Bharati Vidyapeeth(Deemed to be University),Pune
Faculty of Engineering and Technology
Programme:B.Tech.(Electronics & Communication)–CBCS2021Course

B.Tech.(Electronics & Communication)Sem V

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./ Week)			Examination Scheme(Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
27		Information Theory& Coding	4	2	0	60	40	25	0	0	125	4	1	0	5
28		Digital Signal Processing	4	2	0	60	40	25	25	0	150	4	1	0	5
29		Embedded System Design	4	2	0	60	40	25	0	25	150	4	1	0	5
30		Fuzzy Logic, Neural Networks&Genetic Algorithms	4	2	0	60	40	25	25	0	150	4	1	0	5
31		Telecom Switching Techniques*	3	0	0	60	40	0	0	0	100	3	0	0	3
32		Vocational Course-III Calibration & Measuring Instruments	0	2	0	0	0	25	25	0	50	0	1	0	1
33		Web Development	0	2	0	0	0	25	0	0	25	0	1	0	1
	Total		**19**	**12**	**0**	**300**	**200**	**150**	**75**	**25**	**750**	**19**	**6**	**0**	**25**
	Environmental Studies**		2	-	-	50	-	-	-	-	-	-	-	-	-
	Social Activity-II ***		-	-	-	-	-	-	-	-	-	-	-	-	2

*Industry Taught Course–III
**Mandatory audit course
***Add on course

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. (Electronics & Communication Engineering) Sem V
INFORMATION THEORY AND CODING

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW:25 Marks	
	Total:125 Marks	Total Credits: 05

Course Pre-requisites:

The students should have knowledge of

1	Digital Communication

Course Objectives:

1	To understand the concept of Entropy, the Rate of information and order of the source regarding dependent and independent sources.
2	To study various source encoding algorithms.
3	To model discrete & continuous communication channels.
4	To make students aware of various error control coding algorithms.
5	To have a detailed knowledge of compression and decompression techniques.
6	To introduce the concepts of multimedia communication.

Course Outcomes: After learning this course students will be able to

1	Differentiate between Dependent & Independent Sources, Entropy & Rate of Information.
2	Encode the information using Shannon, Shannon Fano, Prefix, and Huffman coding Algorithms.
3	Model the continuous and discrete communication channels using input, output, and joint probabilities.
4	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes, BCH, and Golay codes.
5	Develop the encoding and decoding using various compression coding techniques.
6	Design a multimedia communication system using compression and decompression techniques.

UNIT – I	**Unit-1 Information Theory**	**(07 Hours)**
	Introduction, Measure of a information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Markoff Sources	

UNIT – II	**Source Coding**	**(07 Hours)**
	Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI, Encoding of the Source Output, Shannon's Encoding Algorithm. Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm	
UNIT – III	**Information Channels**	**(08 Hours)**
	Communication, Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of: Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels	
UNIT – IV	**Error Control Coding**	**(10 Hours)**
	methods of Controlling Errors, Types of Errors, types of Codes, Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes. Binary Cyclic Codes, BCH Codes, Convolution Codes: Convolution Encoder, Code Tree, Trellis and State Diagram, Viterbi Algorithm	
UNIT – V	**Compression Techniques**	**(08 Hours)**
	Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.	
UNIT – VI	**Audio And Video Coding**	**(08 Hours)**
	Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.26x & MPEG Video standards.	

Term Work:

The term work shall consist of record of minimum eight experiments using MATLAB

1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channels such as
   a) Noise free channel.
   b) Error free channel

Compare channel capacity of above channels

2. Write a program for generation and evaluation of variable length source coding using Shannon – Fano coding and decoding
3. Write a program for generation and evaluation of variable length source coding using Huffman Coding and decoding

4. Write a program for generation and evaluation of variable length source Lempel Ziv Coding and decoding
5. Write a Program for coding & decoding of Linear block codes.
6. Write a Program for coding & decoding of Cyclic codes.
7. Write a program for coding and decoding of convolutional codes.
8. Write a simulation program to implement source coding and channel coding for transmitting a text file
9. Write a simulation program to implement video compression using H.261
10. Implementation of any compression algorithm for audio data
11. Implementation of any compression algorithm for image or video data
Text Book/ Reference Books:
1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital communication, Simon Haykin, John Wiley India Pvt. Ltd, 2008. 3. Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.
3. Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, Asia 2002; Chapters: 3,4,5.
4. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods ,4rd edition
5. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
6. Principles of digital communication, J. Das, S. K. Mullick, P. K. Chatterjee, Wiley, 1986 - Technology & Engineering
7. Digital Communications – Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
8. Information Theory and Coding, K. N. Haribhat, D. Ganesh Rao, Cengage Learning, 2017.
9. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
10. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.
Project Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. (Electronics & Communication Engineering) Sem V
DIGITAL SIGNAL PROCESSING

Teaching Scheme	Examination Scheme	Credits Allotted
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical:02	Internal Assessment (IA): 40 Marks	Credit:01
	TW: 25 Marks & OR: 25 Marks	
	Total:150 Marks	Total Credits:05

Course Pre-requisites:

The students should have the knowledge of

1	Mathematical Preliminaries
2	Signals and Systems

Course Objectives:

1	To introduce the concept of Discrete Fourier Transform.
2	To learn the algorithm of fast computation
3	To design the finite impulse response filter & infinite impulse response filter
4	To examine the finite word-length effect of a filter
5	To understand the architecture & programming of a DSP processor

Course Outcomes: After learning this course students will be able to

1	Compute the Discrete Fourier transform & Fast Fourier transform
2	Design and realize appropriate linear FIR filters based on frequency domain specifications
3	Design and realize appropriate digital IIR filters through the classical approach of analog filter design
4	Evaluate the finite word length effect in digital filters
5	Implement the various applications on the DSP processor
6	Experiment with speech processing applications

UNIT – I	**Discrete Fourier Transform**	**(07 Hours)**
	Overview of signals and systems, Definition of DFT, Matrix representation and its inverse, Properties; duality, linearity, Complex Conjugation, time reversal, Circulation shifting, circular convolution and its graphical interpretation, circular correlation, filtering with block convolution. Introduction to Discrete Cosine Transform	
UNIT – II	**Fast Fourier Transform**	**(09 Hours)**
	Direct computation of D.F.T., its computational complexity, FFT algorithms, their classification, radix 2 FFT algorithms, Decimation-in-Time – FFT, Decimation-in-Frequency –FFT, Inverse radix 2	

	algorithms, FFT algorithms for composite value of N, Goertzel's algorithm, Chirp Z transform algorithm, Quantization effects, applications. Relation between DFT and FFT.	
UNIT – III	**Finite Impulse Response Filter**	**(08 Hours)**
	FIR Filter Design Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form, cascade form and lattice form	
UNIT – IV	**Infinite Impulse Response Filters**	**(08 Hours)**
	IIR filter design from analog filters using approximation of derivatives, impulse invariance, Bilinear transform, warping effect. Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design, IIR filters design from pole zero plots.	
UNIT – V	**Finite Word Length Effects in Digital Filters**	**(08 Hours)**
	Fixed- and floating-point number representation, sign-magnitude, 1's & 2's complement, Quantization noise in signal representation, effects due to truncation and rounding, SQNR computation and limit cycle, Quantization in Floating Point realization IIR, finite word length effects in FIR	
UNIT – VI	**Introduction to DSP Processors and Application**	**(08 Hours)**
	Introduction to DSP Processor, Sampling rate conversion by a non-integer factor, Design of two stage sampling rate converter, General Architecture of DSP, Introduction to Code composer studio. Application of DSP to Voice Processing, Music processing, Image processing and Radar processing	

Term Work:

Minimum 10 experiments should be conducted using MATLAB & at least one using hardware.

