement ARP, bit stuffing, and line coding techniques.								
CO3	Implement and analyze static and dynamic routing.								
CO4	Simulate Stop-and-Wait, Go-Back-N, and Selective Repeat protocols.								
CO5	Apply basic cryptographic techniques for network security.								
CO6	Analyze packet loss, congestion, data rate, and throughput using NS2.								
Laboratory Experiments									
A minimum of 8 experiments should be selected from the list (but not Restricted to) provided below:use any simulation tool/virtual lab for demonstration 1. Illustrate use of EIA 232 STD, DTE, DCE Interface & Bioscom. 2. Demonstrate basic networking commands 3. Implementation and simulation of different topologies. 4. Implementation and simulation of ARP protocol. 5. Implementation and simulation of Bit stuffing concept using C. 6. Implementation and simulation of static routing algorithm 7. Implementation and simulation of dynamic routing algorithm 8. Demonstration of cryptographic techniques 9. Simulation of stop and wait/go back N /Selective repeat protocol 10. Implementation and simulation of line coding schemes 11. Make use of NS2 Simulator-Introduction ii) Simulate to Find the Number of Packets Dropped iii) Simulate to Find the Number of Packets Dropped by TCP/UDP iv) Simulate to Find the Number of Packets Dropped due to Congestion v) Simulate to Compare Data Rate& Throughput									
Text Books:									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|---|
| <ol style="list-style-type: none">1. William Stallings, Computer Networking with Internet Protocols and Technology.2. Behrouz A. Forouzan, TCP/IP Protocol Suite, Forouzan, MGH, Fourth Edition.3. James F. Kurose, Person, Computer Networking. Fifth Edition. |
|---|

Reference Books:

- | |
|---|
| <ol style="list-style-type: none">1. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall2. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall |
|---|

E-Resources:

https://www.netacad.com/courses/packet-tracer .

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

OPEN ELECTIVE - III
(Select any one course from the given Open
Elective Courses)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Open Elective – III (Data Analytics)							Code: ALOE503A		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	-	-	50	50	-	100
Prerequisites:									
Basic knowledge of Mathematics and Statistics, Fundamentals of Computer Science									
Course Objectives:									
1. To introduce the types and applications of data analytics across domains. 2. To apply descriptive statistics and visualization techniques to summarize data. 3. To apply inferential statistics and hypothesis testing for decision-making. 4. To analyze relationships in data using correlation, regression, and ANOVA. 5. To build predictive models using classification and clustering techniques. 6. To familiarize students with prescriptive analytics and Big Data concepts.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Explain the types of data analytics and their applications across domains.								
CO2	Apply descriptive statistics and visualization techniques to summarize data.								
CO3	Analyze data using inferential statistics and hypothesis testing methods.								
CO4	Apply correlation, regression, and ANOVA techniques for data-driven decisions.								
CO5	Design predictive models using classification and clustering approaches.								
CO6	Evaluate prescriptive analytics approaches and Big Data platforms for applications.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Data Analytics: Types of analytics — descriptive, diagnostic, predictive, and prescriptive; Analytics vs. reporting; Key applications across domains: business, healthcare, finance, and marketing; Overview of analytics tools landscape: Excel, Python, R, and Power BI (comparative overview); KPIs and metrics for decision-making.								04
2.	Descriptive Analytics: Frequency distributions, outliers; Measures of central tendency and dispersion; Interquartile range; Skewness and kurtosis; Normal distribution and z-scores; Data visualization principles: bar chart, histogram, box plot, scatter plot, and heat map.								05
3.	Inferential Statistics: Population vs. sample, random sampling; Sampling distribution, standard error; Hypothesis testing: null and alternate hypothesis, z-test, t-test; One-tailed and two-tailed tests; Confidence intervals and level of confidence; Type I and Type II errors.								05

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

4.	Correlation, Regression & ANOVA: Correlation and scatter plots; Simple linear regression, least squares method; Multiple regression; Coefficient of determination (R^2); One-way and two-way ANOVA; Chi-square test of independence.	04
5.	Predictive Analytics: Introduction to predictive modeling; Classification techniques: logistic regression, decision trees; Clustering: k-means; Model evaluation: accuracy, confusion matrix; Time series analysis basics: moving averages, trend analysis.	04
6.	Prescriptive & Big Data Analytics: Prescriptive analytics: optimization and simulation for decision-making; Introduction to Big Data: the 5 V's, sources of big data; Overview of the Big Data ecosystem: Hadoop, Spark (conceptual only); Applications: business analytics, web analytics, and social media analytics.	04
TOTAL		26

Term Work:

Sr. No.	Title	Proposed Tutorial Activities
1	Introduction to Data Analytics	Identify descriptive, diagnostic, predictive, and prescriptive analytics using real-world case studies. Compare Excel, Python, R, and Power BI for analytics tasks.
2	Descriptive Statistics – I	Calculate mean, median, mode, range, variance, and standard deviation using a given dataset in Excel/Python.
3	Descriptive Statistics – II	Detect outliers using IQR and visualize distributions using histograms and box plots.
4	Data Visualization	Create bar charts, scatter plots, heat maps, and box plots. Interpret insights from visualizations.
5	Sampling & Probability	Perform random sampling, calculate standard error, and differentiate between population and sample using datasets.
6	Hypothesis Testing	Perform z-test and t-test for given scenarios and interpret Type I and Type II errors.
7	Correlation & Regression	Calculate correlation coefficients, build simple linear regression models, and interpret R^2 values.
8	ANOVA & Chi-Square	Perform one-way ANOVA and Chi-square tests using statistical software and interpret results.

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

9	Predictive Analytics	Build basic classification models (Logistic Regression/Decision Tree) and perform K-Means clustering using Python.
10	Model Evaluation	Evaluate predictive models using confusion matrix and accuracy metrics.
11	Time Series Analytics	Apply moving averages and identify trends in time-series datasets.
12	Big Data & Prescriptive Analytics	Explore Hadoop and Spark concepts through case studies and discuss optimization-based decision-making.

Text Books:

1. Anil Maheshwari, "Data Analytics", McGraw Hill Education
2. Robert S. Witte and John S. Witte, "Statistics", Wiley Publications
3. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley India

Reference Books:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press

E-Resources:

1. NPTEL Course on "Introduction to Data Analytics" (IIT Madras Track)
Link: nptel.ac.in
2. NPTEL Course on "Data Analytics with Python" (IIT Roorkee Track)
Link: <https://nptel.ac.in/courses/106107220>
3. NPTEL Course on "Business Intelligence & Analytics" (IIT Madras Track)
Link: https://onlinecourses.nptel.ac.in/noc25_cs09/preview
4. NPTEL Course on "Business Analytics for Management Decision" (IIT Kharagpur Track)
Link: <https://nptel.ac.in/courses/110105089>
5. Coursera: "Google Data Analytics Professional Certificate" Link: coursera.org
6. edX: "Data Science: Statistics and Machine Learning" by Harvard University
Link: edx.org

EBooks

1. Allen B. Downey – Think Stats: Exploratory Data Analysis in Python (Open Access)
Link: greenteapress.com
2. EMC Education Services – Data Science and Big Data Analytics (Open Academic Archive)
Link: archive.org

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Open Elective – III (Green Building)							Code: ALOE503B		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	-	-	50	50	-	100
Prerequisites:									
Basic environmental engineering, building materials & construction, engineering chemistry/ environmental science, basic knowledge of energy and sustainability concepts									
Course Objectives:									
1. To equip students with the principles of sustainable building design, resource-efficient construction, and green building practices. 2. To provide students with knowledge of energy-efficient technologies, water and waste management, sustainable materials, and green building rating systems.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Explain the concepts, principles, benefits, and environmental impacts associated with green buildings and sustainable development.								
CO2	Assess building orientation, climate-responsive planning, landscaping, green roofs, and green walls for improving environmental performance.								
CO3	Evaluate building energy consumption and recommend energy-efficient strategies, HVAC optimization, renewable energy systems, and conservation measures.								
CO4	Design suitable water conservation, rainwater harvesting, greywater recycling, waste management, and sustainable drainage solutions for buildings.								
CO5	Select appropriate sustainable building materials and assess indoor environmental quality based on thermal comfort, indoor air quality, lighting, and acoustics.								
CO6	Compare major green building rating systems such as IGBC, GRIHA, and LEED and apply their principles to assess building sustainability.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Green Buildings: Definition, concept, and need of green buildings, Sustainable development principles, Environmental impacts of conventional buildings, Benefits of green buildings.								05
2.	Sustainable Planning & Architecture: Sustainable planning, Orientation and climate-responsive design, Landscape planning, Green roofs and walls.								05
3.	Energy Efficiency in Buildings: Energy consumption in buildings, Energy-efficient building design, HVAC optimization, Renewable energy systems (solar, wind), Energy audit and conservation techniques.								04

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

4.	Water & Waste Management: Water conservation techniques, Rainwater harvesting systems, Greywater recycling, Waste management in buildings, Sustainable drainage systems.	04
5.	Sustainable Materials & Indoor Environmental Quality: Eco-friendly building materials, Low embodied energy materials, Recycled and locally available materials, Indoor air quality (IAQ), Thermal comfort, lighting, and acoustics.	04
6.	Green Building Rating Systems & Regulations: Overview of rating systems: Indian Green Building Council (IGBC) Green Rating for Integrated Habitat Assessment (GRIHA) Leadership in Energy and Environmental Design (LEED)	04
TOTAL		26
Teamwork : (Any 10)		
1. Study any IGBC/GRIHA certified building and identify the sustainable features adopted. 2. Study how sustainable development principles have been implemented in any residential, commercial, or institutional building. 3. Study a construction project and identify its environmental impacts. Suggest green alternatives to reduce these impacts. 4. Analyze building designed using passive architectural principles. 5. Study the site planning of a green campus, township, or commercial complex. 6. Study an existing building incorporating green roofs or vertical gardens. 7. Study an energy-efficient building and identify passive design strategies adopted. 8. Study a building utilizing renewable energy systems and evaluate their benefits. 9. Analyze an energy audit report (or published case study) and summarize the recommended energy-saving measures. 10. Study water conservation measures implemented in any green building. 11. Study a residential or institutional building with rainwater harvesting and grey water reuse systems. 12. Study the waste management practices of a smart city, residential township, or institutional campus. 13. Study a building that has extensively used sustainable building materials. 14. Perform a literature review on the life cycle assessment of one construction material. 15. Study an office, hospital, educational building, or green building focusing on indoor environmental quality improvements. 16. Compare two certified buildings, each evaluated under different rating systems (e.g., IGBC vs LEED or GRIHA vs IGBC) 17. Study the certification journey of an IGBC or GRIHA certified building.		
Text Books:		

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

1. K.S. Jagadeesh, "Alternative Building Materials and Technologies", New Age International.
2. C.J. Kibert, "Sustainable Construction: Green Building Design and Delivery", Wiley.
3. Charles J. Kibert, "Green Buildings: Principles and Practices", Island Press.