1. Preform DTFS and DTFT on periodic and non-periodic signals.
2. Perform DFT and IDFT on DT signal.
3. Find the frequency response and stability of DT system using convolution.
4. Perform convolution using overlap and add method.
5. Perform circular convolution.
6. To plot pole-zero plot of Z-domain using transfer function.
7. To solve the difference equation and find the system response using Z transform.
8. To find the impulse invariance IIR digital filter to realize the first order analog Butterworth filter.

9. To design IIR filter for first order analog Butterworth approximation using bilinear transformation.
10. Plot the frequency response for the rectangular and Hamming window.
11. To design FIR filter using frequency sampling method.
12. To plot spectrogram of speech signal.
13. To implement convolution sum using DSP processor.
14. To implement Speech processing applications using DSP processors.
Text Book/ Reference Books:
1. Essentials of Digital Signal Processing, B P Lathi, Cambridge University Press, 2014
2. Digital Signal Processing: Principles Algorithms and Applications, Proakis John and Manolakis, D. G. Prentice Hall 2012
3. Discrete Time Signal Processing, Oppenheim, Schafer & Buck, Pearson, 3e, 2008.
4. Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs, Welch, Wright and Morrow, Second Edition, CRC Press
5. Digital Signal Processing A Computer -Based Approach, Mitra S.K, Tata McGraw- Hill
6. Lyons, Richard. "Digital signal processing." *New York* (2006): 23-54.
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B. Tech. (Electronics & Communication Engineering) Sem V
EMBEDDED SYSTEM DESIGN

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW: 25 Marks & Practical: 25 Marks	
	Total:150 Marks	Total Credits: 05

Course Pre-requisites:

The students should have knowledge of

1	Fundamentals of Computer, Computer Organization, and Architecture
2	Microcontroller and Applications

Course Objectives:

1	To make the student understand the need & application of embedded system.
2	To learn the Micro-python programming
3	To make the student aware of the ESP modules
4	To understand the concept of RTOS.
5	To introduce the concept of task communication
6	To interpret the applications of ESP modules

Course Outcomes: After learning this course students will be able to

1	Describe the architecture of embedded systems
2	Write Micro-python program for hardware application
3	Identify the features & architecture of the ESP modules
4	Elaborate the need of real time systems
5	Discuss the issues related to real time operating system
6	Select & use the appropriate ESP module for real world application

UNIT – I	**Introduction to Embedded Systems**	**(06 Hours)**
	Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems,Characteristics and Quality Attributes of Embedded Systems. Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs.	
UNIT – II	**Introduction to Micro-python language**	**(08 Hours)**
	Introduction, Physical computing, Micro-Python hardware, Micro-	

	python workflow, The Micro-python interactive Interpreter mode (aka REPL) Auto-intent, Auto-Completion, interrupting a running Program, paste mode, soft reset.	
UNIT – III	**Introduction to ESP modules**	**(09 Hours)**
	Espress if systems, Introduction to ESP 8266 and ESP32, block diagram, features, functional description, peripherals & sensors, applications.	
UNIT – IV	**Concepts of real time operating system**	**(08 Hours)**
	Operating system basics, Types of OS, Tasks, process, Threads Multiprocessing and, Multitasking , Task scheduling,Introduction to Free RTOS and Mbed OS .	
UNIT – V	**Task Communication**	**(08 Hours)**
	Shared Memory, stack memory, Context switching, Tasks and queues, semaphores, Controlling tasks, task management, inter-task communication	
UNIT – VI	**Interfacing of ESP modules to external devices**	**(09 Hours)**
	Interfacing of ESP 8266 and ESP 32 real world applications with Arduino IDE using Micro-python, Embedded C.	

Term Work:

The term work shall consist of record of minimum eight experiments using ESP 8266/ESP 32 and programming in Embedded C/Micro python/Free RTOS.

1. To Interface LED and write a program to turn on LED.
2. To Interface digital sensor (IR/LDR) and write a program to turn on LED at sensor detection.
3. To Interface motor through relay and write a program to turn on motor when push button is pressed
4. Interfacing of LCD module
5. Create a web page to be hosted by ESP 32
6. To interface Seven Segment display
7. Generation of PWM signal for motor control
8. Program/code to estimate the stack memory
9. Program/code to communicate between two tasks using queues
10. Program/code to understand the application of mutex
11. Program/code to understand the application of binary semaphore
12. Interface DHT22 using Micropython

Text Book/Reference Books:
1. J.W. Valvano, "Embedded Micro computer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.
3. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
4. A. Gupta, “Microcontroller and Embedded Systems”, S.K. Kataria & Sons (India), 2019.
5. Vedat O Oner,”Developing IoT projects with ESP32”, Packet Publishing, 2021
6. Koen Vervloesem,”Getting started with ESPHome, Elektar, 2021
7. Kamal, Raj. Embedded systems: architecture, programming and design. Tata McGraw-Hill Education, 2011.
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B. Tech. (Electronics & Communication Engineering) Sem V
FUZZY LOGIC, NEURAL NETWORKS & GENETIC ALGORITHMS

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW: 25 Marks and OR: 25 Marks	
	Total:150 Marks	Total Credits: 05

Course Pre-requisites:

The students should have knowledge of

1	Probability and Statistics
2	Signals and Systems

Course Objectives:

1	To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real-world problems
2	To give insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks, and evolutionary algorithms.
3	To create awareness of the application areas of neural network techniques.
4	To provide alternative solutions to the conventional problem-solving techniques in signal processing, pattern recognition, and classification, control system.
5	To understand Genetic algorithm and Evolutionary Algorithm

Course Outcomes: After learning this course students will be able to

1	Describe the fundamentals of Crisp sets, Fuzzy sets, Fuzzy Relations, and Fuzzy Logic Controller.
2	Design fuzzy system for application in electronics and communication engineering.
3	Compare the various architectures for building an ANN and its applications
4	Develop neural network systems to solve real-world problems.
5	Categorize Genetic and Evolutionary algorithm
6	Program Genetic and Evolutionary algorithm

UNIT – I	**Fuzzy Sets, Uncertainty, and Relations**	**(08 Hours)**
	Uncertainty and information, fuzzy sets and membership functions, chance versus fuzziness, properties of fuzzy sets, and fuzzy set operations. Cardinality, operations, properties, fuzzy Cartesian product and composition, fuzzy tolerance and equivalence relations, forms of composition operation	
UNIT– II	**Fuzzification, Defuzzification, and Membership Function**	**(08 Hours)**