Environmental Legislations & Standards:

Indian Regulations

1. Environment (Protection) Act, 1986
2. Energy Conservation Act, 2001
3. National Building Code (NBC) of India
4. Eco-Niwas Samhita (Energy Conservation Building Code – Residential)

Standards & Guidelines

1. Energy Conservation Building Code (ECBC)
2. GRIHA & IGBC rating guidelines
3. LEED certification standards
4. Bureau of Energy Efficiency (BEE) norms

Reference Books:

1. O.H. Koenigsberger, "Manual of Tropical Housing and Building", Orient BlackSwan
2. G.Z. Brown and Mark DeKay, "Sun, Wind & Light", Wiley
3. Laurie Baker, "Building with Earth", Centre for Science and Environment
4. Indian Green Building Council, "IGBC Manuals and Guidelines", CII – Indian Green Building Council

E-Resources:

1. Indian Green Building Council - <https://igbc.in>
2. Green Rating for Integrated Habitat Assessment - <https://grihaindia.org>
3. U.S. Green Building Council - <https://usgbc.org>
4. NPTEL Green Building courses - <https://nptel.ac.in>
5. Ministry of Environment, Forest and Climate Change - <https://moef.gov.in>

[**Back to Structure**](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Open Elective – III (Electrical Mobility)							Code: ALOE503C		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	-	-	50	50	-	100
Prerequisites:									
Basic Electrical and Electronics Engineering.									
Course Objectives:									
1. To apply fundamental principles of electric mobility to interpret EV architectures, components and applications. 2. To utilize energy storage and battery management concepts to evaluate battery performance, charging, and safety. 3. To implement basic concepts of EV powertrains, electric drives, regenerative braking, and charging infrastructure. 4. To integrate smart charging, vehicle-to-grid, IoT, and emerging technologies for sustainable electric mobility.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Explain the concepts, architecture, and applications of Electric and Hybrid Electric Vehicles.								
CO2	Identify the suitable energy storage systems used in electric vehicles.								
CO3	Illustrate battery charging methods, battery management systems, and SoC estimation techniques.								
CO4	Interpret hybrid powertrain configurations, operating modes, and regenerative braking.								
CO5	Demonstrate the use of electric drives, charging levels, charging standards, and EV charging equipment.								
CO6	Describe EV charging technologies and grid integration concepts such as G2V, V2G, V2H, V2B, and V2V.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Electric Mobility: Need for electric mobility, evolution of EVs, advantages and challenges, environmental and economic aspects, EV vs conventional vehicles, types of EVs: BEV, HEV, PHEV and fuel-cell vehicles, basic EV architecture and major components.								04
2.	Energy Storage Systems: Energy storage requirements, battery terminology and specifications, Li-ion batteries and their types, basic battery characteristics, battery alternatives: solid-state, Aluminium-air, fuel cell and supercapacitor, battery–supercapacitor hybrid system, selection of energy storage system.								04
3.	Battery Charging and Management:								05

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	EV charging basics, AC and DC charging, charging methods and levels, charging time and factors affecting charging, Battery Management System (BMS), functions of BMS, State of Charge (SoC), State of Health (SoH), State of Power (SoP), cell balancing, battery thermal management and safety.	
4.	EV Powertrain and Electric Drives: EV powertrain architecture, energy flow in EVs, vehicle performance and basic tractive effort, electric motors used in EVs: BLDC and PMSM, motor selection, basic drive control, regenerative braking and its benefits.	04
5.	EV Charging Infrastructure: EV charging infrastructure, charging levels, AC/DC chargers, EVSE, charging connectors and standards: CCS, CHAdeMO, SAE J1772, Bharat AC/DC, basic charging station components, installation and safety considerations.	04
6.	Smart and Emerging Electric Mobility: Grid-to-Vehicle (G2V), Vehicle-to-Grid (V2G), Vehicle-to-Home (V2H), Vehicle-to-Building (V2B), Vehicle-to-Vehicle (V2V), smart charging, wireless charging, battery swapping, energy management, IoT and digital technologies in EVs, future trends and challenges.	05
TOTAL		26

Teamwork :

1. Study the architecture of an Electric Vehicle (EV) and identify the functions of major components such as battery, BMS, motor, inverter, charger, controller and sensors.
2. Compare 3–5 EVs available in India based on battery capacity, motor power, driving range, charging time, efficiency, cost and other key specifications.
3. Study and compare different energy storage technologies such as Li-ion batteries, solid-state batteries, fuel cells and supercapacitors based on energy density, charging time, life, cost, safety and applications.
4. Visit an EV charging station and study the charger type, AC/DC charging, charging level, connector/standard, power rating, and charging time and safety provisions.
5. Prepare a basic layout of an EV charging station showing charging points, power supply, protection system, parking area, cable routing, safety provisions and user facilities.
6. Study smart EV charging and Vehicle-to-Grid (V2G) concepts, including G2V, V2G, V2H and V2B, and identify their applications in smart grids and buildings.
7. Collect and analyze EV performance or charging data using Excel/Python/MATLAB and study parameters such as battery capacity, range, charging time and energy consumption.
8. Design a conceptual IoT-based EV monitoring system showing sensors, communication network, cloud platform and user interface for monitoring SoC, temperature, charging status and energy consumption.
9. Study regenerative braking in EVs and prepare an energy-flow diagram. Analyze energy recovery under different braking conditions using numerical calculations or simulation.
10. Study an emerging EV technology such as battery swapping, wireless charging, solid-state batteries, autonomous EVs, solar charging or second-life batteries and evaluate its technical, economic and environmental benefits.

Text Books:

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

1. James Larminie and John Lowry, "Electric Vehicle", John Wiley & Sons, 2012.
2. Ronald K. Jurgan, "Electric and Hybrid-Electric Vehicles", SAE International.
3. K. T. Chau, "Energy Systems for Electric and Hybrid Vehicles", The Institution of Engineering and Technology.
4. D. A. J. Rand, R. Woods, and R. M. Dell, "Batteries for Electric Vehicles", Research Studies Press Ltd., New York, John Wiley & Sons.
5. "Electric & Hybrid Vehicles – Design Fundamentals", CRC Press.

Reference Books:

1. Mehrdad Ehsani, Yimin Gao, and Ali Emadi, "Modern Electrical Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.
2. Junwei Lu and Jahangir Hossain et al. (Eds.), "Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid", IET Digital Library.
3. Tom Denton, "Automobile Electrical and Electronic Systems", SAE International Publications.
4. C. Mi, M. A. Masrur, and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
5. Mark Warner, "The Electric Vehicle Conversion Handbook", HP Books, 2011.

E-Resources:

1. <https://www.theiet.org/resources/books/transport/vehicle2grid.cfm>
2. <https://www.sae.org/publications/books/content/pt-143.set/>
3. <http://nptel.ac.in/courses/108103009/>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Open Elective – III (Introduction to Stock Market)							Code: ALOE503D		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	-	-	50	50	-	100
Prerequisites:									
• Basic knowledge of economics and financial systems. • Familiarity with percentage calculations and simple mathematics. • Interest in investing and financial markets.									
Course Objectives:									
1. To understand the structure and functioning of financial and stock markets along with investor psychology. 2. To apply candlestick patterns and indicators for identifying market trends. 3. To understand the fundamentals of option trading and option pricing concepts. 4. To develop short-term and long-term investment strategies using fundamental and technical analysis.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Explain the functioning of financial markets using fundamental analysis								
CO2	Analyze stock price movements using candlestick patterns for trading decisions.								
CO3	Analyze stock price movements using technical indicators for trading decisions.								
CO4	Describe the concepts of derivatives and option trading.								
CO5	Apply the strategies for option trading.								
CO6	Apply investment strategies based on market analysis.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Fundamental Analysis and Investor Psychology: Introduction to Financial Markets, Primary and Secondary Markets, Market Participants, Stock Exchanges, SEBI and Regulatory Framework, Investment vs Trading, Understanding Business Models, Reading Financial Statements (Balance Sheet, Profit & Loss Account, Cash Flow Statement), Fundamental Ratios (EPS, PE Ratio, PB Ratio, ROE, ROCE, Debt-Equity Ratio), Sector Analysis, Economic Indicators, Investor Psychology, Market Emotions (Fear & Greed), Behavioral Biases, Risk Management Principles.								06
2.	Technical Analysis using Candlestick Charts: Introduction to Technical Analysis, Dow Theory, Support and Resistance, Trend Analysis, Price Action Concepts Candlestick Anatomy: Single Candlestick Patterns (Doji, Hammer, Shooting Star, Marubozu, Spinning Top), Double Candlestick Patterns (Bullish & Bearish								04

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Engulfing, Harami, Piercing Pattern, Dark Cloud Cover), Triple Candlestick Patterns (Morning Star, Evening Star, Three White Soldiers, Three Black Crows), Gap Analysis, Trend Reversal and Continuation Patterns.	
3.	Technical Analysis using Indicators: Technical Indicators : Moving Averages (SMA, EMA), MACD, RSI, Stochastic Oscillator, Bollinger Bands, VWAP, ADX, ATR, Volume Analysis, Fibonacci Retracement, Pivot Points, Trend Confirmation, Indicator-Based Trading Strategies, Combining Multiple Indicators, Entry and Exit Rules, Backtesting Concepts.	04
4.	Introduction to Derivatives and FNO: Introduction to Derivatives, Futures and Options, Types of Options (Call and Put), Option Terminology (Strike Price, Expiry, Premium, Lot Size, Open Interest), Intrinsic and Time Value, ITM, ATM, OTM Options, Option Chain Analysis, Greeks (Delta, Gamma, Theta, Vega, Rho - Basic Concepts), Option Pricing Factors, Option Expiry and Settlement Process.	04
5.	Introduction to Option Trading Strategies: Option Buying vs Option Selling, Risk and Reward Analysis, Long Call, Long Put, Covered Call, Cash Secured Put, Bull Call Spread, Bear Put Spread, Bull Put Spread, Bear Call Spread, Iron Condor (Basic Concept), Straddle and Strangle (Introduction), Position Sizing, Stop Loss Techniques, Capital Management, Risk Management in Options Trading.	04
6.	Short-Term and Long-Term Trading & Investment Strategies: Swing Trading, Positional Trading, Intraday Trading (Overview), Momentum Trading, Breakout Trading, Trend Following Strategies, Portfolio Building, Value Investing, Growth Investing, Dividend Investing, SIP in Equity, Asset Allocation, Diversification, Trading Plan Development, Trading Journal, Performance Evaluation, Common Mistakes Made by Traders and Investors, Ethics in Financial Markets.	04
Total		26

Term Work:

Perform Any 10:

Sr No	Title	Proposed Activities
1	Stock Market Basics & Trading Platform	Introduction to NSE & BSE, SEBI, Demat & Trading Accounts, Market Participants, Creating a Paper Trading Account.
2	Fundamental Analysis – I	Reading Financial Statements, EPS, PE Ratio, Book Value, Market Capitalization, Sector Analysis
3	Fundamental Analysis – II & Investor Psychology	Company Comparison, Economic Indicators, Market Cycles, Fear & Greed, Trading Discipline

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

4	Candlestick Analysis – I	Candlestick Anatomy, Doji, Hammer, Shooting Star, Marubozu, Trend Identification
5	Candlestick Analysis – II	Bullish/Bearish Engulfing, Morning Star, Evening Star, Support & Resistance using Charts
6	Technical Indicators – I	SMA, EMA, Volume Analysis, Trend Identification using TradingView
7	Technical Indicators – II	RSI, MACD, Bollinger Bands, VWAP, Indicator-based Entry & Exit
8	Option Trading Fundamentals	Call & Put Options, Strike Price, Premium, Expiry, Option Chain Analysis
9	Option Buying Strategies	Long Call, Long Put, Break-even Calculation, Risk & Reward Analysis
10	Option Selling Strategies	Covered Call, Cash Secured Put, Bull Call Spread, Bear Put Spread
11	Short-term Trading Strategies	Intraday (Concept), Swing Trading, Breakout Trading, Risk Management
12	Long-term Investment Strategies	Value Investing, Growth Investing, Dividend Investing, Portfolio Diversification

Students should spend most of the session on:

- Live chart analysis using TradingView or similar platforms.
- Analyzing real companies using NSE/BSE financial data.
- Paper trading (no real money involved).
- Maintaining a trading journal.
- Presenting and reviewing trading decisions.

Reference Books:

1. John J. Murphy, "Technical Analysis of the Financial Markets", Pearson.
2. Benjamin Graham, "The Intelligent Investor", Harper Business.
3. Martin J. Pring, "Technical Analysis Explained", McGraw-Hill.
4. Sheldon Natenberg, "Option Volatility and Pricing", McGraw-Hill.
5. Aswath Damodaran, "Investment Valuation", Wiley.
6. Alexander Elder, "Trading for a Living", Wiley.