	Various forms of membership functions, fuzzification, defuzzification to crisp sets and scalars. Membership value assignments: intuition, inference, rank-ordering, neural networks, genetic algorithms, inductive reasoning.	
UNIT – III	**Artificial Neural Network-I**	**(08 Hours)**
	Introduction to Early ANN architectures (basics only)- McCulloch & Pitts model, Perceptron, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model: the concept of error energy, gradient descent algorithm and application of linear neuron for linear regression, Activation functions: binary, bipolar (linear, signup, log sigmoid, tan-sigmoid) Learning mechanisms: Hebbian, Delta Rule.	
UNIT – IV	**Artificial Neural Network-II**	**(08 Hours)**
	Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification and regression, Self-organizing Feature Maps, k-means clustering, Learning vector quantization Radial Basis Function, Application of RBFN for classification and regression.	
UNIT – V	**Introduction to Genetic Algorithm**	**(08 Hours)**
	Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, schema theorem, Classification of genetic algorithm, Holland classifier systems, genetic programming, applications of genetic algorithm, Convergence of GA.	
UNIT – VI	**A Brief Introduction to Deep Learning**	**(08 Hours)**
	Introduction, Neural Nets as Universal Approximators, Modelling a specified input-output relationship: the problem of learning a Neural Net, Learning from data: Empirical risk minimization, Models of vision, Convolutional Neural Networks, Learning in Convolutional Neural Networks. Learning in CNNs, transpose Convolution, Time Series and Recurrent Networks.	
List of Tutorials/Experiments: The students have to perform a minimum of eight experiments using MATLAB/SCILAB, and Python libraries.		
1. Study of Fuzzy sets and operations.		
2. Study of fuzzy relation, Max-min composition.		
3. Analyze t-norms and t-conorms.		
4. Analyze Fuzzy Inference systems with any of the models (Mamdani, Sugeno, and Tsukamoto).		
5. Study of learning mechanisms, approaches, and activation functions in ANN.		
6. Implement Multilayer perceptron (MLP) and back propagation algorithm		
7. Implement Radial Basis Function networks.		

8. Implement Crossover, mutation, crossover, and mutation rates.
9. Implement Mixing different search operators.
10. Study of Genetic Algorithm
11. Build CNN and Test for synthetic data/time series data.
Text Book/ Reference Books:
1. Principles of Soft Computing, S. N. Sivanandam, S. N. Deepa, John Wiley & Sons, 2007.
2. Evolutionary Computation: A Unified Approach, Kenneth A, De Jong, Prentice-Hall of India Pvt.Ltd.
3. Fuzzy Logic with Engineering Applications, Third Edition Thomas, Timothy Ross, John Wiley & Sons,2010.
4. A First Course in Fuzzy Logic, Third Edition, Hung T. Nguyen, Elbert A. Walker, Taylor & Francis Group, LLC, 2008.
5. Introduction to Fuzzy Logic using MATLAB, S. N. Sivanandam ,S.Sumathi, S. N. Deepa, Springer Verlag, 2007.
6. Neuro- Fuzzy and Soft Computing, J.S. Jang, C.T. Sun, E. Mizutani, PHI Learning Private limited.
7. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene Fausett, Pearson Education, Inc, 2008.
8. Neural Networks A comprehensive foundation, Simon Haykin, Prentice Hall International Inc- 1999.
9. Neural Networks and Deep Learning, Michael Nielsen, *Online book, 2016*
10. Deep Learning Step by Step with Python: A Very Gentle Introduction to Deep Neural Networks for Practical Data Science, N. D. Lewis
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B. Tech. (Electronics & Communication Engineering) Sem V
ITC-III:TELECOM SWITCHING TECHNIQUES

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination (ESE): 60 Marks	Credits: 03
	Internal Assessment (IA): 40 Marks	
	Total:100 Marks	Total Credits: 03

Course Pre-requisites:	
The students should have knowledge of	
1	Probability & Statics Digital Communication

Course Objectives:	
1	To learn the concepts of switching system and networks in detail.
2	To educate the students about measurement of telecommunication network traffic using mathematical model, performance and quality of service.

Course Outcomes: After learning this course students will be able to	
1	Comprehend the basic concepts and architecture of SS7.
2	Exemplify about the session initiation protocol.
3	Infer about the switching techniques and its relative merits.
4	Apply the principles of queuing theory for performance measurement of telecommunication networks.
5	Identify the IP Multimedia Subsystem's (IMS) role in Next Generation Networking.
6	Evaluate the ISDN architecture and plethora of services provided by ISDN.

UNIT – I	**Switching:**	**(08Hours)**
	Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Enhanced Services, Two stage networks, Three stage network n-stage networks. **Time Division Switching:** Time multiplexed Space Switching, Time Multiplexed time switching, combination Switching, three stage combination switching, n-stage combination switching.	
UNIT – II	**Signalling System No.7 -SS7:**	**(05 Hours)**
	Signaling Overview, Network Architecture, SS7 Signal Data Links, SS7 Applications, Signaling Connection Control Part (SCCP).	
UNIT – III	**Session Initiation Protocol-SIP:**	**(05 Hours)**
	Introduction, Network Elements, SIP system architecture, SIP basic call flow, SIP-Mobility.	

UNIT – IV	**Traffic Engineering:**	**(06Hours)**
	Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.	
UNIT – V	**Integrated Services:**	**(07Hours)**
	Digital Networks: Motivation for ISDN, New services, Network and Protocol architecture, Transmission Channels, User Network Interface, Numbering and Addressing, Service characterization, Interworking, ISDN standards, Broadband ISDN, Voice data Integration.	
UNIT – VI	**IP Multimedia Subsystem (IMS):**	**(05 Hours)**
	Introduction, IMS Concepts, Functional Entities and their Roles, Architecture, IMS Call Flow.	

Text /Reference Books:

1. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks"; PHI Publications.
2. J. E. Flood, "Telecommunications Switching, Traffic and Networks", Pearson Education.
3. R. A. Thomson, "Telephone switching Systems", Artech House Publishers.
4. Vijay Garg, "Wireless Communications and networking ", Elsevier.
5. James P. Martin, "Modern Telecommunication networks", PHI Publication
6. T. N. Saadawi, M. H. Ammar, A. E. Hakeem, "Fundamentals of Telecommunication Networks", Wiley Interscience.
7. W.D. Reeve, "Subscriber Loop Signaling and Transmission Handbook", IEEE Press (Telecomm Handbook Series).
8. https://datatracker.ietf.org/doc/html/rfc3261
9. https://www.eventhelix.com/ims/

Project-Based Learning:

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B. Tech. (Electronics & Communication Engineering) Sem V
CALIBRATION & MEASURING INSTRUMENTS

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Practical:02	TW:25 Marks	Credit: 01
	OR: 25 Marks	
	Total:50 Marks	Total Credits: 01

Course Pre-requisites:

The students should have knowledge of

1	Electronic Devices
2	Integrated Circuits
3	Digital Electronics

Course Objectives:

1	To classify measuring electronic equipment based on the applications.
2	To familiarize with measurement methods of electronic measuring equipment.
3	To analyze various signals using different measuring equipment.
4	To calibrate electronic measuring equipment.

Course Outcomes: After learning this course students will be able to

1	Distinguish electronic instruments viz signal generators, wave analyzers, and various oscilloscopes by knowing their specifications for electronic measurements.
2	Reproduce the required signals using various measuring equipment.
3	Calibrate digital oscilloscope, function generator, and signal generator.
4	Use True RMS meter and DMM as per practical applications.
5	Calculate unknown frequency/phase shift with Lissajous pattern
6	Analyzeanalog/digital signal for a particular application.

Term Work:

The term work shall consist of record of minimum eight experiments

1. Use of Signal generator, Universal counter & DSO for electronic signal measurements.
2. Use of Distortion factor meter for electronic signal measurements.
3. Measure phase shift using CRO/DSO.
4. Analyze the frequency using spectrum analyzer.
5. Use of Logic analyzer to analyze digital signal.
6. Use of Vector network analyzer to analyze electronic signal.
7. Configure dual power supply for OP-AMP applications.
8. Measure True RMS value with DMM/True RMS meter.

9. Troubleshoot front panel functions of the oscilloscope.
10. To calculate Q factor using LCR-Q meter.
11. To plot the characteristics of various transistors using Curve tracer.
Text Book/Reference Books:
1. "Troubleshooting Electronic Equipment", by R. Khandpur
2. "How to Diagnose and Fix Everything Electronic", Second Edition by Michael Jay Geier
3. Datasheets and manuals
4. H. S. Kalsi, "Digital Instrumentation", Tata McGraw Hill
5. Clyde F. Coombs "Electronic Instrumentation Handbook" McGraw Hill
6. Cooper Helfric, "Electronic Instrumentation & Measurement Techniques", PrenticeHall Publication.

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B. Tech. (Electronics & Communication Engineering) Sem V
WEB DEVELOPMENT

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Practical: 02	TW: 25 Marks	Credit: 01
	Total: 25 Marks	Total Credits: 01

Course Pre-requisites:

The students should have knowledge of

1	Computation & Programming using C
2	Data Structures

Course Objectives:

1	To introduce the basics of web development technologies
2	To explain web servers and understanding of DNS and HTTP
3	To make aware of vanilla JavaScript for writing business logic
4	To introduce MongoDB database
5	To familiarize various concepts of SQL
6.	To make students aware of cloud technology

Course Outcomes: After learning this course students will be able to

1	Create web pages using HTML
2	Identify the recursive and non-recursive query in DNS
3	Understand Javascript for writing websites
4	Install React, MongoDB, Express library for Frontend app
5	Apply SQL to create database connectivity
6	Design Cloud to push local database using MongoDB Atlas

Term Work:

The term work shall consist of a record of any ten experiments.

List of Practicals:

1. Introduction to web development technologies Create your first HTML document. Learn CSS properties and use it add design and make the HTML Attractive. Simple Javascript Primer. Create a navbar with dropdowns using javascript and load related pages on mouse click. Access the DOM with JS event properties and make the page dynamic.
2. Web server and understanding DNS, by creating an image searching app, using unspash api to retrieve images via HTTP request and showing the requested data on UI using vanilla JavaScript. with use of HTTP protocol.
3. Creating domains,(getting an original domain name) Project, create a sample static website with vanilla JavaScript, HTML, CSS(Use JavaScript to create drop downs, or handling event listeners such as on Click, using the same js to alter DOM element with a inBuilt JS function.e.g (geteElementById, getElementByClass etc.). make the site responsive without bootstrap using only media queries.Using FTP protocol to host data on the domain.
4. Create a todolist app with vanilla JS, without database saving feature. Create a to-do list app with react, saving the to-do items to database MongoDB(Install MongoDB and start local mongo server) and just add another button for delete on every To-do. Basically to-do

	adding and deleting should work
5.	React frontend library. Understanding Virtual DOM. What is JSX. The Component system. Understanding props and state in React. Create your first react app with a simple component and another component within it, sending data through props.
6.	What is server. Create your first server-side document. Setup server port configuration. What is the Express middleware. Installing the Express library. Create your first route and display Hello World on Browser.
7.	Connecting React frontend with server side backend using HTTP protocol by fetch method.
8.	Bootstrap. Installing Bootstrap. Creating sample Website and making it responsive visually appealing with Bootstrap and CSS.
9.	Database and why its needed. Two types of database SQL and noSQL. Difference between SQL and NoSQL. Creating simple queries and different types of join in SQL
10.	What is MongoDB noSQL database. Setting up local MongoDB development environment. MongoDB Queries in mongo console.
11.	What is Mongoose library and why its easy way to handle MongoDB operations. Simple types of Mongo queries to access data from database. Create you first data by model by mongoose schema and access the database by simple Mongo query.
12.	The MVC architecture and how its related to Nodejs full stack.
13.	Putting it all together. Setting up document structure. Setup express node js server and send data to parent route. Create your first React app by simple react command in the document structure. Create three routes Home, About and Contact and create a form on contact page, access the filled parameters from react and send it to express backend, save it to database
14.	Use CRUD. Server backend data to show details in frontend. Add a delete method.
15.	Cloud fundamentals. Using MongoDB Atlas to push local database to cloud. Use Netlify to push client React code by using Build command. Connect both cloud parameters. Format the code with best practices. Introduction to industry tools and best practices.
Text Books/ Reference Books:	
1. Web Technologies, Uttam K Roy, Oxford University Press	
2. Java Server Pages – Hans Bergsten, SPD O'Reilly	
3. Java Script, D.Flanagan, O'Reilly, SPD	
4. Java Server Pages – Hans Bergsten, SPD O'Reilly	
5. Beginning Web Programming-Jon Duckett WROX.	
6. Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson.	

Bharati Vidyapeeth (Deemed to be University),Pune
Faculty of Engineering and Technology
Programme:B.Tech.(Electronics & Communication)–CBCS 2021 Course

B.Tech.(Electronics & Communication)Sem VI

Sr. No.	Course Code	Name of Course	Teaching Scheme(Hrs ./Week)			Examination Scheme(Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
34		Computer Communication Networks	4	2	0	60	40	25	25	0	150	4	1	0	5
35		Cellular Technology and 4G	3	0	0	60	40	0	0	0	100	3	0	0	3
36		VLSI Design Technology	4	2	0	60	40	25	0	25	150	4	1	0	5
37		Quantitative Techniques Communication and Values	4	0	0	60	40	0	0	0	100	4	0	0	4
38		Industrial IOT and ML*	3	2	0	60	40	25	0	25	150	3	1	0	4
39		Vocational Course-IV RF Cell Planning & Drive Test Analysis	0	2	0	0	0	25	25	0	50	0	1	0	1
40		Power Electronics	0	2	2	0	0	50	0	0	50	0	1	2	3
	Total		**18**	**10**	**2**	**300**	**200**	**150**	**50**	**50**	**750**	**18**	**5**	**2**	**25**
	MOOC-II**		--	--	--	-	-	--		--	--	-	-	-	2