E-Resources:

1. National Stock Exchange (NSE) Learning Portal – <https://www.nseindia.com> learn tab
2. Bombay Stock Exchange (BSE) Investor Education – <https://www.bseindia.com>
3. SEBI Investor Education – <https://investor.sebi.gov.in>
4. NISM (National Institute of Securities Markets) – <https://www.nism.ac.in>
5. Zerodha Varsity – <https://zerodha.com/varsity>
6. Investopedia – <https://www.investopedia.com>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Open Elective – III (Patent Law for Engineers and Scientists)							Code: ALOE503E		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	-	-	50	50	-	100
Prerequisites:									
Basic understanding of engineering/scientific concepts and technological innovation, Basic skills in technical reading, documentation, and report writing.									
Course Objectives:									
1. To understand the importance of Intellectual Property Rights (IPR) and patents. 2. To identify patentable and non-patentable inventions based on patentability criteria. 3. To conduct prior-art and patent searches using public patent databases. 4. To draft a basic patent specification, including claims and abstract. 5. To understand and apply the complete patent filing, examination, and granting process in India. 6. To analyze engineering case studies involving patents, innovation, and commercialization.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Apply the provisions of the Indian Patent Law to engineering inventions.								
CO2	Perform prior-art and patent searches using standard patent databases.								
CO3	Analyze the patentability, filing, examination, and grant process under the Indian Patent Act.								
CO4	Evaluate patent infringement, licensing, technology transfer, and commercialization issues.								
CO5	Draft a patent specification, including claims and abstract, in compliance with patent law.								
CO6	Develop a patent application for an innovative engineering solution following legal and procedural requirements.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Intellectual Property Rights and Patents: Introduction to Intellectual Property Rights (IPR), significance of IPR in engineering, innovation and entrepreneurship, types of IPR, concept and objectives of patents, patentability criteria (novelty, inventive step and industrial applicability), patentable and non-patentable inventions under the Indian Patent Act, 1970, patents versus research publications and products, role of patents in technology commercialization and startup ecosystem. Case Study: Patentability analysis of a simple engineering innovation.								05
2.	Indian Patent Law and Prior-Art Search: Overview of the Indian Patent Act, 1970 and its amendments, objectives and scope of patent law, rights and duties of inventors, overview of WIPO, Patent Cooperation Treaty (PCT) and international patent systems, prior-art search techniques, patent classification systems, patent search using Google Patents,								04

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	InPASS, Espacenet, and WIPO PATENTSCOPE novelty assessment and patent landscape analysis. Case Study: Prior-art search and novelty analysis of an engineering invention.	
3.	Patent Drafting: Structure and components of a patent specification including title, field of invention, background, prior art, problem statement, objectives, summary of invention, brief description of drawings, detailed description, claims, abstract, and drawings. Principles of claim drafting, dependent and independent claims, patent drafting guidelines, common drafting errors, and patent documentation for engineering innovations. Case Study: Drafting of a patent specification for a smart engineering product.	05
4.	Patent Filing, Examination and Grant: Patent filing procedure in India, provisional and complete specification, online filing process, statutory forms, publication of patent application, request for examination, First Examination Report (FER), response to objections, hearing process, patent grant, renewal, restoration, opposition, and maintenance of patents under the Indian Patent Act. Case Study: Patent filing and grant timeline of an Indian engineering patent.	04
5.	Patent Commercialization and Legal Issues: Patent ownership, licensing, assignment, technology transfer, patent valuation, startup and university patents, patent infringement, remedies and dispute resolution, freedom-to-operate (FTO), patent analytics, commercialization strategies, and ethical issues in patent protection. Case Study: Commercialization of a patented engineering innovation.	04
6.	Emerging Technologies and Patent Case Studies: Patents in Artificial Intelligence, Machine Learning, Internet of Things (IoT), Robotics, Semiconductor Technology, Biotechnology, Software, Green Technologies, and Industry 4.0, AI-generated inventions, recent developments in patent law, international patent trends, patent portfolio management, and innovation-driven entrepreneurship. Case Study: Analysis of landmark patent disputes such as Apple vs Samsung or an Indian engineering innovation, along with preparation of a basic patent draft for an engineering solution.	04
Total		26
Term Work:		
Students shall complete the following practical, activity-oriented assignments based on a selected engineering innovation/project: 1. Identify suitable IP protection for an engineering innovation and assess basic patentability criteria. 2. Conduct patent searches using Google Patents, IP India, WIPO PATENTSCOPE and Espacenet and analyze the novelty of the selected innovation. 3. Identify a copyrightable work such as software, technical content or digital work and prepare/undertake the copyright registration process.		

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

4. Develop a product/start-up brand, conduct trademark search, identify the appropriate class and prepare a basic trademark application.
5. Identify protectable visual features of an engineering product, conduct design search and prepare a basic design registration application.
6. Prepare a basic patent specification including title, background, objectives, description, drawings, abstract and claims for an engineering innovation.
7. Prepare a mock provisional/complete patent application and study the filing, publication, examination, FER, response and grant process in India.
8. Study the PCT route and prepare a mock PCT application based on the selected engineering invention.
9. Analyze patents in a selected emerging technology area and identify major patent holders, technology trends and basic FTO considerations.
10. Develop an IP portfolio for the selected innovation covering patent, copyright, trademark/design and propose a basic commercialization strategy.

Text Books:

1. P. Narayanan, "Patent Law", Eastern Law House.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw-Hill.
3. N. S. Gopalakrishnan and T. G. Agitha, "Principles of Intellectual Property", Eastern Book Company.
4. Government of India, "The Patents Act, 1970 (as amended) and The Patents Rules, 2003 (as amended)", Government of India.

Reference Books:

1. David Pressman, "Patent It Yourself", NOLO Publications.
2. WIPO, "WIPO Intellectual Property Handbook: Policy, Law and Use", World Intellectual Property Organization.
3. Indian Patent Office, "Manual of Patent Office Practice and Procedure", Office of the Controller General of Patents, Designs & Trade Marks (CGPDTM), Government of India.
4. Alexander I. Poltorak and Paul J. Lerner, "Essentials of Intellectual Property", John Wiley & Sons.

E-Resources:

1. **Patent Law for Engineers and Scientists – NPTEL (IIT Madras):**
<https://nptel.ac.in/courses/110106081>
7. **Intellectual Property – NPTEL (IIT Madras):** <https://nptel.ac.in/courses/109106137>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. Mechanical/R&A/Electrical/ECE/E&TC								Semester: V	
Course: Project Management System – II								Code: ETMD503	
Teaching Scheme (Hrs /week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	25	-	-	25
Prerequisites:									
Project Management System - I									
Course Objectives:									
1. Curate all project tasks to meet the needs of the company, consumers, and stakeholders. 2. Schedule and divide different tasks and work among team members. 3. Set the quality standard in a project. 4. Able to use various PMS Software’s as per specific domain									
Course Outcomes: After completion of this course, students will able to -									
CO1	To be aware with lifecycle models of project management.								
CO2	To perform feasibility analysis and apply CPM & PERT Techniques.								
CO3	To understand project audit methodologies and scrum scheduling using Delphi Technique.								
CO4	Learn various project management software’s like JIRA, MSP, Teamwork.com, Trello etc.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	UNIT I: Project Life cycle Management Traditional project activity planning, agile project planning, coordination through integration management, project feasibility analysis, estimating project budget, project risk management, CPM, PERT, resource loading, resource leveling								08
2.	UNIT II: Project execution Planning-monitoring-controlling cycle, earned value analysis, agile tool for tracking project, methods of project controlling, project audit, essentials of audit, evaluation, project closure, benefit realization, change management.								08
3.	UNIT III: Industry trends and software’s in project management Enterprise project management, project success factor, standish factor of success, talent triangle, project governance, Change management, PMI’S code of conduct, software for project management, simulations software for project management.								10
TOTAL								26	
Text Books:									
1. Gary Richard Son, Brad Jackson, "Project Management Theory & Practice" CRC Press. 2. John M. Nicholas, Herman Steyn, "Project Management for business engineering and technology", Elsevier.									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

3. Arun Kanda, "Project Management: A Lifecycle Approach", PHI.

Reference Books:

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", Project Management Institute.
2. B. B. Goel, "Project Management: Principles and Techniques", Deep & Deep Publications Pvt. Ltd.

E-Resources:

1. Dr. Nimisha Singh, "Introduction to Project Management: Principles & Practices", NPTEL Course - https://onlinecourses.swayam2.ac.in/imb25_mg167/preview
2. Prof. Raghu Nandan Sengupta, "Project Management", NPTEL Course - https://onlinecourses.nptel.ac.in/noc25_mg78/preview
3. Project management for beginners by Ramesh Kumar
https://youtu.be/gnkjcRDQkw0?list=PLLy_2iUCG87CBuNhvti0h6W54ZmqrSDJ

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)						Semester: V			
Course: Internship – IV						Code: ETIN504			
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	-	-	02	-	-	25	-	-	25
Preamble:									
Internships serve as vital educational and career development experiences, offering practical exposure in a specific field. Employers seek individuals who possess the necessary skills and an understanding of industry environments, practices, and cultures. This internship is designed as a structured, short-term, supervised training program, often centered on specific tasks or projects with clear timelines. The primary goal is to immerse technical students in an industrial setting, providing experiences that cannot be replicated in the classroom. This exposure aims to develop competent professionals who understand the social, economic, and administrative factors influencing the operations of industrial organizations.									
Course Objectives:									
1. Exposure to students to the industrial environment, which cannot be provided in the classroom and hence creating deployable professionals for the industry. 2. Learn to implement the technical knowledge in real industrial situations.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Gain exposure to industry practices and understand how academic concepts are applied in professional settings.								
CO2	Develop and demonstrate effective communication and teamwork skills within a work environment.								
CO3	Improve your problem-solving and time management skills by working in real-world industry settings.								
Internship Requirements									
1. Internship Duration: It is mandatory for all students to undergo an internship after every semester during vacations for the duration of 3 to 5 weeks. Internships completed during this period will be considered for the assessment of Term Work (TW). 2. Internship Opportunities: Students can explore various opportunities for internships at: a. Industries b. Research labs or organizations c. Collegiate clubs d. In-house research projects e. Online internships 3. Support and Assistance: Students can seek assistance for securing internships from: a. The Training and Placement cell, along with departmental coordinators b. Department or institute faculty members c. Personal contacts d. Directly connecting with industries or organizations 4. Request Letter: Once an industry, research organization, or collegiate club is identified,									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

students must obtain a request letter from the concerned department or placement office. This letter, in the standard format must be duly signed by the authority, should be addressed to the HR manager or relevant authority.

5. **Confirmation Letter:** Students must submit the confirmation letter from the industry, research organization, or collegiate club to the Internship Coordinator and the Head of Department (HOD) office.
6. **Joining Report:** Upon commencing the internship, students must submit the joining report, joining letter, or a copy of the confirmation email to the Internship Coordinator and the HOD office.
7. **Faculty Mentor:** A faculty member will be assigned as a mentor to a group of students. The mentor will be responsible for monitoring, evaluating, and assessing student internship activities. The faculty mentor is also required to visit the internship location and submit formal feedback to the Internship Coordinator.
8. **Faculty Visits:** Faculty members are advised to visit the internship site once or twice during the internship period to monitor progress.
9. **Progress Report:** Students must submit progress report fortnightly to their faculty guide and the final internship report to the Internship Coordinator and department office.
10. **Evaluation Report:** After the completion of the internship, the mentor, along with the assessment panel members, should submit the evaluation report of the students to the department office and the Internship Coordinator.
11. **Internship Certificate:** Students must receive the Internship Certificate from the industry and submit it to the Internship Coordinator and department office.
12. **Presentation and Assessment:** Students are required to give a presentation on their internship work as part of the term work. The internship diary and report will also be verified and assessed.

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

SYLLABUS

SEMESTER - VI

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)									Semester: VI
Course: Control Systems									Code: ETPC611
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	01	04	40	60	-	-	-	100
Prerequisites: Engineering Mathematics, Network Analysis and Synthesis, and Laplace Transforms									
Course Objectives:									
1. To introduce the fundamental concepts of control systems and develop mathematical models for electrical and mechanical systems using transfer functions, block diagrams, and modern state-space representations. 2. To enable the analysis of system stability, time-domain performance, and steady-state errors using both classical and modern control system techniques. 3. To familiarize students with the design and implementation of controllers and advanced control strategies tailored for industrial automation and modern engineering applications.									
Course Outcomes:									
CO1	Apply fundamental concepts of control systems to identify system elements and develop mathematical models of electrical and mechanical systems using transfer function, block diagram, and signal flow graph techniques.								
CO2	Analyze time domain responses of first and second order control systems to standard test inputs and evaluate steady-state errors to assess system performance.								
CO3	Formulate and analyze state-space models of control systems and perform conversion between state-space and transfer function representations to evaluate system stability.								
CO4	Analyze the stability of control systems using Routh-Hurwitz criterion and root locus techniques by examining pole-zero locations in the s-plane.								
CO5	Analyze frequency response characteristics of control systems using Bode and polar plots and determine stability margins such as gain margin and phase margin.								
CO6	Analyze and apply conventional and modern control techniques, including P, PI, PID controllers, PLC, IoT-based automation, digital, adaptive, and fuzzy logic control systems for industrial automation and process control applications.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to control Systems: Basic Elements of Control System, Open loop and Closed loop systems, Concept of feedback and automatic control, Transfer function of Electrical, Mechanical (translational & rotational)systems: Mathematical model, Block diagram reduction and Signal flow graph techniques.								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

2.	Time Domain Analysis: Standard test inputs and system response, Transient analysis of first and second order systems. Time domain specifications of second order system for step response, Error Analysis: Steady state errors in control systems due to step, ramp and parabolic inputs. Concept of system types and error constants.	6
3.	Stability Analysis: Characteristic equation of a system, Effect of pole locations in the s plane on stability and response, Impact of pole placement on system performance, concept of stability: absolute stability, relative stability, Routh-Hurwitz stability criterion, Root locus: definition, magnitude and angle conditions, construction of root locus, concept of dominant poles, effect of addition of pole and zero on root locus. Application of root locus for stability analysis	7
4.	Frequency domain analysis: Frequency response and frequency domain specifications, correlation between time domain and frequency domain specifications, Construction of Polar plot and Bode plot, gain crossover frequency, phase crossover frequency, gain margin, phase margin and stability analysis. Concept of Nyquist Criterion.	7
5.	State Variable Analysis Introduction to state variable, General state space representation, State space representation of Electrical and Mechanical systems. Conversion between state space and transfer function. Alternative representations in state space: (Phase variable, canonical, parallel & cascade). Similarity transformations, diagonalizing a system matrix. Laplace Transform solution of state equation, stability in state space	6
6.	Controllers and Modern Control Systems: Basics of controllers, P, PI, PID controllers, tuning of controllers- Zeigler-Nicholas method, Programmable Logic Controller (PLC) and IoT based Industrial Automation - Introduction, Block diagram, working principles and its need, Digital Control Systems, Adaptive Control Systems, Fuzzy logic Control Systems.	6
TOTAL		39

List of Tutorials:

1. Determine transfer function of Electrical, Mechanical System using mathematical model.
2. Find the overall transfer function of the given control system using block diagram algebra.
3. Find the overall transfer function of the given control system using signal flow graph.
4. Determine the time domain specifications of a unity feedback control system for standard test inputs.
5. Determine the steady-state error of a unity feedback control system for standard test inputs.
6. Determine the stability of a system using Routh–Hurwitz criterion, find the marginal value of

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

gain K , and calculate the frequency of sustained oscillations.

7. Construct the root locus and comment on the stability.
8. Find frequency domain specifications of the system.
9. Analyze the stability of a control system using Bode plot by determining gain margin, phase margin, and crossover frequencies.
10. Find stability of the system using Nyquist Criteria.
11. Write State space model of the system and solution.
12. Find State Transition Matrix for given system and verify the properties of the same.

Text Books:

1. N. J. Nagrath and M. Gopal, Control System Engineering, New Age International Publishers, 5th Edition.
2. K. Ogata, Modern Control Engineering, Prentice Hall India Learning Private Limited; 5th Edition.

Reference Books:

1. Benjamin C. Kuo, Automatic control systems, Prentice Hall of India, 7th Edition.
2. M. Gopal, Control System Principles and Design, Tata McGraw Hill, 4th Edition
3. John J. Dazzo and Constantine H. Houpis, Linear Control System Analysis and Design, Tata McGraw-Hill, Inc
4. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Addison Wesley
5. Jitendra R. Raol, Ramakalyan Ayyagari, "Control Systems Classical, Modern, and AI-Based Approaches", CRC Press, 1st Edition.

E-Resources:

1. NPTEL Course Control System, <https://nptel.ac.in/courses/107/106/107106081/>
2. MIT OpenCourseWare – Control Systems (Lecture notes & videos)
https://ocw.mit.edu/courses/2-04a-systems-and-controls-spring-2013/resources/mit2_04as13_lecture1/

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Power Electronics								Code: ETPC612	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Basic Electronics									
Course Objectives:									
1. To introduce different power Devices viz. SCR, GTO, MOSFET and IGBT with construction, characteristics, repetitive and non-repetitive ratings.									
2. To understand working, design and performance analysis of various power converter circuits such as ac to dc converter, inverters and choppers.									
3. To design various protection circuits for power circuits.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Analyze the operation, characteristics, ratings, triggering, and commutation of SCR, MOSFET, GTO, and IGBT devices.								
CO2	Analyze single-phase and three-phase AC–DC converters with PWM control.								
CO3	Design and analyze inverter circuits and PWM techniques.								
CO4	Design and evaluate DC–DC converters and MPPT systems.								
CO5	Design protection circuits and evaluate EMI/EMC issues in power electronic systems.								
CO6	Apply power electronic converters in drives, EVs, and solar energy systems.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	POWER DEVICES:- construction of SCR, VI and switching characteristics. Construction, working and VI and switching charecristics of MOSFET GTO and IGBT. Different ratings of power devices. Design and need of Triggering and commutation Circuit								4
2.	AC TO DC POWER CONVERTERS :- Types of commutation . Single phase semi and full converter using bridge configuration for R and RL Load. PWM control basics. Three phase semi and full converter for R and RL load . PWM control using IGBT converters.								7
3.	DC TO AC CONVERTER :- single phase half and full bridge inverter for R and RL load using MOSFET and IGBT. Concept of voltage control and its classification. PWM control techniques. Three phase voltage source inverter . Matrix inverter, multi-level inverters and topologies								7
4.	DC TO DC CONVERTER :- Concept of Chopper. Its classification. Class A, B, C, D, E choppers. Switch mode power supply. Buck and boost, fly back, half and full bridge isolated and non-isolated interleaved bidirectional topologies. Integrated converter. LM 3524 based choppers design. Maximum power point tracking								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

5.	POWER DEVICES PROTECTION CIRCUITS:- over voltage, over current di/dt and dv/dt protection circuit basics and design. Different cooling techniques. Resonant converters. Zero voltage and zero current switch. Electromagnetic interference and EMC. Difference between EMI and EMC. Standards and isolation transformer.	7
6.	POWER ELECTRONIC APPLICATIONS:- Industrial DC Drive design and applications. Industrial AC Drive design and applications. BL DC motor drive. Electrical Vehicles basics. Design of charger of EVs. Case study of power electronics in electric vehicle and photovoltaic solar systems.	7
TOTAL		39

Text Books:

1. M. H. Rashid, Power Electronics Circuits Devices and application, PHI, 4th edition 2017 New Delhi.
2. Vedam Subrahmanyam, Power Electronics, by New age international publication new delhi
3. M. D. Singh, K. B. Khanchandani. Power Electronics, by Tata MC Graw Hill Publications, New Delhi.

Reference Books:

1. “ Power Electronics essentials and applications” by L. Umanand. Publication:- Wiely India pvt. Ltd. 4435-3617, Ansari road, daryaganj, new delhi-110002.
 2. “ Power Electronics principles and applications” by Joseph Vithayathil Tata MC Graw Hill edition.
 3. “ Modern Power Electronics” by P. C. Sen. Publication: S. Chand and sons pvt. Ltd
 4. “ Power Electronics Devices and Circuits and Industrial Applications” by V. R. Moorthi publication: Oxford university press.
 5. “ Power Electronics, Converters and Applications and Design” by Mohan Undeland Ribbons publication: John Wiely and Sons.
- “ Power Electronics” by Dr. P. S. Bhimra, Khanna publication, Nai Sarak, Delhi-110006

E-Resources:

NPTEL Course NPTEL course on “ Power Electronics” IIT Kharagpur, IIT Delhi

<https://nptel.ac.in/courses/108102145>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Power Electronics Lab								Code: ETPC612P	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	-	50	50
Prerequisites:									
Basic Electronics									
Course Objectives:									
☐ To understand the characteristics and operation of power semiconductor devices. ☐ To analyze power converters, inverters, choppers, and motor drives through experiments. ☐ To develop practical skills in SMPS, UPS, EV charging, and solar power applications.									
Course Outcomes: After completion of this course, students will able to -									
CO1	CO1: Demonstrate and analyze the V-I characteristics of SCR, IGBT, and MOSFET. (Analyze)								
CO2	CO2: Implement and analyze single-phase converters, inverters, and chopper circuits. (Apply)								
CO3	CO3: Observe and interpret power electronic waveforms using digital storage oscilloscopes. (Analyze)								
CO4	CO4: Analyze the performance of DC and AC motor drives using power electronic converters. (Analyze)								
CO5	CO5: Evaluate the operation and performance of SMPS, UPS, and EV charging systems. (Evaluate)								
CO6	CO6: Design and implement solar energy-based power electronic applications. (Create)								
Laboratory Experiments									
Perform any 8 experiment: 1. Perform and verify VI charectristics of SCR 2. Perform and verify VI charecristics of IGBT 3. Perform and verify VI charecristics of MOSFET 4. Perform and verify Single phase full converter for R and RL load. Observation of waveforms on DSO. 5. Perform and verify Single phase bridge inverter using IGBT and PWM control. 6. Perform and verify operation of chopper circuits and observation of output 7. Performance analysis of DC drive for DC Motor 8. Performance analysis of AC drive for AC Motor 9. Performance analysis of SMPS and UPS. 10. Testing of EV charger 11. To design and implement a solar cell operated emergency lighting systems.									
Text Books:									
1. M. H. Rashid, “ Power Electronics Circuits Devices and applications”, PHI,4th edition 2017 New Delhi. 2. “ Power Electronics” by Vedam Subrahmanyam New age international publication new delhi 3. “Power Electronics” by M. D. Singh, K. B. Khanchandani. Tata MC Graw Hill Publications, New Delhi.									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Reference Books:

1. “ Power Electronics essentials and applications” by L. Umanand. Publication:- Wiely India pvt. Ltd. 4435-3617, Ansari road,daryaganj, new delhi-110002.
2. “ Power Electronics principles and applications” by Joseph Vithayathil Tata MC Graw Hill edition.
3. “ Modern Power Electronics” by P. C. Sen. Publication: S. Chand and sons pvt. Ltd
4. “ Power Electronics Devices and Circuits and Industrial Applications” by V. R. Moorthi publication: Oxferd university press.
5. “ Power Electronics, Converters and Applications and Design” by Mohan Undeland Ribbonson publication: John Wiely and Sons.
 - a. “ Power Electronics” by Dr. P. S. Bhimrqa , Khanna publication , nai sarak, Delhi-110006

E-Resources:

NPTEL Course NPTEL course on “ Power Electronics” IIT Kharagpur , IIT Delhi
<https://nptel.ac.in/courses/108102145>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

PROGRAM ELECTIVE - II
(Select any one course from the given Program
Elective Courses)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Program Elective II-Digital Image Processing								Code: ETPE602A	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-		03	40	60	-	-	-	100
Prerequisites:									
Vector Algebra, Engineering Mathematics									
Course Objectives:									
2. To provide students with a strong foundation in digital image processing principles, image formation, and color image representation.									
3. To equip students with techniques for image enhancement, transformation, filtering, and morphological processing for effective image analysis.									
4. To enable students to design and implement image segmentation and compression methods for efficient image interpretation and storage.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the fundamentals of digital image processing, image acquisition, image representation, color models, and pixel relationships used in digital images.								
CO2	Apply image transformation and enhancement techniques, including intensity transformations, histogram processing, and orthogonal transforms for image analysis.								
CO3	Analyze and implement spatial and frequency domain filtering techniques for image smoothing and sharpening								
CO4	Apply morphological operations and algorithms for image analysis, shape processing, and feature extraction.								
CO5	Utilize edge detection, thresholding, and region-based methods to perform image segmentation and object extraction.								
CO6	Evaluate and apply image compression techniques based on redundancy reduction, fidelity criteria, and predictive coding methods.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Digital Image Fundamentals. Fundamentals steps in DIP, Components of image processing system, Elements of Visual Perception, Image sensing and acquisition, image sampling and quantization, basic relations between pixels. Color Fundamentals, Color Models, pixel connectivity, Pseudo color image processing.								8
2.	Image Transforms Basic intensity transformation: image negation, Log transformation, power law transformation, Piecewise linear transformation functions, arithmetic and Logic operation, Histogram processing (equalization and matching) , sine cosine, Hadamard, Haar, Slant transform								6