**Industry Taught Course– IV
** Add on course

Bharati Vidyapeeth
(Deemed to be University)
College of Engineering, Pune

B. Tech. (Electronics & Communication Engineering) Sem VI
COMPUTER COMMUNICATION NETWORKS

Teaching Scheme	Examination Scheme	Credits Allotted
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW: 25 Marks & OR: 25 Marks	
	Total: 150 Marks	Total Credits: 05

Course Pre-requisites:

The students should have knowledge of

1	Telecom Switching Network

Course Objectives:

1	To understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2	To describe the protocols associated with each layer.
3	To learn the different networking architectures and their representations.
4	To interpret the various routing techniques
5	To formulate the security issues in the network and various security algorithms

Course Outcomes: After learning this course students will be able to

1	Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.
2	Identify the protocols and services of Data link layer.
3	Design a network model and determine the routing of packets using different routing algorithms.
4	Articulate the protocols and functions associated with the transport layer services.
5	Exemplify the protocols and services of the application layer
6	Design the wireless network using IEEE 802.11

UNIT – I	**Data Communications and Network Model**	**(08 Hours)**
	Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet. Network Models: Protocol Layering: Scenarios, Principles, Logical Connections. The OSI Model and TCP/IP Protocol Suite: Layered Architecture, Layers in model, Description of layers, Encapsulation and De-capsulation, Addressing, Multiplexing and De-multiplexing, OSI Versus TCP/IP	
UNIT – II	**Data-Link Layer**	**(08 Hours)**
	Design issues, error detection and correction, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols- Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing, Ethernet, Data Link Layer switching, Wired LANs: Ethernet: Ethernet Protocol: IEEE802,	

	Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Access	
UNIT – III	**Network Layer**	**(10 Hours)**
	Network Layer services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, IPV4 Datagram format, IPV6 Addresses, and IPV6 Datagram format, Forwarding of IP Packets Network Layer Protocols: Internet Protocol (IP): Datagram Format, Security of IPv4 Datagrams, ICMPv4, Mobile IP , routing algorithms: Distance Vector Routing, Link State Routing, Routing Information Protocol, Open Shortest Path First, Border gateway protocol (BGP), Hot potato routing and socio-political aspects of routing	
UNIT – IV	**Transport Layer**	**(08 Hours)**
	Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer sliding window protocols, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control.	
UNIT – V	**Application layer and Security**	**(07 Hours)**
	Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. Application layer protocols: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet, network security	
UNIT – VI	**Wireless LANs**	**(07 Hours)**
	Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers. Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages.	
Term Work: The term work shall consist of record of minimum eight experiments		
1. LANs and its components, practically implement the cross-wired cable and straight through cable using clamping tool.		
2. Study of network IP		
3. Connect the computers in Local Area Network.		
4. Performing an Initial Switch Configuration using CISCO Packet Tracer		
5. Configuring WEP on a Wireless Router using CISCO Packet Tracer		
6. Planning Network-based Firewalls using CISCO Packet Tracer		
7. Configure Virtual LANs using CISCO Packet Tracer		
8. Configure DHCP server & Helper address feature in Cisco router using CISCO Packet		

Tracer

9. Examining WAN Connections using CISCO Packet Tracer
10. Simulation of various Topologies using CISCO packet Tracer
11. Write a program in C for RSA
12. Examine packets of different protocols using Wireshark (Network Traffic Analysis and Filtering) using CISCO Packet Tracer

Text Book/ Reference Books:

1. Data Communications and Networking, Forouzan,6th Edition, McGraw Hill, 2021 ISBN: **978-1260597820**
2. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 7th Edition, Pearson, 2016.ISBN: 978-0133594140
3. Cryptography and Network Security - Principles and Practice, Stallings William,7th Edition Pearson, 2020, ISBN: 9780135764213
4. Introduction to Data Communication and Networking, Wayarles Tomasi, 1st edition, Pearson Education, 2007, ISBN:0130138282
5. Understanding Communications and Networks, W. A. Shay, Cengage Learning. 3rd Edition,2008, BS Publications, ISBN: 978-0534950545

Project Based Learning:

Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.
Also, write pseudo code/proof for it, wherever applicable. Use CISCO Packet Tracer for simulation.

Bharati Vidyapeeth
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College of Engineering, Pune

B. Tech. (Electronics & Communication Engineering) Sem VI
CELLULAR TECHNOLOGY & 4G

Teaching Scheme	Examination Scheme	Credits Allotted
Theory: 03	End Semester Examination (ESE): 60 Marks	Credits: 03
	Internal Assessment (IA): 40 Marks	
	Total:100 Marks	Total Credits:03

Course Pre-requisites:

The students should have knowledge of

1	Electronics Communication

Course Objectives:

1	To understand the cellular technology and propagation models
2	To overview various communication standards like GSM, EDGE, GPRS, CDMA
3	To interpret various wireless networks, mobile networks, and their basic architecture starting from 2G through to 3G and 4G.
4	To investigate evolution and architecture of 4G wireless generations

Course Outcomes: After learning this course students will be able to

1	Understand the basics of mobile communication systems.
2	Design the cellular system and improve the coverage and capacity of a system
3	Examine various mobile propagation model
4	Differentiate GSM and CDMA wireless networks.
5	Examine the 3G and future communication technology's evolution
6	Evaluate 4G digital mobile technology

UNIT – I	**Evolution of Mobile Communication System**	**(06 Hours)**
	Introduction-base station, mobile station, MSC, forward and reverse channel, control channel, Cordless telephone system, Cellular telephone system, Advantages and disadvantages of mobile communications, Comparison of wireless systems, applications of wireless communications. Small cells: Past, present, and future trends of cellular networks coverage and capacity of small cell networks, Interference management.	
UNIT – II	**Cellular Concept – System Design Fundamentals**	**(06 Hours)**
	Introduction, frequency reuse, channel assignment strategies, handoff strategies, umbrella cell concept, interference and system capacity, Erlang Capacity, co-channel and adjacent channel interference, cell splitting, sectoring, microcell zone concept.	
UNIT – III	**Mobile Communication Engineering**	**(06 Hours)**
	Radio paths, Propagation attenuation, Basic propagation mechanisms, Link budget, Free-space path loss, Noise figure of a receiver, Multipath fading, Shadowing, Fading margin, Shadowing margin, Wireless Channel Capacity, OFDM and LTE, Large Scale	

	Propagation effects, and free space propagation model, The Three Basic propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, outdoor propagation model (Okumura model & Hata model).	
UNIT – IV	**GSM Technology**	**(06 Hours)**
	GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM speech coding, authentication and security in GSM, Call processing and Roaming in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, GSM vs CDMA.	
UNIT – V	**Evolution of 3G and Future Mobile Technology**	**(06 Hours)**
	2.5G TDMA evolution path, GPRS technology, EDGE technology, Need for 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, introduction to LoRa technology, introduction to Radar, mmWave frequency communication, introduction to THz frequencies for communication: 5G & 6G mobile networks.	
UNIT – VI	**4G Digital Mobile Technology**	**(06 Hours)**
	4G-LTE. Next-generation wireless systems: Features of 4G and 4G LTE, VoLTE, 4.5G, 5G, Architecture, advantages, disadvantages, and applications of 4G. 4G Technologies – Multicarrier modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation, and Coding with Time-Slot Scheduler.	

Text Book/ Reference Books:

1. T. S. Rappaport, "Wireless Communications: Principles and practice", Pearson, 2nd Edition, 2010.
2. Raj Pandya, "Mobile & Personnel communication Systems and Services", Prentice Hall India, 2001.
3. T. L. Singal, "Wireless Communications", Tata McGraw Hill, 2nd Edition, 2011.
4. A. Goldsmith, "Wireless Communications", Cambridge university press, 1st Edition, 2005.
5. B. Razavi, "RF Microelectronics", Prentice-Hall, 1st Edition, 1998.
6. W.C.Y. Lee, "Mobile Communications Engineering", McGraw Hill Telecomm., 2nd Edition, 1998.
7. 4G LTE/LTE – Advanced for Mobile Broadband, Erik Dahlman, Stefan Parkvall, Johan Skold, Academic Press 2011.
8. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.

Project-Based Learning (PBL):

Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

Also, write pseudo code/proof for it, wherever applicable.

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B. Tech. (Electronics & Communication Engineering) Sem VI
VLSI DESIGN TECHNOLOGY

Teaching Scheme	Examination Scheme	Credits Allotted
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
Practical: 02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW: 25 Marks & PR: 25 Marks	
	Total: 150 Marks	Total Credits: 05

Course Pre-requisites:

The students should have knowledge of

1	Switching Theory and Logic Design
2	Analog Electronics

Course Objectives:

1	To understand the VLSI Design Flow and design styles.
2	To introduce the VHDL Hardware Description Language (HDL) for front end design implementation
3	To articulate MOSFET physics and CMOS logic gates.
4	To interpret the layout design of combinational and sequential circuits.
5	To study internal structure of programmable logic devices.

Course Outcomes: After learning this course students will be able to

1	Design and simulate digital system using Structural, Behavioural, Dataflow or Mixed style of Modelling.
2	Apply concepts of Finite State Machine on sequential circuits
3	Implement CMOS combinational logic Design
4	Identify MOSFET Physics and CMOS structures.
5	Correlate the physical design of CMOS Technology
6	Realize digital hardware system utilizing PLDs

UNIT – I	**Implementation Technology & Introduction to VHDL**	**(08 Hours)**
	Introduction to VLSI design flow, Brief description of VHDL, Entity Declaration, Architecture Declaration, Modelling styles: Data Flow, Structural, Behavioural and Mixed Style. Assignment Statements, Select Signal Assignment, Conditional Signal Assignment, Component Declaration, Generate Statements, Concurrent and Sequential Assignment Statement, Process Statement, Case Statement. VHDL programming of basic logic gates, Multiplexer, Decoder, Encoder, Half Adder, Full Adder	
UNIT – II	**Sequential Logic Design using VHDL**	**(08 Hours)**
	VHDL Programming for D- Flip-Flop, SR Flip-Flop, JK Flip-Flop,	

	T-Flip-Flop & D-Latch, Shift Registers, Synchronous Counter: UP counter, Down counter, BCD counter; design of finite state machines and state minimization, Modelling of FSM-Mealy and Moore machines. Test Bench generation	
UNIT – III	**Analysis of CMOS circuit**	**(08 Hours)**
	Complexity and Design: Design Flow, Moore's Law; MOSFETs as Switch: FET Threshold Voltages, Pass Characteristics; Basic Logic Gates in CMOS: NOT Gate, NOR Gate, NAND Gate; Complex Logic Gates in CMOS: Structured Logic Design, XOR and XNOR Gates; Transmission Gate Circuits: Multiplexers, OR Gate, XOR/XNOR Gate	
UNIT – IV	**CMOS Device**	**(08 Hours)**
	CMOS structure, CMOS I/V characteristics, DC characteristics of the CMOS inverter, Switching Characteristics: Fall Time, Rise Time, Propagation Delay; Power Dissipation. Body effect, Scaling of MOS circuits, MOSFET capacitances, MOS small signal model, MOS amplifiers.	
UNIT – V	**Fabrication & Physical Design of CMOS Integrated Circuits**	**(08 Hours)**
	Fabrication steps of MOS device, Overview of Silicon Processing; Material Growth and Deposition; Lithography; Ion-implantation, CMOS Process Flow; CMOS Design Rules; Physical Design (Stick diagram & Layout Design) of Logic Gates: NOT, NAND & NOR Schematic and Layout of CMOS Combinational Circuits.	
UNIT – VI	**Programmable logic devices**	**(08 Hours)**
	FPGA: Introduction, study of architecture, PLAs, PALs, function implementation using PLDs, CPLD: Introduction, study of architecture, Programming design Approach.	

Term Work:
The term work shall consist of record of minimum eight experiments using VHDL
1. To model all basic logic gates: AND, OR, NAND, NOR, XOR, XNOR
2. To model adder and subtractor
3. To model 8:1mux, 1:8 demux, 3:8line decoder, 8:3 encoder using VHDL
4. To model synchronous and asynchronous D FF
5. To model 4- bit universal shift register
6. To model 4-bit counter
7. To model bidirectional buffer
8. To model parity generator and checker
9. Study of RAM/FIFO
10. Study of Temperature sensing using ADC

Text Book/ Reference Books:
1. CMOS Digital Integrated Circuits: Analysis & Design; Sung-Mo Kang & Yusuf Leblebici, TMH.
2. Neil E. Weste and Kamran Eshraghain, “Principles of CMOS VLSI Deign", Pearson Education Publication.
3. J. Bhaskar “A VHDL primer” Pearson Education Publication
4. Introduction to VLSI Circuits and Systems – John P. Uyemura, John Wiley, 2003.
5. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, TMH, 3rd Ed., 2011.
6. Chip Design for Submicron VLSI: CMOS Layout & Simulation, John P. Uyemura, Thomson Learning.
7. Douglas Perry, “VHDL", Pearson Education Publication.
8. John Walkerly, “Digital Design Principles and Practices”, Prentice Hall Publication.
Project Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

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B. Tech. (Electronics & Communication Engineering) Sem VI
QUANTITATIVE TECHNIQUES, COMMUNICATION AND VALUES

Teaching Scheme	Examination Scheme	Credits Allotted
Theory: 04	End Semester Examination (ESE): 60 Marks	Credits: 04
	Internal Assessment (IA): 40 Marks	
	Total: 100 Marks	Total Credits: 04

Course Pre-requisites:

The students should have knowledge of

1	Basic math's and reasoning, and comprehensive ability
2	Basic knowledge of communication process, soft skills
3	Basic knowledge and ideas about leaders and leadership qualities, ethics, etiquettes, and values

Course Objectives:

1	To augment students to face the campus recruitment test and train them on applying short techniques/ tricks to solve questions of Maths, reasoning and English in very less amount of time.
2	To articulate aspects of communication and soft skills such as grooming personality for leading team, presentation, business communication which would enable graduates to project themselves as a professional in the corporate sector and/or otherwise.