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

3.	Image filtering Fundamentals of spatial filtering, smoothening and Sharpening in spatial domain, smoothening and Sharpening in frequency domain.	6
4.	Morphological image processing Dilation & erosion, opening and closing operation, Hit- or –miss transformation. Basic morphological algorithms: Boundary extraction, region filling, thinning and thickening, skeletons.	6
5.	Image segmentation Detection of discontinuities: Point detection, line detection, edge detection, (Sobel, Prewitt, Laplacian), global and adaptive thresholding, Region based segmentation (region growing, region splitting and merging).	6
6.	Image Compression Fundamentals, Coding redundancy , interpixel redundancy, fidelity criteria , image compression model, lossless predictive coding, Lossy predictive coding	7
TOTAL		39
Text Books:		
1. Gonzalez & Woods, “Digital Image Processing”, Pearson Education, 3 rd Edition, 2008 2. S Sridhar, “Digital Image Processing”, Oxford University Press, 2nd Edition		
Reference Books:		
1. Jain Anil K., “Fundamentals Digital Image Processing”, Prentice Hall India, 4 th Edition. 2. Milan Sonka, Vaclav Hlavav, Roger Boyle, “Image Processing, Analysis and Machine Vision”, Thomson Learning, 2 nd Edition., 2001 3. Pratt W.K, “Digital Image Processing”, John Wiley & Sons, 3 rd Edition, 2007 4. Jayaraman. S, Veerakumar. T, “Digital Image Processing”, McGraw Hill Education, 2nd Edition.		
E-Resources:		
1. NPTEL Course “Digital Image Processing” Link of the Course: https://nptel.ac.in/courses/117/105/117105079/ 2. NPTEL Course “Digital Image Processing” Link of the Course: https://nptel.ac.in/courses/106/105/106105032/		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Program Elective II-Image Processing Lab								Code: ETPE602AP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02		01	-	-	-	25	-	25
Prerequisites:									
Vector Algebra, Engineering Mathematics									
Course Objectives:									
1. To understand fundamental concepts and techniques of digital image processing. 2. To develop practical skills in image enhancement, segmentation, and feature extraction. 3. To implement image processing algorithms using MATLAB, SCILAB, or OpenCV.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Perform basic image processing operations such as negative, flipping, and bit-plane slicing.								
CO2	Analyze and enhance images using spatial filters and histogram processing techniques.								
CO3	Implement edge, line, point detection, and thresholding techniques for image analysis.								
CO4	Apply Sobel, Prewitt, and Roberts operators for image feature extraction.								
CO5	Implement image segmentation techniques for extracting meaningful regions from images.								
CO6	Implement image compression and noise analysis techniques using DCT and statistical methods.								
Course Contents:									
List of Practical									
1. Introduction to Image Processing Toolbox/ CVIP tools (MATLAB/SCILAB/Open CV) 2. Perform the following basic operations on image a. Obtain Negative image b. Obtain Flip image 3. (a) Implement Gray level slicing (intensity level slicing) in to read cameraman image. (b) Read an 8 bit image and to see the effect of each bit on the image. (c) Read an image and to extract 8 different planes i.e. ‘bit plane slicing.’ 4. Implement various Smoothing spatial filter 5. Perform the following basic operations on image: a. Point Detection b. Line Detection c. Edge Detection d. Thresholding 6. Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts) 7. Implement region based segmentation. 8. Implement Image compression using DCT Transform. 9. Implement various noise models and their Histogram. 10. Read an image, plot its histogram then do histogram equalization. Any 8 experiments of above									
Text Books:									
1. Gonzalez & Woods, “Digital Image Processing”, Pearson Education, 3 rd Edition, 2008 2. S Sridhar, “Digital Image Processing”, Oxford University Press, 2nd Edition									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Reference Books:

1. Jain Anil K., “Fundamentals Digital Image Processing”, Prentice Hall India, 4 th Edition.
2. Milan Sonka, Vaclav Hlavav, Roger Boyle, “Image Processing, Analysis and Machine Vision”, Thomson Learning, 2 nd Edition., 2001
3. Pratt W.K, “Digital Image Processing”, John Wiley & Sons, 3 rd Edition, 2007
4. Jayaraman. S, Veerakumar. T, “Digital Image Processing”, McGraw Hill Education, 2nd Edition.

E-Resources:

1. NPTEL Course “Digital Image Processing” Link of the Course:
<https://nptel.ac.in/courses/117/105/117105079/>
2. NPTEL Course “Digital Image Processing” Link of the Course:
<https://nptel.ac.in/courses/106/105/106105032/>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Program Elective II-Advanced Java Programming								Code: ETPE602B	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Data Structures, Object Oriented Programming concept									
Course Objectives:									
1. To apply modern Java programming features, Collections Framework, and GUI programming concepts to develop efficient desktop applications.									
2. To design and develop database-driven and web-based applications using JDBC, Servlets, and JSP technologies.									
3. To develop client-server and distributed applications using Java Networking and Remote Method Invocation (RMI).									
Course Outcomes: After completion of this course, students will able to -									
CO1	Apply modern Java programming features and Collections Framework for developing Java applications								
CO2	Design GUI applications using Swing components and appropriate layout managers.								
CO3	Implement event-driven applications using Java event handling mechanisms								
CO4	Develop database applications using JDBC to perform CRUD operations								
CO5	Build dynamic web applications using Servlets and JSP technologies								
CO6	Develop client-server and distributed applications using Java Networking and RMI.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Java 8 Useful Features Default Methods, Static Methods. Functional Interfaces: Introduction, @FunctionalInterface Annotation, Built-in Functional Interfaces (Predicate, Consumer). Lambda Expressions: Introduction, Syntax, Advantages, Applications of Lambda Expressions. Method References: Introduction, Types of Method References, Programming Examples. Streams API: Introduction, Stream Creation, Intermediate Operations – filter(), map(), distinct(), limit(), sorted(); Terminal Operations – forEach(), toArray(), collect(). Date and Time API: Limitations of Date and Calendar Classes, LocalDate, LocalTime, LocalDateTime, ZonedDateTime, Period and Duration.								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

2.	GUI Programming using Swing Introduction to GUI Programming, AWT vs Swing, Swing Architecture. Swing Components and Containers: JFrame, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JComboBox, JTable. Layout Managers: FlowLayout, BorderLayout, GridLayout, CardLayout. Developing GUI Applications: Creating Forms, Adding Components, Designing User-Friendly Interfaces. Programming Examples using Swing Components.	7
3.	Event Handling and Collections Framework Event Delegation Model, Event Sources, Event Classes, Event Listeners, Handling Events: ActionEvent, MouseEvent, KeyEvent, WindowEvent. Adapter Classes and Anonymous Inner Classes. Collections Framework: Introduction, Collection Interface. List Interface: ArrayList, LinkedList. Set Interface: HashSet. Map Interface: HashMap. Applications of Collections Framework.	6
4.	Database Programming using JDBC Introduction to JDBC, JDBC Architecture, JDBC Driver Types, JDBC Packages. Database Connectivity: Establishing Connection with Database. JDBC Components: Statement, PreparedStatement, ResultSet, Executing SQL Commands: Insert, Update, Delete and Select Operations CRUD, Operations using JDBC. Exception Handling in JDBC Applications. Programming Examples using JDBC.	7
5.	Web Programming using Servlets and JSP Introduction to Web Applications, Client-Server Architecture, Static and Dynamic Web Pages. Servlet Programming: Servlet Life Cycle, GenericServlet, HttpServlet. Handling Client Requests and Server Responses Session Management: Cookies and Session Tracking. Java Server Pages (JSP): JSP Life Cycle, JSP Elements, Implicit Objects. Form Processing using JSP. Introduction to RESTful Web Services and Spring Boot Framework..	6
6.	Java Networking and RMI Java Networking Fundamentals: java.net Package. InetAddress Class: Factory Methods and Instance Methods. Socket Programming: TCP/IP Client-Server Communication using Socket and ServerSocket Classes. URL and URLConnection, Classes, Remote Method Invocation (RMI): RMI Architecture, Remote Interfaces, RMI Registry. Developing Simple Client-Server Applications using RMI Programming Examples using Networking and RMI.	6
TOTAL		39
Text Books:		
1. E Herbert Schildt, “Java: The complete reference”, Tata McGraw Hill, 7th Edition 2. Jim Keogh, “Complete Reference J2EE” 3. Eckel B., “Thinking in Java”, Pearson Education, (3rd Edition), (2017)..		
Reference Books:		

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|--|
| <ol style="list-style-type: none">1. Joshua Bloch, "Effective Java", Addison-Wesley Professional, (3rd Edition), (2017).2. "Java Server Programming, Java EE6 (J2EE 1.6)", Black Book,3. "Advanced Java Technology", M.T. Savaliya |
|--|

E-Resources:

- | |
|--|
| <ol style="list-style-type: none">1. NPTEL Course "Programming in Java"
Link of the Course: : https://nptel.ac.in/courses/106/105/1061051912. Oracle Java Tutorials
https://docs.oracle.com/javase/tutorial |
|--|

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Program Elective II-Advanced Java Programming Lab								Code: ETPE602BP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	-	25	25
Prerequisites:									
Data Structures, Object Oriented Programming concept									
Course Objectives:									
1. To understand advanced Java programming concepts and application development. 2. To develop GUI, database, web, and network applications using Java technologies. 3. To apply Java frameworks and APIs for developing integrated real-world applications.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Implement advanced Java features such as lambda expressions, functional interfaces, and collections.								
CO2	Develop event-driven GUI applications using Java Swing components.								
CO3	Implement database applications using JDBC and perform CRUD operations.								
CO4	Develop dynamic web applications using Servlets and JSP.								
CO5	Implement network and distributed applications using sockets, URL, and RMI.								
CO6	Design and develop integrated Java applications using GUI/web technologies and database connectivity.								
Course Contents:									
Unit	Description								Duration (Hrs.)
Laboratory Experiments									
List of Laboratory Experiments: (Any 8) 1. Write a Java program to demonstrate Lambda Expressions and Functional Interfaces. 2. Write a Java program to perform operations using Collections Framework (ArrayList, HashSet, and HashMap). 3. Design a GUI application using Swing components and layout managers. 4. Develop an event-driven Swing application to handle mouse and keyboard events. 5. Develop a GUI-based CRUD application using Swing and JDBC. 6. Write a Java program to connect to a database and perform CRUD operations using JDBC. 7. Develop a Servlet to accept user input and display the processed result. 8. Create a JSP page to perform form processing and display dynamic content. 9. Develop a registration application using Servlet, JSP and JDBC. 10. Write a Java program to demonstrate the use of InetAddress and URL classes. 11. Develop a TCP client-server application using Socket and ServerSocket classes. 12. Develop an RMI application to invoke methods on a remote object.									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

13. Mini Project: Develop a Java-based application integrating GUI/Web Interface with Database Connectivity.

Text Books:

1. E Herbert Schildt, “Java: The complete reference”, Tata McGraw Hill, 7th Edition
2. Jim Keogh, “Complete Reference J2EE”
3. Eckel B., “Thinking in Java”, Pearson Education, (3rd Edition), (2017)..

Reference Books:

1. Joshua Bloch, “Effective Java”, Addison-Wesley Professional, (3rd Edition), (2017).
2. “Java Server Programming, Java EE6 (J2EE 1.6)”, Black Book,
3. “Advanced Java Technology”, M.T. Savaliya

E-Resources:

1. NPTEL Course “Programming in Java”
Link of the Course: : <https://nptel.ac.in/courses/106/105/106105191>
2. Oracle Java Tutorials
<https://docs.oracle.com/javase/tutorial>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Program Elective II-Wireless Communication								Code: ETPE602C	
Teaching Scheme:				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-		03	40	60			-	100
Prerequisites: Digital and analog Communication, Signals & Systems, Electromagnetic Theory, Probability & Random Processes.									
Course Objectives:									
1. The objective of the course is to introduce the Concepts of basic wireless mobile communication systems									
2. To learn and understand the basic principles of Telecommunication switching, traffic, and networks.									
3. To learn and understand basic concepts of cellular system, wireless propagation, and the techniques used to maximize the capacity of a cellular network.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the evolution of wireless communication and identify the key milestones in the development of wireless technologies.								
CO2	Explain the principles of radio wave propagation and the free-space propagation model.								
CO3	Apply handoff strategies and roaming concepts to ensure seamless mobile communication.								
CO4	Compare the characteristics, advantages, limitations, and applications of different multiple access techniques.								
CO5	Compare the combining techniques—Selection Combining (SC), Equal Gain Combining (EGC), and Maximal Ratio Combining (MRC)—based on their performance and implementation complexity.								
CO6	Compare the characteristics, advantages, limitations, and applications of various emerging wireless communication technologies.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Wireless Communication: Evolution of wireless communication, Wireless communication systems and applications, Generations of mobile communication (1G–5G), Wireless spectrum and regulatory aspects, Challenges in wireless communication.								7
2.	Radio Wave Propagation: Free-space propagation model, Friis transmission equation, Reflection, diffraction, and scattering, Path loss models, Shadowing and log-normal fading, Large-scale propagation models.								7
3.	Cellular Communication Systems: Cellular architecture, Cell								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	splitting and sectoring, Frequency reuse, Handoff strategies, Roaming concepts, Capacity improvement techniques, Co-channel interference, Signal attenuation, Network congestion, Security and privacy concerns.	
4.	Multiple Access Techniques: Introduction, comparisons of multiple access strategies like TDMA, CDMA, FDMA, OFDM, CSMA Protocol, SC-FDMA, NOMA (Non-Orthogonal Multiple Access).	6
5.	Diversity Techniques: Diversity concepts, Time diversity, Frequency diversity, Space diversity, combining techniques: Selection Combining (SC), Equal Gain Combining (EGC), and Maximal Ratio Combining (MRC).	6
6.	Recent Trends: Introduction to Wi-Fi, Wi-MAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Ad hoc Network, Mobile Portability, MIMO, Security issues, and challenges in a Wireless network.	6
TOTAL		39

Laboratory Experiments

Experiments based on a MATLAB/ SCILAB. Write a program for the following, Perform any 8 experiments out of 10:

1. Study and Analysis of Free Space Propagation Model and Frequency Selective Fading Model.
2. Study and Analysis of Ground Reflection (Two-Ray) Propagation Model in Wireless Communication.
3. Study and Analysis of Diffraction (Knife-Edge) Model in Wireless Communication.
4. Study and Analysis of Small-Scale Empirical Propagation Models in Wireless Communication
5. Study and Analysis of Large-Scale Empirical Propagation Models in Wireless Communication.
6. Study and Analysis of Cellular Communication Systems.
7. Study and Analysis of GSM Network Using Wireless Communication Trainer.
8. Study and Demonstration of Frequency Division Multiple Access (FDMA) Using Wireless Communication Trainer.
9. Study and Demonstration of Code Division Multiple Access (CDMA) Using Wireless Communication Trainer
10. Study and Demonstration of Orthogonal Frequency Division Multiplexing (OFDM) Using Wireless Communication Trainer

Text Books:

1. Theodore S. Rappaport, "Wireless Communication," Prentice Hall
2. Vijay Garg, "Wireless Communications and Networking", Elsevier.
2. Kamilo Feher, "Wireless digital communication", PHI
3. William C. Y. Lee, "Mobile Communications Engineering Graw Hill Publications.
4. Raj Pandya, "Mobile and personal Communication system and services", IEEE press (PHI).
5. T. L. Singh, "Wireless Communication", TMH

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Reference Books:

1. Upena Dalal, — “Wireless Communication” Oxford Higher Education.
2. David Tse, Pramod Viswanath — “Fundamentals of Wireless Communication”, CAMBRIDGE University Press.
3. Gary. J. Mullet, — “Introduction to Wireless Telecommunication Systems and Networks”, DELMAR CENGAGE Learning
4. William C. Y. Lee, “Mobile Cellular Telecommunications: Analog and Digital Systems”, Tata McGraw Hill Edition.
5. Vijay. K. Garg, “Wireless Network Evolution: 2G to 3G” , Pearson Education

E-Resources:

1. NPTEL Videos - <http://www.digimat.in/nptel/courses/video/117102062/L01.html>
2. Virtual Labs - <https://iitb.vlabs.co.in/>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: V	
Course: Program Elective II-Wireless Communication Lab								Code: ETPE602CP	
Teaching Scheme:				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02		01	-	-	-	25	-	25
Prerequisites:									
Digital and analog Communication, Signals & Systems, Electromagnetic Theory, Probability & Random Processes.									
Course Objectives:									
1. To understand wireless propagation models and cellular communication concepts. 2. To analyze the effects of fading, reflection, diffraction, and path loss on wireless links. 3. To simulate and study wireless communication techniques using MATLAB/SCILAB and communication trainers.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Analyze free-space and frequency-selective fading propagation models								
CO2	Evaluate the effects of reflection, diffraction, and empirical propagation models on wireless communication.								
CO3	Analyze small-scale and large-scale propagation characteristics of wireless channels.								
CO4	Demonstrate the basic architecture and operation of cellular communication systems.								
CO5	Implement and demonstrate multiple access techniques such as FDMA and CDMA using wireless communication trainers.								
CO6	Analyze and demonstrate GSM and OFDM techniques for wireless communication applications.								
Laboratory Experiments									
Experiments based on a MATLAB/ SCILAB. Write a program for the following, Perform any 8 experiments out of 10: 1. Study and Analysis of Free Space Propagation Model and Frequency Selective Fading Model. 2. Study and Analysis of Ground Reflection (Two-Ray) Propagation Model in Wireless Communication. 3. Study and Analysis of Diffraction (Knife-Edge) Model in Wireless Communication. 4. Study and Analysis of Small-Scale Empirical Propagation Models in Wireless Communication 5. Study and Analysis of Large-Scale Empirical Propagation Models in Wireless Communication. 6. Study and Analysis of Cellular Communication Systems. 7. Study and Analysis of GSM Network Using Wireless Communication Trainer. 8. Study and Demonstration of Frequency Division Multiple Access (FDMA) Using Wireless Communication Trainer. 9. Study and Demonstration of Code Division Multiple Access (CDMA) Using Wireless Communication Trainer 10. Study and Demonstration of Orthogonal Frequency Division Multiplexing (OFDM)									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Using Wireless Communication Trainer

Text Books:

1. Theodore S. Rappaport, “Wireless Communication,” Prentice Hall
2. Vijay Garg, “Wireless Communications and Networking”, Elsevier.
2. Kamilo Feher, “Wireless digital communication”, PHI
3. William C. Y. Lee, “Mobile Communications Engineering Graw Hill Publications.
4. Raj Pandya,” Mobile and personal Communication system and services”, IEEE press (PHI).
5. T. L. Singh, “Wireless Communication”, TMH

Reference Books:

1. Upena Dalal, — “Wireless Communication” Oxford Higher Education.
2. David Tse, Pramod Viswanath — “Fundamentals of Wireless Communication”, CAMBRIDGE University Press.
3. Gary. J. Mullet, — “Introduction to Wireless Telecommunication Systems and Networks”, DELMAR CENGAGE Learning
4. William C. Y. Lee, “Mobile Cellular Telecommunications: Analog and Digital Systems”, Tata McGraw Hill Edition.
5. Vijay. K. Garg, “Wireless Network Evolution: 2G to 3G” , Pearson Education

E-Resources:

1. NPTEL Videos - <http://www.digimat.in/nptel/courses/video/117102062/L01.html>
2. Virtual Labs - <https://iitb.vlabs.co.in/>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

**PROGRAM ELECTIVE -
III**

(Select any one course from the given Program

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Program Elective IV-Modernized IoT								Code: ETPE603A	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-		-	-	-	-	-	100
Prerequisites:									
Microcontrollers, Embedded Systems									
Course Objectives:									
1. To understand the fundamentals of IoT and IoE, including sensors, actuators, communication models, architectures, and networking technologies used in connected systems. 2. To analyze IoT protocols, device interfacing techniques, and embedded platforms for designing and deploying IoT-based applications. 3. To explore Industrial IoT (IIoT) frameworks and develop IoT solutions for smart environments, healthcare, smart cities, energy management, and industrial automation.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Comprehend and analyze concepts of sensors, actuators, IoT and IoE.								
CO2	Interpret IoT Architecture Design Aspects.								
CO3	Comprehend the operation of IoT protocols.								
CO4	Describe various IoT boards, interfacing, and programming for IoT.								
CO5	Illustrate the technologies, Catalysts, and precursors of IIoT using suitable use cases.								
CO6	Provide suitable solution for domain specific applications of IoT.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Sensors, Actuators, IoT & IoE: Definitions, Types of sensors, Types of Actuators, Example and Working, Networking Basics, RFID Principals and components, Wireless Sensor Networks, Definition, and characteristics of an IoT, Physical Design of an IoT, Logical design of IoT, Communication Models, Communication API's, What is the IoE? Difference between IoT and IoE, Pillars of the IoE, Connecting the Unconnected, Transitioning to the IoE, Bringing It All Together								7
2.	IoT Architecture Design Aspects: IoT-An Architectural Overview, building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology FundamentalsDevices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

3.	IoT Protocols: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP, Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT	7
4.	Interfacing Boards and Programming: Introduction to IoT Boards, Interfacing with IoT Boards, IoT deployment for Raspberry Pi /Arduino/Equivalent platform – Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, wifi and USB - Contiki OS- Cooja Simulator	6
5.	Industrial IoT: Introduction, Key IIOT technologies, Catalysts, and precursors of IIoT, Innovation and the IIoT, Applications of IIoT Examples: Healthcare, Oil and Gas Industry, Logistics and the Industrial Internet, Retail applications, IoT innovations and design methodologies, Industrial Internet Architecture Framework (IIAF): Control domain, operational domain and application domain, Three tier topology, Design of low power device network, legacy industrial protocols, Bluetooth, Zigbee IP, Z-wave, Wi-Fi backscatter in IIoT design	6
6.	Applications of IoT: Smart Environment: Forest Fire Detection, Air Pollution, Smart Cities: Parking, Structural Health, Noise Urban maps, Smart Metering: Smart Grid, Tank level, Photovoltaic Installations, Silos Stock Calculation, Health: Fall Detection, Medical Fridges, Sportsmen Care, Patients Surveillance, Ultraviolet Radiation	6
TOTAL		39
Text Books:		
1. Ovidiu Vermesan, Peter Fresiss, “Internet of Things” From research and innovation to market Deployment”, River Publishers series in Communication, USA. 2. Olivier Hersent, David Boswarthick, and Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2 nd Edition, Wiley Publications.		
Reference Books:		
1. Dr. Ovidiu Vermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication 2. “Internet of Things: Case Studies”, Libelium Inc, White papers, Spain http://www.libelium.com/resources/case-studies		
E-Resources:		
1. NPTEL Course on Introduction to IoT, by Prof. Sudip Misra, IIT Kharagpur Link of the Course: https://nptel.ac.in/courses/106105166 2. NPTEL Course on “Introduction to Industry 4.0 and Industrial Internet of Things”, by Prof. Sudip Misra, IIT Kharagpur Link of the Course: https://nptel.ac.in/courses/106105195		

[**Back to Structure**](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: : Program Elective IV Modernized IoT Lab								Code: ETPE603AP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-		-	-	-	25	-	25
Prerequisites:									
Microcontrollers, Embedded Systems									
Course Objectives:									
1. To understand IoT platforms, operating systems, sensors, actuators, and communication protocols. 2. To develop practical skills in interfacing and controlling IoT devices using Arduino and Raspberry Pi. 3. To implement IoT applications using wireless communication, cloud connectivity, and simulation platforms..									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the architecture and operating systems of common IoT development platforms.								
CO2	Interface sensors, actuators, LEDs, and switches with Arduino and Raspberry Pi.								
CO3	Develop IoT-based motor control applications using Arduino and Raspberry Pi.								
CO4	Implement IoT communication using MQTT, CoAP, Bluetooth, and wireless technologies.								
CO5	Transfer and monitor sensor/device data through web and cloud platforms.								
CO6	Design and implement IoT-based solutions for real-world problems using hardware or simulation platforms.								
Laboratory Experiments									
Perform any 08 experiment out of 10: 1. Study of Raspberry-Pi, Beagle board, Arduino, and different operating systems for RaspberryPi/Beagle board/Arduino. Understanding the process of OS installation on RaspberryPi/Beagle board/Arduino 2. Open-source prototype platform- Raspberry-Pi/Beagle board/Arduino -Simple program digital read/write using LED and Switch -Analog read/write using sensor and actuators. 3. Interfacing sensors and actuators with Arduino/Raspberry-pi. 4. IoT based Stepper Motor/DC Motor Control with Arduino/Raspberry Pi. 5. Introduction to MQTT/ CoAP and sending sensor data to cloud using Raspberry-Pi/Beagle board/Arduino. 6. Get the status of a bulb at a remote place (on the LAN) through web. 7. Interfacing Arduino to Bluetooth Module 8. Communicate between Arduino and Raspberry PI using any wireless medium like ZigBee 9. IoT based small project implementation on the topics based on small problem statements of the fields like chat bot, smart home (Home Automation), social issues and environmental issues etc. This project can be built on any IoT simulation platform like Tinkercad, Cooja									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

etc.

Text Books:

1. Ovidiu Vermesan, Peter Fresiss, “Internet of Things” From research and innovation to market Deployment”, River Publishers series in Communication, USA.
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2 nd Edition, Wiley Publications.