Course Outcomes: After learning this course students will be able to

1	Solve the aptitude test in the recruitment and competitive exam by applying short techniques and solve the question in less amount of time
2	Apply the short mnemonics and techniques to solve the questions of logical reasoning in the placement and competitive exam in lesser time.
3	Develop the verbal ability to communicate effectively using suitable vocabulary and proper sentence pattern
4	Understand the concept of soft skills and its implication at workplace
5	Build up the ability to study employment business correspondences and its proper implications
6	Understand business ethics, etiquettes and values and apply them in the professional ventures.

UNIT – I	Quantitative Aptitude	(08 Hours)
	Number system, Percentage, profit and loss, Simple Interest and Compound Interest, Ratio, Proportion and Average, Mixture and Allegation, Time, Speed & Distance, Time & Work , Permutation & Combination, Probability, Pipes and Cisterns	

UNIT – II	**Non-Verbal Reasoning**	**(08 Hours)**
	Coding, Decoding, Number series, Blood relation Directions, cubes & dices, Data Interpretation, Data Sufficiency, Set Theory & Syllogisms, Matching, Selection & Arrangement, Clocks & Calendars, Visual Reasoning, Input, Output & Flow Chart.	
UNIT – III	**Verbal Reasoning**	**(08Hours)**
	Sentence Patterns, Sentence correction and spotting errors, Vocabulary, antonyms and synonyms and analogy, Phrasal Verbs, idiomatic expressions, reading comprehension, closest, sentence rearrangement and theme detection	
UNIT – IV	**Self-Awareness and Soft Skills Development**	**(08Hours)**
	Concept of SWOT, Importance of SWOT, Individual & Organizational SWOT Analysis, Soft skills, meaning, need and importance, difference between soft skills and hard skills, life skills and personal skills, Leadership skills,-Importance ,Types, Attributes of good leader Motivational theories and leadership ,Emotional intelligence in personal and professional lives its importance need and application, Team Building and conflict resolution Skills ,Problem solving skills, Time Management and Stress Management Skills Pareto Principle(80/20) Rule in time management, Time management matrix, creativity and result orientation, working under pressure, stress management	
UNIT – V	**Communication And Honing Employment Skills**	**(08Hours)**
	Communication process, Non-verbal codes in communication, importance of LSRW in communication, Barriers to communication, Principles of effective Technical writing, Email writing and Netiquettes, Letter writing – formal letters, job application letter, cover letter, structure of technical report writing, Building Resume and CV, Tips to build an effective Resume Group discussion, Skills required for Group Discussion Interview skills, Ways of handling telephonic interviews, Importance of body language, grooming &etiquettes for getting right impression in PI&GD , Extempore, Introduction to PowerPoint presentation, ,Structure & flow of presentation,	
UNIT – VI	**Business Ethics, Etiquettes and Values**	**(08Hours)**
	The Importance of Ethics and Values in Business World, Respect for Individuality and diversity at workplace values of a good manager Key features of corporate etiquette, corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour at the work place, Corporate social responsibility (CSR) its importance and need.	

Text Book:
1. Quantitative Aptitude, R. S. Agarwal, S. Chand publication, 1 January 2021
2. The Book of Numbers, Shakuntala Devi, Orient Paperbacks 3rd 1984, 8122200060 (ISBN13: 9788122200065)
3. A Modern Approach To Logical Reasoning, R. S. Agarwal, published by S. Chand publication,2nd edition,2018, ISBN: 9789352832194
4. A New Approach to Reasoning Verbal & Non-Verbal, Indu Sijwali, B.S. Sijwali, Indu Sijwali, Arihant publication,2014
5. Business Communication, Meenakshi Raman, Prakash Singh, Oxford University press, second edition ,2012
6. Communication Skills, Sanjay Kumar, Pushp Lata, published by Oxford University press, 2nd edition ,2012
7. Technical Communication, Meenakshi Raman, Sangeeta Sharma published by Oxford University press ,4th edition,2022, ISBN-10: 0-19-948296-9
8. Developing Communication Skills, Krishna Mohan, Meera Banerji Macmillan India Pvt Ltd publication,2nd edition, 2009, 9780230638433, 0230638430
9. Soft Skills, Meenkashi Raman, Cengage publishers ,2017, ISBN13:9789386858252
10. Soft Skills by Dr. K Alex published by Oxford University press
11. Soft skills for Managers, Dr. T. Kalyana Chakravarthi ,Dr. T. Latha Chakravarthi, biztantra publisher, 2011
Project Based Learning:
Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples.

Bharati Vidyapeeth
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B. Tech. (Electronics & Communication Engineering) Sem VI
INDUSTRIAL INTERNET OF THINGS AND MACHINE LEARNING

Teaching Scheme	**Examination Scheme**	**Credits Allotted**
Theory: 03	End Semester Examination (ESE): 60Marks	Credits: 03
Practical:02	Internal Assessment (IA): 40 Marks	Credit: 01
	TW: 25 Marks &PR: 25 Marks	
	Total:150 Marks	Total Credits: 04

Course Pre-requisites:

The students should have knowledge of

1	Embedded System Design
2	Essentials of Data Science

Course Objectives:

1	To understand the basic concept and the industrial IoT Paradigm
2	To know the state of art architecture for IoT applications
3	To learn the available protocols used for IoT for optimal IoT applications.
4	To design basic IIoT Applications
5	To learn security in IIoT protocols
6	To apply ML algorithms in IIoT

Course Outcomes: After learning this course students will be able to

1	Identify the IoT Components and its capabilities
2	Explain the architectural view of IoT under real world constraints
3	Analyse the different Network and link layer protocols
4	Evaluate and choose among the transport layer protocols
5	Evaluate and choose among Layer Protocols & Security Service Layer
6	Design an IOT application with ML and Arduino /Raspberry Pi

UNIT – I	**IoT-Introduction**	**(06Hours)**
	Understanding IoT fundamentals, overview of IOT Architecture and protocols , Various Platforms for IoT , Components of IIoT , IoT Vs. IIoT, History of IIoT ,Real time Examples of IIoT ,Overview of IoT components and IoT Communication Technologies ,Challenges in IIOT	
UNIT – II	**IoT Architecture**	
	IoT reference Model - IoT Reference Architecture; Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints Introduction, Technical Design constraints	**(06Hours)**
UNIT – III	**IoT Data Link Layer & Network Layer Protocols**	**(06Hours)**

	PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, Network Layer-IPv4, IPv6, 6LoWPAN, DHCP, ICMP, RPL, CORPL,RFID	
UNIT – IV	**Transport & Session Layer Protocols**	**(06Hours)**
	Transport Layer (TCP, MPTCP, UDP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, MQTT, RFID	
UNIT – V	**Layer Protocols & Security Service Layer**	**(05Hours)**
	One M2M, ETSI M2M, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL	
UNIT – VI	**Application of IOT using ML**	**(07Hours)**
	Introduction to cloud - Azure, Thingspeak ,Programming using Python, Integration of Sensors and Actuators with ESP8266. IoT Based Home Automation using Relays, IoT based, Pollution monitoring, IOT based weather monitoring, Evaluation of Power options and Communication Options	

Term Work:

The term work shall consist of record of minimum eight experiments using Node MCU board-ESP8266, ESP32, Arduino IDE