Reference Books:

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication
2. “Internet of Things: Case Studies”, Libelium Inc, White papers, Spain
<http://www.libelium.com/resources/case-studies>

E-Resources:

1. NPTEL Course on Introduction to IoT, by Prof. Sudip Misra, IIT Kharagpur Link of the Course:
<https://nptel.ac.in/courses/106105166>
2. NPTEL Course on “Introduction to Industry 4.0 and Industrial Internet of Things”, by Prof. Sudip Misra, IIT Kharagpur Link of the Course:
<https://nptel.ac.in/courses/106105195>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: VI		
Course: : Program Elective IV -Cloud Computing							Code: ETPE603B		
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-		40	60	-	-	-	100
Prerequisites: Computer Network									
Course Objectives:									
1. To introduce the fundamentals of Cloud computing and its Architecture. 2. To learn cloud services and virtualization technologies. 3. To provide insight into cloud security and IOT.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Analyze the basic concepts of Cloud Computing.								
CO2	Analyze the architecture, delivery models, and industrial platforms used for cloud computing-based applications.								
CO3	Analyse storage system and services in Cloud.								
CO4	Explain Virtualization in Cloud Computing.								
CO5	Examine and understand the importance of Cloud Security.								
CO6	Evaluate computing systems and the Internet of Things.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Fundamentals of Cloud Computing: Definition of Cloud Computing, Characteristics of Cloud computing Cloud Deployment Models(Introduction, advantages and disadvantages) : Public Cloud, Private Cloud, Community Cloud, Hybrid Cloud Cloud Service Models (Function, advantages, disadvantages) : IaaS, PaaS, SaaS Cloud cost benefits Architectural and Infrastructural components of Cloud Computing								7
2.	Cloud Computing Architecture: Details of cloud system and cloud reference architecture. Different types of cloud deployments, Study of the economic aspects of cloud computing, key open research challenges, and issues related to cloud interoperability and standards. Understanding scalability and fault tolerance mechanisms in cloud environments.								7
3.	Cloud Services: Storage, Database, Process, Information, Service, and Testing.Concept of scaling cloud infrastructure, including capacity planning and methods for achieving cloud scalability. Overview of disaster recovery in cloud environments, covering disaster recovery planning, types of cloud-related disasters, and disaster management strategies.								6
4.	Virtualization :Introduction, Virtualization Reference Model, Characteristics of virtualized environment ,Differentiate various types of Virtualization : Storage, Network , Desktop , Application server Technology Examples.VMWare: Full								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Virtualization Reference Model Xen: Architecture and Guest Operating System Management ,Definition and Life Cycle of Virtual Machine(VM), VM Migration: Concept and Techniques,Advantages and Disadvantages of Virtualization	
5.	Cloud Security: Overview of cloud security issues and major concerns of cloud users, including security risks and privacy impact assessment. Techniques for cloud data encryption and securing database services. Security measures for operating systems, Concepts such as XOAR, trusted hypervisors, and security considerations for mobile devices in cloud environments. Cloud security defense mechanisms, including distributed intrusion and anomaly detection systems, data and software protection methods, and reputation-based approaches for protecting data centers.	6
6.	Computing Systems and Internet of Things: Introduction to distributed computing and its importance. Comparison between distributed computing and cloud computing. Overview of technologies that enable the Internet of Things (IoT) and study of innovative IoT applications. Understanding online social networking and professional networking platforms.	6
TOTAL		39
Text Books:		
1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, “Cloud Computing: Black Book”, Dreamtech Press. 2. Rajkumar Buyya, James Broberg, Andrzej Goscinski”Cloud Computing, Principals and Paradigms” 3. Surbhi Rastogi, “Cloud Computing Simplified”, 2021 Edition, BPB Publications.		
Reference Books:		
1. Kamal Kant Hiran, et al. “Cloud Computing: Master the concepts, Architecture and Applications with Real-world examples and Case Studies”, 1st Edition, BPB Publication. 2. Arshdeep Bahga, Vijay Madiseti,Cloud Computing: A Hands-On Approach 3. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017. 4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.		
E-Resources:		
NPTEL Course “Cloud Computing” https://nptel.ac.in/courses/106105167/		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: VI		
Course: : Program Elective IV -Cloud Computing Lab							Code: ETPE603BP		
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	-	-	-	-	25	-	25
Prerequisites: Computer Network									
Course Objectives:									
1. To understand cloud computing concepts, virtualization, and cloud service models.									
2. To develop practical skills in deploying applications, storage, and virtual machines on cloud platforms.									
3. To implement and analyze cloud infrastructure, distributed file systems, and resource scheduling.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Configure and deploy virtual machines with specified computing resources on cloud platforms.								
CO2	Develop and host web applications using cloud application platforms and services.								
CO3	Implement cloud storage, file transfer, and distributed file systems using appropriate cloud technologies.								
CO4	Develop and deploy cloud functions for event-driven and automated tasks.								
CO5	Configure and manage PaaS environments and cloud infrastructure using open-source tools.								
CO6	Simulate cloud environments and evaluate resource scheduling algorithms using CloudSim.								
Laboratory Experiments									
Perform any 08 experiment out of 10:									
1. Creating a Virtual Machine: Configure and deploy a virtual machine with specific CPU and memory requirements in Google Cloud.									
2. Use GAE launcher to launch the web applications.									
3. Create and Host Simple Web Application on Google cloud/Any cloud platform. Implement Storage Service on Cloud using OpenStack.									
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.									
5. Cloud Functions: Create and deploy a Cloud Function to automate a specific task based on a Cloud Storage event.									
6. Create a File System using HDFS.									
7. Design and deploy a PaaS environment.									
8. Configure Server using CF Engine or any other open source tool.									
9. Find a procedure to launch virtual machine using try stack (Online Openstack Demo									
10. Version)									
11. 10.Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not									
12. present in CloudSim.									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Text Books:

1. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, “Cloud Computing: Black Book”, Dreamtech Press.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski”Cloud Computing, Principals and Paradigms”
3. Surbhi Rastogi, “Cloud Computing Simplified”, 2021 Edition, BPB Publications.

Reference Books:

1. Kamal Kant Hiran, et al. “Cloud Computing: Master the concepts, Architecture and Applications with Real-world examples and Case Studies”, 1st Edition, BPB Publication.
2. Arshdeep Bahga, Vijay Madisetti, Cloud Computing: A Hands-On Approach
3. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017.
4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.

E-Resources:

NPTEL Course “Cloud Computing”

<https://nptel.ac.in/courses/106105167/>

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: : Program Elective IV- Fiber Optic Communication								Code: ETPE603C	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-		03	40	60			-	100
Prerequisites: Microwave Communication, Electromagnetics.									
Course Objectives:									
1. After learning FOC course, students will get advantage to pursue higher studies or employment in core engineering/communication engineering companies. 2. To get insight into different fiber types, fabrication methods, optical transmission characteristics, optical sources, optical detectors and optical amplifiers, and applications. 3. To understand different design considerations in optical links involving link power budget and rise time budget.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain the evolution of communication systems and the development of optical fiber communication technology.								
CO2	Explain the nature of light, electromagnetic wave propagation, and basic optical principles used in fiber communication.								
CO3	Apply the concepts of attenuation and dispersion to calculate signal losses and performance parameters of optical fiber links								
CO4	Apply the concepts of optical power, receiver noise, and detector characteristics to analyze the performance of optical communication systems.								
CO5	Analyze the performance and applications of active optical components including tunable light sources and optical amplifiers in fiber communication networks.								
CO6	Analyze optical fiber link performance using measurement tools such as Optical Time Domain Reflectometer (OTDR) for fault detection and characterization.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Optical Fiber Communication: Evolution of communication systems, Advantages and applications of optical fiber communication, Elements of an optical communication system, Optical communication bands and spectrum								7
2.	Fundamentals of Light and Optical Fibers: Nature of light, Electromagnetic wave propagation, Optical laws: reflection, refraction, and Snell's law, Total Internal Reflection (TIR), Numerical Aperture (NA), Acceptance angle, Step-index and graded-index fibers, Single-mode and multimode fibers, Numerical based on above,								7
3.	Transmission Characteristics of Optical Fiber: Signal degradation on optical fiber due to attenuation. Material absorption loss,								7

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	scattering loss, Bending Loss, Dispersion, Chromatic dispersion, Intermodal and Intramodal dispersion, Polarization mode dispersion, international fiber standards. Numerical based on dispersion and attenuation.	
4.	Optical Sources, Detectors and Link Design: LEDs and Laser Diodes, Photo detectors, pin-diodes, APDs, detector responsivity, Noise, Optical receivers. Optical link design, Power budget, and Rise Time Budget.	6
5.	WDM Concepts and Components: Overview of Wavelength Division Multiplexing, Passive Optical Couplers, Isolator and Circulators, Fiber grating filters, Active optical components, Tunable light sources, Erbium Doped Fiber Amplifier, Raman Amplifier.	6
6.	Optical Networks and measurements: Long-haul optical networks, Access networks and Fiber-to-the-Home (FTTH), Numerical Aperture (NA) measurement, Mode field diameter measurement, Chromatic dispersion measurement, Polarization Mode Dispersion (PMD) measurement, Bandwidth measurement, Optical Time Domain Reflectometer (OTDR),	6
TOTAL		39
Text Books:		
1. Gerd Keiser, “Optical Fiber Communications” 4th Edition, Tata McGraw-Hill. 2. John M Senior, “Optical Fiber Communications,” 2nd Edition, PHI		
Reference Books:		
1. J. E. Midwinter, — Optical fibers for transmission, John Wiley, 1979. 2. J. Gower, — Optical communication systems, Prentice Hall India, 1987. 3. G. Agrawal, — Nonlinear fiber optics, Academic Press, 2nd Ed, 1994. 4. Siva Ram Murth, Mohan Guruswamy, — “WDM Optical Networks Concepts Design and Algorithms”, PHI Eastern Economy, Edition, 2001. 5. Uyless Black, — “Optical Networks- Third Generation Transport Systems”, Pearson Education. 6. Fredrick C Allard, — “Fiber Optics Handbook for Engineers & Scientists”, MH International.		
E-Resources:		
1. NPTEL Course on “Advanced Optical Communication”, by Prof R K Shevgaonkar, IIT Madras.: https://nptel.ac.in/courses/117101002 2. NPTEL Course on “Fiber Communication Technology”, by Prof Deepa Venkatesh, IIT Madras : https://nptel.ac.in/courses/108106167 3. NPTEL Course on “Fiber-Optic Communication Systems & Techniques”, by Dr Pradeep Kumar K, IIT Kanpur : https://nptel.ac.in/courses/108104113		

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: : Program Elective IV- Fiber Optic Communication Lab								Code: ETPE603CP	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02		01				25	-	25
Prerequisites: Microwave Communication, Electromagnetics.									
Course Objectives:									
1. To understand the principles and characteristics of optical fiber communication components and systems.									
2. To develop practical skills in measuring fiber losses, numerical aperture, splice loss, and device characteristics.									
3. To analyze and implement optical communication links using fiber optic devices and measurement instruments.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Measure and analyze the numerical aperture and transmission losses of optical fibers.								
CO2	Design and implement a fiber optic digital communication link.								
CO3	Prepare optical fiber splice joints and evaluate splice losses.								
CO4	Analyze the V-I and P-I characteristics of LED and laser diode sources.								
CO5	Analyze photodiode and avalanche photodiode characteristics and determine their responsivity.								
CO6	Characterize optical fibers and detect faults using OTDR measurements.								
Laboratory Experiments									
Perform any 08 experiments out of 11:									
1. Measurement of Numerical Aperture (NA) of an Optical Fiber Using the Far-Field Method									
2. Measurement and Analysis of Losses in Optical Fiber Communication.									
3. Design and Implementation of a Fiber Optic Digital Communication Link									
4. Preparation of Optical Fiber Splice Joint and Measurement of Splice Loss.									
5. Study of Power-Current (P-I) Characteristics of a Laser Diode and Measurement of Slope Efficiency.									
6. Study of Voltage-Current (V-I) Characteristics of a Semiconductor Laser Diode.									
7. Study of Power-Current (P-I) Characteristics of LED and Measurement of Slope Efficiency.									
8. To study the Voltage-Current (V-I) characteristics of an LED and determine its forward conduction characteristics.									
9. To study the V-I characteristics of a photodiode and measure its responsivity.									
10. Study of Avalanche Photodiode (APD) Characteristics and Measurement of Responsivity.									
11. Analysis of Optical Fiber Characteristics and Fault Detection Using Optical Time Domain Reflectometer (OTDR)									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Text Books:
1. Gerd Keiser, “Optical Fiber Communications” 4th Edition, Tata McGraw-Hill. 2. John M Senior, “Optical Fiber Communications,” 2nd Edition, PHI
Reference Books:
1. J. E. Midwinter, — Optical fibers for transmission, John Wiley, 1979. 2. J. Gower, — Optical communication systems, Prentice Hall India, 1987. 3. G. Agrawal, — Nonlinear fiber optics, Academic Press, 2nd Ed, 1994. 4. Siva Ram Murth, Mohan Guruswamy, — “WDM Optical Networks Concepts Design and Algorithms”, PHI Eastern Economy, Edition, 2001. 5. Uyles Black, — “Optical Networks- Third Generation Transport Systems”, Pearson Education. 6. Fredrick C Allard, — “Fiber Optics Handbook for Engineers & Scientists”, MH International.
E-Resources:
1. NPTEL Course on “Advanced Optical Communication”, by Prof R K Shevgaonkar, IIT Madras. Link of the Course: https://nptel.ac.in/courses/117101002 2. NPTEL Course on “Fiber Communication Technology”, by Prof Deepa Venkatesh, IIT Madras Link of the Course: https://nptel.ac.in/courses/108106167 3. NPTEL Course on “Fiber-Optic Communication Systems & Techniques”, by Dr Pradeep Kumar K, IIT Kanpur Link of the Course: https://nptel.ac.in/courses/108104113