1. Write a program for object detection the ultrasonic sensor HC-SR04
2. Case Study on cloud services SAAS, PAAS,IAAS
3. write a program to send humidity and temperature data to cloud
4. write a program to retrieve humidity and temperature data from cloud
5. Write a program to publish temperature data to MQTT broker
6. Write a program to subscribe to MQTT broker for temperature data and print it
7. Write a program to read temperature and its predication using ML algorithm
8. Write a program to read humidity and its predication using ML algorithm
9. Write a program for any real time application and it's prediction using ML
10. Set up Cloud IoT Infra using MQTT, MIddleWare (Node Red), MySQL
11. Setup Temperature and Humidity Web Server with Arduino IDE
12. Write a program for power measurement and save it on cloud

Text Book:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Peter Waher, Learning Internet of Things, PACKT publishing, BIRMINGHAM – MUMBAI.
3. Tim Cox, Steven Fernandes ,Raspberry Pi 3 Cookbook for Python Programmers,3rd edition, Packt Publishing,2018.
4. Sai Yamanoor,SrihariYamanoor ,Python programming with Raspberry Pi , Packt Publishing,2017
5. Bernd Scholz-Reiter, Florian Michahelles, Architecting the Internet of Things, ISBN 978-

3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.
6. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6",Wiley,2013
7. Simon Monk, Programming the Rasberry Pi ,2nd edition McGraw Hill,2015
Project Based Learning:
Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines. Also, write pseudo code/proof for it, wherever applicable. Use ESP8266 for implementation

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B. Tech. (Electronics & Communication Engineering) Sem VI
ITC-IV RF CELL PLANNING & DRIV TEST ANALYSIS

Teaching Scheme	**Examination Scheme**	**Credits Allotted**
Practical: 02	TW: 25 Marks & OR: 25 Marks	Credit: 01
	Total: 50 Marks	Total Credits: 01

Course Pre-requisites:

The students should have knowledge of

1	Electronics Communication

Course Objectives:

1	To understand the telecom frequency bands
2	To overview the radio network design & planning process
3	To interpret Coverage Areas and User Density
4	To investigate the Basics of RF Drive Test

Course Outcomes: After learning this course students will be able to

1	Understand the basics of the telecom frequency bands
2	Design the radio network design
3	Survey various Coverage Areas and User Density for wireless sites
4	Distinguish the various hopping techniques
5	Evaluate the RF drive testing methods
6	Use App-based RF measurement tools

UNIT – I	**Telecom Frequency Bands**	**(06 Hours)**
	Radiofrequency bands, Paired and unpaired frequency bands, International telecommunications regions, liberalized and non-liberalized spectrum	
UNIT – II	**Radio Network Design & Planning Process**	**(06 Hours)**
	Major tasks in the planning process, planning tools for different phases, planning environment, dimensioning, capacity and quality coverage analysis and studies – frequency planning & coordination services – network design (cellular and transmission) – network implementation – network optimization: coverage, interferences, capacity – geo data: consulting, generation, conversion, and acquisition	
UNIT – III	**Site Survey and Site Selection**	**(06 Hours)**
	Identify Coverage Areas and User Density, conduct a wireless site survey, networking monitoring tools, footprint thewireless network by active or passive method, Use Maps to Document Wireless Signal Leakage, radio frequency spectrum analysis	

UNIT – IV	**Frequency Hopping**	**(06 Hours)**
	Definition, Slow frequency and fast frequency hopping, Hybrid direct sequence and frequency hopping, frequency hopping spread spectrum	
UNIT – V	**Basics of RF Drive Test**	**(06 Hours)**
	Significance of drive test, types of drive testing, drive test analysis, RF Drive test measurements, Classification of drive test in the telecom industry, Outcomes of drive test analysis, Drive test analysis for 4G LTE network	
UNIT – VI	**Drive test tools & Equipment**	**(06 Hours)**
	Features of the RF drive test tools, RF drive tools(RF spectrum analyzer, RF scanners, App-based RF measurement tools, RF layer capable tools, voice quality measurement, the load generator	
Term Work: The term work shall consist of the record of a minimum of eight experiments based on the above syllabus		
Text Book/Reference books		
1. Sharawi, Mohammad S. "RF Planning and Optimization for LTE Networks." CRC Press, 2010.		
2. E-books related to RF Cell planning.		

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B. Tech. (Electronics & Communication Engineering) Sem VI
POWER ELECTRONICS

Teaching Scheme	Examination Scheme	Credits Allotted
Practical: 02	TW: 50 Marks	Credit: 01
Tutorial: 02		Credit: 02
	Total: 50 Marks	Total Credits: 03

Course Pre-requisites:

The students should have knowledge of

1	Knowledge of the principals and applications of electronic devices including semiconductor diodes, bipolar-junction and field-effect transistor.
2	Understanding of transformers and magnetically coupled circuits.

Course Objectives:

1	To understand and acquire knowledge about various power semiconductor devices.
2	To study the characteristics, operation and performance parameters of controlled rectifiers.
3	To acquire knowledge about power electronics applications such as UPS, induction motor etc.

Course Outcomes: After learning this course students will be able to

1	Identify and compare various power semiconductor devices
2	Perform the operations of single-phase converters
3	Analyze the performance of three phase converters circuits.
4	Distinguish between single and three-phase inverters
5	Perform the operations of dc-to-dc converters (Choppers)
6	Validate the basic principles of HVDC, UPS, motors etc.

Term Work:

The term work shall consist of eight experiments and ten tutorials.

List of Practicals:

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study V-I characteristics of :i) MOSFET ii) IGBT
3. Study of (R/RC/UJT) triggering for SCR.
4. To study operation of Single phase fully controlled converter.
5. To study operation of IGBT/MOSFET chopper circuit.
6. To study MOSFET/IGBT based single phase inverter.
7. Study of AC voltage controller.
8. Study of speed control of motor.

List of Tutorials:

1. Study of Power BJT and Power diodes. Describe any two applications of each in detail.
2. Study of Single-phase semi-converter with R and RL load.
3. Study of three phase full converter with R & RL load.
4. Study of single-phase half and full bridge inverter.
5. Study of three phase inverter in 120 degree and 180-degree conduction mode.
6. Study of step-down chopper.

7. Study of step-up chopper.
8. Study of cyclo-converters.
9. Study of UPS.
10. Study of induction motor.
11. Study of Servomotor.
12. Study of Universal motor
13. Study of Electronic ballast and HVDC transmission.
14. Study of electric welding and induction heating.
15. Study of separately excited DC motor.
Text Books/ Reference Books:
1. Power Electronics- M D Singh & K B Khanchandani, TMH, New Delhi
2. Modern Power Electronics- P. C. Sen, S. Chand & Co., New Delhi
3. Electric Motors & Drives-Austin Hughes, Bill Drury, Newnes,4th Edition
4. Power Electronics, Devices, Circuits & Industrial Applications- V. R. Moorthi
5. Power Electronics Circuits, Devices and Applications- M. H. Rashid, PHI, 3rd Edition, 2004, New Delhi
6. Electrical Machine Drives: Fundamental Basics and Practices-Claiton Moro Franchi, CRC Press