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Embedded Systems								Code: ETMD604	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
03	-	-	03	40	60	-	-	-	100
Prerequisites:									
Microprocessors & Microcontrollers, Digital Electronics, Basic C Programming									
Course Objectives:									
1. To understand the fundamentals of embedded systems, ARM processor architecture, design methodologies, and hardware-software co-design concepts. 2. To develop embedded applications using LPC2148 and ARM Cortex-M4 microcontrollers by interfacing peripherals, sensors, displays, timers, ADC/DAC, and communication modules. 3. To analyze and implement embedded communication protocols such as UART, USART, I2C, SPI, USB, Ethernet, and CAN for real-time embedded system applications.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Explain embedded system architecture and design methodologies								
CO2	Program LPC2148 for peripheral interfacing								
CO3	Design real-time embedded applications using ARM7								
CO4	Program STM32 using HAL/LL libraries								
CO5	Interface sensors, communication protocols, and displays								
CO6	Develop and debug industry-oriented embedded applications								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Embedded Systems Embedded system (ES) definition, Applications of Embedded Systems, Characteristics/ Design metrics of Embedded systems, Classification of Embedded, system, Components of an Embedded system, Embedded system								5

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

	Design flow-Issues in Hardware-Software design and co-design, testing of embedded systems	
2.	ARM Processor Fundamentals ARM Architecture Details: Comparison of RISC and CISC processor, RISC architecture design philosophy, ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM data flow model, Register banks, CPSR and SPSR, Pipelining, Exceptions, Interrupts & Vector Table, Core Extensions, Architecture Revisions	7
3.	LPC 2148 MICROCONTROLLER: Features, Block Diagram and Description, System Control Block, Memory Map, System Control Block (PLL and VPB divider), Pin Connect Block, GPIO, Timer Block for Delay Generation, LPC 2148 Interfacing with LED, Switches, Relay, Interfacing LCD and keypad, Timer/Counter, UART, ADC module.	7
4.	Introduction to ARM CORTEX M4Based Microcontroller: Introduction to ARM CORTEX series: CORTEX A, R, M processors, Firmware development using CMSIS Standard. Introduction to ARM CORTEX M4 microprocessor core, programmer model, Processor Modes, Memory Map, Introduction Arm Cortex-M cores, STM32F4xx Architecture, ARM STM Bus Architecture, STM32F4xx Clock and SYSCLK, Peripheral Clock, PLL clock, Interrupts and Exceptions in STM32F4xx	7
5.	Real World Interfacing with Cortex M4 Based Microcontroller: GPIO Programming, Interfacing seven segment LED, LDR and MQ3 sensor with STM32F4xx, STM32F4xx: Counters and Timers: Timer and Delay Generation, UART Programming, on chip ADC and Onchip DAC for waveform generation.	7
6.	Communication protocols: UART, USART, I2C, SPI, USB, Ethernet, CAN protocol, Features and comparisons of various protocols	6
TOTAL		39
Text Books:		
1. The Insider's Guide To The Philips ARM7-Based Microcontrollers (LPC2000 family) — Hitex / ARM-based 2. Raj Kamal – Embedded Systems: Architecture, Programming and Design 3. ARM Controller: ARM Fundamentals, LPC2148 CPU and Peripherals - A. P. Godse 4. Joseph Yiu – The Definitive Guide to ARM Cortex-M3/M4		
Reference Books:		

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|--|
| <ol style="list-style-type: none">1. Steve Furber – ARM System-on-Chip Architecture2. Mastering STM32 (2nd Edition) — <i>Carmine Noviello</i> |
| E-Resources: |
| <ol style="list-style-type: none">1. Embedded Systems – Lecture Playlist & Course Content (IIT Delhi – NPTEL)
https://nptel.ac.in/courses/108102045
(Covers introduction, architecture, interfaces & real-time concepts)2. NPTEL Prep – Embedded System Design with ARM (Structured Video Lectures)
https://www.nptelprep.in/courses/106105193/videos
(Official indexed set of videos covering full lecture series) |

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)								Semester: VI	
Course: Embedded Systems Lab								Code: ETMD604P	
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	-	-	50	50
Prerequisites:									
Microprocessors & Microcontrollers, Digital Electronics, Basic C Programming									
Course Objectives:									
1. To understand ARM7/LPC2148 and STM32 microcontroller architectures and programming. 2. To develop embedded applications using GPIO, timers, ADC, PWM, UART, and peripheral interfacing. 3. To implement multitasking and IoT-based applications using STM32 and FreeRTOS.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Develop and simulate ARM7/LPC2148 programs using assembly language and Embedded C.								
CO2	Interface and control LEDs, LCDs, keypads, relays, and stepper motors using LPC2148.								
CO3	Implement timers, counters, ADC, PWM, and serial communication on ARM-based microcontrollers.								
CO4	Configure STM32 peripherals such as GPIO, timers, PWM, ADC, DMA, and UART using HAL drivers.								
CO5	Develop multitasking embedded applications using FreeRTOS on STM32.								
CO6	Design and implement sensor-based applications using STM32.								
Laboratory Experiments									
LPC2148 Experiments									
1. Develop Program for addition and subtraction of 32 bit numbers on ARM7 and simulate using keil software 2. Develop Program for barrel shifter and simulate using keil software 3. Develop program for different addressing modes in ARM7 and simulate using keil software 4. Develop Program for arranging 10 bytes in ascending and descending order and simulate using keil software 5. Develop embedded C Program for square wave generation on ARM7 and simulate using									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- keil software
6. Develop embedded C program for LED interfacing to LPC2148 to generate different patterns and implement on Hardware kit
 7. Develop embedded C Program for stepper motor interface to LPC 2148 and implement on hardware kit
 8. Develop embedded C Program for LCD interfacing in 4 bit mode and implement on LPC2148 Hardware kit
 9. Develop Embedded C Program for serial communication simulate and implement on hardware kit
 10. Develop Embedded C Program for key and relay interfacing and implement on Hardware kit
 11. Develop Embedded C Program for ADC interface and implement on Hardware kit
 12. Develop Embedded C Program for timer as timer and Timer as counter and simulate using keil software

STM32 Experiments

1. GPIO using HAL: To configure and control STM32 GPIO pins using HAL drivers.
2. Timer & PWM: To generate PWM signals using STM32 timers for control applications.
3. ADC with DMA: To acquire analog sensor data using STM32 ADC with DMA for efficient data transfer.
4. UART Communication: To implement serial communication on STM32 using HAL-based UART drivers.
5. FreeRTOS Multitasking: To design and implement a multitasking embedded application using FreeRTOS on STM32.
6. Sensor-Based IoT Demo: To develop an STM32-based sensor monitoring system with cloud connectivity.

Minimum 5 experiments on LPC 2148 and 3 experiments on STM32

Text Books:

1. The Insider's Guide To The Philips ARM7-Based Microcontrollers (LPC2000 family) — Hitex / ARM-based
2. Raj Kamal – Embedded Systems: Architecture, Programming and Design
3. ARM Controller: ARM Fundamentals, LPC2148 CPU and Peripherals - A. P. Godse
4. Joseph Yiu – The Definitive Guide to ARM Cortex-M3/M4

Reference Books:

1. Steve Furber – ARM System-on-Chip Architecture
2. Mastering STM32 (2nd Edition) — Carmine Noviello

E-Resources:

1. Embedded Systems – Lecture Playlist & Course Content (IIT Delhi – NPTEL)
<https://nptel.ac.in/courses/108102045>
(Covers introduction, architecture, interfaces & real-time concepts)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

2. NPTEL Prep – Embedded System Design with ARM (Structured Video Lectures)

<https://www.nptelprep.in/courses/106105193/videos>

(Official indexed set of videos covering full lecture series)

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Quality Management System – III							Code: ETVS605		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	02	-	01	-	-	25	-	-	25
Prerequisites:									
Quality Management System – I, Quality Management System – II.									
Course Objectives:									
1. To understand basic principles and terms related to statistical process control.									
2. To understand Kaizen philosophy of continuous, incremental improvement & Six Sigma, data-driven methodology aimed at reducing defects and process variation.									
3. To understand processes in Business process management and know significance of concept customer driven quality.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Apply control charts for process controls to perform statistical analysis.								
CO2	Apply kaizen and six sigma for industrial processes								
CO3	Gain knowledge in customer relationship management								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Statistical process Control: Specification and control limits, types of control charts, control charts for variables and attributes, Pareto diagram, process flow diagram, cause and effect diagram, check sheets and histogram, Experimental design.								08
2.	Six Sigma and Kaizen- Continuous Improvement: Key six sigma concepts, quality level, three sigma's', defects per million opportunities, implementation, DMAIC, DMADV Concept of Kaizen, lean, 5S, kaizen vs innovation, CWQC, Kaizen practice, QFD, QCC, Poka yoke, quality of work life Taguchi quality engineering, loss function, orthogonal arrays, signal to noise ratio Parameter and tolerance design								09
3.	Customer driven quality and business process management: Customers perception of quality, customer relationship management and its components, customer retention programs CRM modules, CRM in B2B and B2C context, e- CRM. BMP: introduction and BMP implementation framework.								09
TOTAL								26	
Text Books:									
1. Kanishka Bedi, "Quality Management", Oxford University Press.									
2. Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education.									
Reference Books:									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- | |
|--|
| <ol style="list-style-type: none">1. Dale H. Besterfield, "Total Quality Management", Pearson Education.2. Poornima M. Charantimath, "Total Quality Management", Pearson, 2nd Edition.3. V. K. Khanna, "TQM: Planning, Design and Implementation", New Age International Publishers. |
|--|

E-Resources:

- | |
|--|
| <ol style="list-style-type: none">1. 1. Dr. N. Venkateshwarlu, "Quality Engineering & Management", NPTEL Course,
https://onlinecourses.swayam2.ac.in/e-learning/preview/nou25_me09 |
|--|

[Back to Structure](#)

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Program: B. Tech. (Electronics and Telecommunication Engineering)							Semester: V		
Course: Internship – V							Code: ETIN605		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
-	-	-	02	-	-	25	-	-	25
Preamble:									
Internships serve as vital educational and career development experiences, offering practical exposure in a specific field. Employers seek individuals who possess the necessary skills and an understanding of industry environments, practices, and cultures. This internship is designed as a structured, short-term, supervised training program, often centered on specific tasks or projects with clear timelines. The primary goal is to immerse technical students in an industrial setting, providing experiences that cannot be replicated in the classroom. This exposure aims to develop competent professionals who understand the social, economic, and administrative factors influencing the operations of industrial organizations.									
Course Objectives:									
1. Exposure to students to the industrial environment, which cannot be provided in the classroom and hence creating deployable professionals for the industry. 2. Learn to implement the technical knowledge in real industrial situations.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Gain exposure to industry practices and understand how academic concepts are applied in professional settings.								
CO2	Develop and demonstrate effective communication and teamwork skills within a work environment.								
CO3	Improve your problem-solving and time management skills by working in real-world industry settings.								
Internship Requirements									
1. Internship Duration: It is mandatory for all students to undergo an internship after every semester during vacations for the duration of 3 to 5 weeks. Internships completed during this period will be considered for the assessment of Term Work (TW). 2. Internship Opportunities: Students can explore various opportunities for internships at: f. Industries g. Research labs or organizations h. Collegiate clubs i. In-house research projects j. Online internships 3. Support and Assistance: Students can seek assistance for securing internships from: e. The Training and Placement cell, along with departmental coordinators f. Department or institute faculty members g. Personal contacts									

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

- h. Directly connecting with industries or organizations
4. **Request Letter:** Once an industry, research organization, or collegiate club is identified, students must obtain a request letter from the concerned department or placement office. This letter, in the standard format must be duly signed by the authority, should be addressed to the HR manager or relevant authority.
 5. **Confirmation Letter:** Students must submit the confirmation letter from the industry, research organization, or collegiate club to the Internship Coordinator and the Head of Department (HOD) office.
 6. **Joining Report:** Upon commencing the internship, students must submit the joining report, joining letter, or a copy of the confirmation email to the Internship Coordinator and the HOD office.
 7. **Faculty Mentor:** A faculty member will be assigned as a mentor to a group of students. The mentor will be responsible for monitoring, evaluating, and assessing student internship activities. The faculty mentor is also required to visit the internship location and submit formal feedback to the Internship Coordinator.
 8. **Faculty Visits:** Faculty members are advised to visit the internship site once or twice during the internship period to monitor progress.
 9. **Progress Report:** Students must submit progress report fortnightly to their faculty guide and the final internship report to the Internship Coordinator and department office.
 10. **Evaluation Report:** After the completion of the internship, the mentor, along with the assessment panel members, should submit the evaluation report of the students to the department office and the Internship Coordinator.
 11. **Internship Certificate:** Students must receive the Internship Certificate from the industry and submit it to the Internship Coordinator and department office.
 12. **Presentation and Assessment:** Students are required to give a presentation on their internship work as part of the term work. The internship diary and report will also be verified and assessed.

[Back to Structure](#)